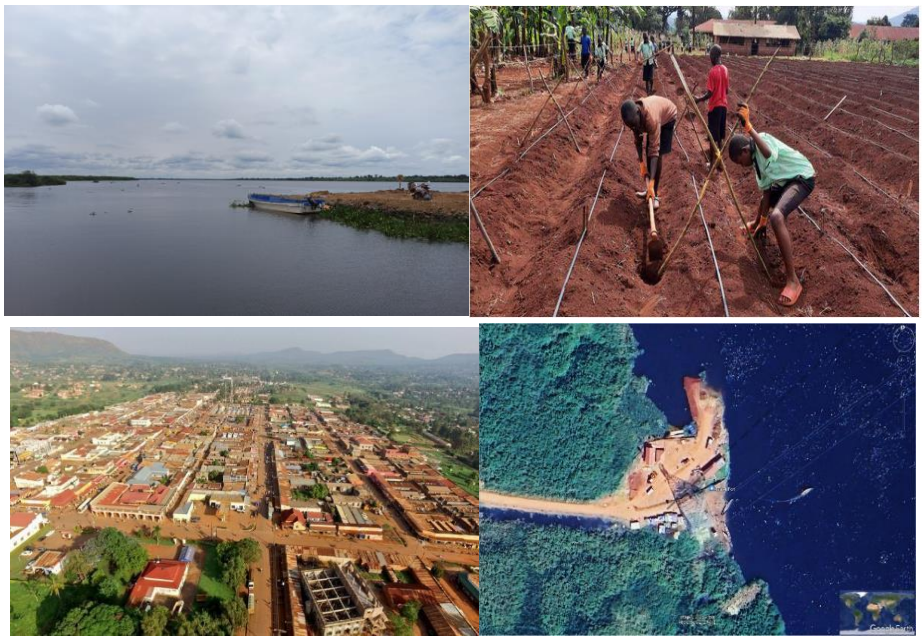
THE REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA



Submitted by:

ARDENT SERVICES INT. LTD
Plot 4, Ardent House, Gayaza High Avenue, P.O. Box 111680,
Gayaza-Wakiso-Uganda, Tin: 1013653797, Tel: +256773237772/706389541,
Email: ardentservicesint@gmail.com, Website: www.ardentservicesint.com

JUNE 2025

TABLE OF CONTENTS

TABLE OF CONTENTS i
LIST OF TABLES ix
LIST OF FIGURES x
THE ESIA TEAM xiii
ABBREVIATIONS AND ACRONYMS xv
E. EXECUTIVE SUMMARY xvi
1 INTRODUCTION 1
1.1 Background 1
1.2 Objectives of the ESIA Study 2
1.3 Project Categorization 3
1.3.1 National Categorisation 3
1.3.2 African Development Bank categorization 3
1.4 Project Justification 3
1.5 Developer details 4
1.6 Overview of ESIA process 4
2 ESIA Methodology 6
2.1 Introduction 6
2.2 General Approach 6
2.2.1 Environmental screening 6
2.2.2 Scoping 7
2.2.3 Document Review 7
2.2.4 Stakeholder engagement/consultations 7
2.2.5 Field Surveys 8
2.3 Specialist Studies 8
2.3.1 Physical Environment 8
2.3.2 Biological Environment 10
2.4 Socio-economic Assessment 11
2.4.1 Resettlement Action Plan (RAP) Methodology 12
2.4.2 Physical Cultural Resources (PCR) Surveys 13
2.5 Impact Assessment and Evaluation Method 13

2.6 Environment & Social Management Plan 18
3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK 19
3.1 Introduction 19
3.2 Policies Relevant to the Proposed Project 19
3.3 Legal and Regulatory Framework Relevant to the Proposed Project 27
3.4 Institutional Framework 34
3.4.1 Ministry of Water and Environment (MWE) 34
3.4.2 Albert Water Management Zone (AWMZ) 34
3.4.3 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) 35
3.4.4 National Environment Management Authority (NEMA) 35
3.4.5 Ministry of Gender Labor & Social Development (MoGLSD) 35
3.4.6 Ministry of Energy and Mineral Development (MEMD) 36
3.4.7 Ministry of Works and Transport (MoWT) 36
3.4.8 Ministry of Lands, Housing and Urban Development (MLHUD) 36
3.4.9 The Uganda Land Commission (ULC) 36
3.4.10 National Forestry Authority (NFA) 37
3.4.11 Uganda Investment Authority (UIA) 37
3.4.12 National Water and Sewerage Cooperation (NWSC) 37
3.4.13 Masindi District Local Government (MDLoG) and Kiryandongo District Local Government (KDLoG), ... 38
3.4.14 District Land Boards 38
3.4.15 Nile Basin Commission (NBC) 38
3.5 Permits and Licenses Required by Project Proponent 38
3.6 International Conventions and Agreements 39
3.6.1 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992) 39
3.6.2 United Nations Convention to Combat Desertification (UNCCD) 40
3.6.3 Convention on Biological Diversity (CBD) 40
3.6.4 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 40
3.6.5 Convention on the Conservation of Migratory Species of Wild Animals (CMS) .. 40

3.6.6 The Ramsar Convention 41
3.6.7 Strategic Approach to International Chemicals Management (SAICM) 41
3.7 The African Development Bank Group's (AfDB) Integrated Safeguard System (ISS) 2023 41
4 PROJECT LOCATION, DESCRIPTION AND DESIGN 25
4.1 Project Location 25
4.2 Project components 26
4.2.1 Portable Water Supply Infrastructure Components 26
4.2.2 Irrigation Water Supply Infrastructure system 27
4.2.3 Proposed Water source 55
4.2.4 Treatment Plant 56
4.2.5 Transmission Mains 58
4.2.6 Storage Reservoirs 59
4.2.7 On-farm storage tanks 60
4.2.8 Farmers Summary 61
4.2.9 Potential command areas 63
4.2.10 Water balance and availability 65
4.2.11 Considerations on Climate change 66
4.2.12 Flood risk 67
4.3 Construction phase 69
4.3.1 Overview of components to be constructed 69
4.3.2 Construction activities 73
4.3.3 Civil works 75
4.3.4 Electrical services 75
4.4 Operation and Maintenance of the Proposed Water Supply System 75
4.4.1 Periodic Upgrading/Maintenance of the Energy Supply 75
4.4.2 Emergency/safety support systems 75
4.4.3 Solid and liquid waste management 76
4.4.4 Security, Health and Safety provisions 76
4.5 Decommissioning and Rehabilitation 76
5 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL ECONOMIC BASELINE 78

5.1 Project Location 78
5.2 Physical Environment 78
5.2.1 Climate 78
5.2.2 Geology 58
5.2.3 Soils 61
5.2.4 Topography 66
5.2.5 Water resources and Hydrology 68
5.2.6 Noise Levels 77
5.2.7 Ambient air quality assessments 80
5.3 Biological Environment 85
5.3.1 Biodiversity 85
5.4 Socio-Economic Environment 95
5.4.1 Population Demographics 95
5.4.2 Household Demographic Characteristics 97
5.4.3 Household Conditions 108
5.4.4 Form Of Vulnerability Distribution 111
5.4.5 Physical Cultural Resources (PCRs) 112
5.4.6 Economic activities 113
5.4.7 Livestock Sector 114
5.4.8 Commercial farmer's contribution to economic activities 115
5.4.9 Gender aspects 115
5.4.10 Land Tenure and Use 115
5.4.11 Water Supply and Access 116
5.4.12 Source of Energy 119
5.4.13 Works and Transport 120
6 STAKEHOLDER CONSULTATIONS AND DISCLOSURE 121
6.1 Stakeholder analysis 121
6.2 Approach for Consultation 125
6.3 Findings from Stakeholders Consultations 125
6.4 The Consultation Process 125

6.5 District leadership 126
6.6 Findings from Stakeholders Consultations 129
7 ANALYSIS OF ALTERNATIVES 145
7.1 Storage Reservoirs and distribution network 145
7.1.1 Option n. 1: 145
7.1.2 Option n. 2: 145
7.1.3 Option n.3: 146
7.2 Intake Works and Raw Water Pumps 150
7.2.1 Option 1: Groundwater Intake with Minimal Treatment 150
7.2.2 Option 2: River Water Intake with Comprehensive Treatment 151
7.3 Conclusion on Alternatives 152
8 EVALUATION OF ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION / ENHANCEMENT MEASURES 153
8.1 Pre-Construction / Mobilisation Phase Impacts 161
8.1.1 Positive Impacts 161
8.1.2 Negative Impacts 162
8.2 Construction Phase Impacts 163
8.2.1 Socio-Economic Impacts (Positive) 163
8.2.2 Socio-Economic Impacts (Negative) 165
8.2.3 Environmental Impacts (Negative) 171
8.2.4 Health and Safety Impacts (Negative) 179
8.3 Operational Phase 187
8.3.1 Socio-Economic Impacts (Positive) 187
8.3.2 Socio-Economic Impacts (Negative) 191
8.3.3 Environmental Impacts (Negative) 194
8.3.4 Health and Safety Impacts (Negative) 199
8.4 Impacts Specific to Masindi Port Area 203
8.4.1 Impacts on Masindi MV Ferry Operations 203
8.4.2 Impacts on Small Businesses 204
8.4.3 Impacts on High Voltage Transmission Line 204
8.4.4 Impacts on Masindi Port Road (7 km under construction) 204

8.5 Decommissioning Phase 205
8.5.1 Socio-Economic Impacts (Positive) 206
8.5.2 Socio-Economic Impacts (Negative) 206
8.5.3 Environmental Impacts (Negative) 207
8.5.4 Health and Safety Impacts (Negative) 207
8.6 Cumulative Impacts 208
8.6.1 Habitat Degradation and Loss of Biodiversity 208
8.6.2 Increased Traffic and Road Safety Risks 209
8.6.3 Unsustainable Resource Extraction and Demand 209
9 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP) 210
9.1 Introduction 210
9.2 Objectives of the ESMP 210
9.3 Implementation of the ESMMP 211
9.3.1 Ministry of Water and Environment (MWE) 211
9.3.2 Ministry of Gender, Labour and Social Development (MoGLSD) 211
9.3.3 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) 212
9.3.4 Ministry of Trade, Industry and Cooperatives (MoTIC) 212
9.3.5 Uganda Investment Authority (UIA) 212
9.3.6 National Environment Management Authority (NEMA) Commitments and Resourcing 212
9.3.7 Kiryandongo and Masindi District Local Governments 212
9.3.8 Supervising Consultant 213
9.3.9 Project Implementation Support Mission (Involving AfDB) 213
9.3.10 Contractor's Commitments and Resourcing 213
9.4 Structure of the ESMMP 213
9.5 Grievance Redress Mechanisms: 242
9.5.1 Workers' Council 242
9.5.2 Role Of the Workers Council 243
9.6 Supplementary Management Plans 247
9.6.1 Client / Developer's Action Plans 247

9.6.2 Public Consultation and Disclosure Plan (PCDP) 247
9.6.3 Contractor's Labor Force Management Plan (LFMP) 247
9.6.4 Contractor's Action Plans 248
9.6.5 Traffic Management Plan (TMP) 248
9.6.6 Waste Management Plan (WMP) 248
9.6.7 Pollutant Spill Contingency Plan (PSCP) 248
9.6.8 Contractor's Labor Force Management Plan 248
9.6.9 Hazardous Materials Management Plan (HMMP) 248
9.6.10 Health and Safety Management Plan 249
9.6.11 Pest Management Plan (PMP) 249
9.6.12 Biodiversity Management Plan (BMP) 249
10 CONCLUSION AND RECOMMENDATION 250
10.1 Conclusions 250
10.2 Recommendation 250
REFERENCES 253
APPENDICES 254
APPENDIX A: TOR APPROVAL LETTER 254
APPENDIX B: RECORD STAKEHOLDER ENGAGEMENTS 259
Appendix B-1: MINUTES OF RAP PREPARATION CONSULTATION MEETING 259
Appendix B-2: Meeting with Kimengo Sub County Officials 261
Appendix B-3: Meeting with Kiryandongo District Local Government 263
Appendix B- 4: Meeting with Kiryandongo District Stakeholders 265
Appendix B-4 (a): KEY INFORMANT – KIRYANDONGO 267
Appendix B-5: Meeting with Masindi District Stakeholders 278
Appendix B – 5 (a): Meetings within Masindi District: 280
Appendix B- 5 (b): Sub-Counties Visited: 296
Appendix B (c): KEY INFORMANT – MASINDI DISTRICT 298
Appendix B-6: Meeting with National Forestry Authority (NFA) 377
Appendix B -7: Meeting Minutes with Wetlands Management Department (WMD)- MWE 381
Appendix B – 8: Meeting with Bunyoro Kitara Kingdom 383

Appendix B – 9: Meeting Minutes with Ministry of Works and Transport (MoWT)..... 385
Appendix B – 10: Meeting minutes with Nile Basin Commission (NBC) 389
APPENDIX B 11: LETTER OF NOTIFICATION TO THE RIPARIAN STATES 394
APPENDIX C: BIODIVERSITY SURVEY REPORT..... 397
APPENDIX D: WATER QUALITY RESULTS 463
APPENDIX E: PCR REPORT 464
APPENDIX F: GEOTECHNICAL INVESTIGATION REPORT 499
APPENDIX G: PROJECT LAYOUT DRAWINGS..... 669
APPENDIX H: PEST MANAGEMENT PLAN 751
APPENDIX I : WATER SOURCE PROTECTION PLAN..... 775

LIST OF TABLES

Table 1-1: Summary of the potential project impacts and their enhancement/mitigation measures xxxi
Table 2-1: Impact Assessment and Evaluation 14
Table 2-2: Quantitative rating of impacts 16
Table 2-3: Overall Impact Rating and Description 16
Table 3-1: Policies relevant to the proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project 20
Table 3-2: Ugandan laws and regulations relevant to the Proposed MWACRID project. 27
Table 3-3: Permits and Licenses 38
Table 3-4: AfDB Environmental and Social Operational Safeguards 22
Table 4-1: The villages covered under the Multi-Purpose Water for Climate Resilience and Irrigation Development (MWACRID) Project 25
Table 4-2: On farm storage tanks' volume 60
Table 4-3: Stakeholder Farmers and Cropping Patterns 61
Table 4-4: Crop Farms 63
Table 4-5: Key livestock holdings 64
Table 4-6: Major construction materials and proposed sources 74
Table 5-1: Characteristics of soils encountered in the MWACRID project area 63
Table 5-2: Noise levels measured at the proposed project component sites 77
Table 5-3: Results for air quality measurement 81
Table 5-4: Level of Educational distribution 103
Table 5-5: Ethnicity of the of people in the geographical project scope 105
Table 5-6: Age distribution 106
Table 5-7: Ownership status of the house (home) 109
Table 5-8: Type of roofing 110
Table 6-1: Stakeholder analysis 121
Table 6-2: Matrix table summary of consultations 129
Table 6-3: Summary of key issues raised from consultations with communities 135
Table 6-4: Summary of key issues showing each entity's interests, potential concerns, and expectations during implementation and operation 136
Table 7-1: Summary of the Design Demands for Options 1, 2, 3 146
Table 7-2: Comparison of different options 149
Table 8-1: Evaluation of Anticipated Impacts 154
Table 8-2: Waste streams anticipated to be generated by the project 182
Table 8-3: Water Users Downstream of Masindi Port to Lake Albert 196
Table 9-1: Environmental and Social Management and Monitoring Plan 215
Table 10-1: Sampling points for amphibians 405
Table 10-2: Definition of significance criteria in the expert survey 410
Table 10-3: Rating scales for the criteria assessment in the expert survey 411

Table 10-4: Significance levels and scores for the expert survey 411
Table 10-5: Site Specific vegetation characterization of the project area 414
Table 10-6: Protected Trees and Reserved Species with the project area 423
Table 10-7: Mammal Species Recorded within and around the project area 428
Table 10-8: Amphibian species recorded 432
Table 10-9: Reptile species recorded within and around the project area 433
Table 10-10: Species composition and relative abundance of phytoplankton in water samples from selected sampling sites 435
Table 10-11: Species composition and relative abundance of zooplankton in water samples from selected sampling sites 436
Table 10-12: Diversity of Macro-invertebrates 436
Table 10-13: Relative abundance of fish species recorded during the Audit (P= Present and R= reported to exist during interviews) 437
Table 10-14: Photographic Representation of the Fish Species 438
Table 10-15: Predict impacts and mitigation measures 441
Table 10-1: Results of the Consultative Meetings with Stakeholders 472
Table 1-2: Detail of Cultural Heritage Sites recorded in the Masindi Port Bulk Water Supply and Irrigation infrastructure Project Area 474
Table 1-3: Determination of Impact Significance 489
Table 1-4: Summary of Impact Evaluation and Mitigation Measures 490

LIST OF FIGURES

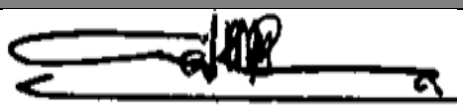
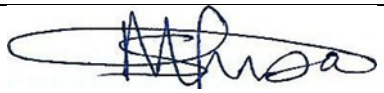
Figure 1-1: EIA Process followed by the ESIA team 5
Figure 2-1: Temtop M2000C air monitor 8
Figure 2-2: PCE-322A sound level meter 9
Figure 4-1: Map showing the location of the proposed MWACRID Project Site 28
Figure 4-2: Map showing the location of the proposed MWACRID Project components 29
Figure 4-3: Abstraction point location 55
Figure 4-4: Proposed location for the project abstraction point on River Nile 55
Figure 4-5: Water Treatment Process and Flow Diagram 57
Figure 4-6: The proposed site for the water treatment plants 58
Figure 4-7: Proposed location for the reservoir tanks 59
Figure 4-8: Overview of the reservoir tanks 60
Figure 4-9. Annual SPEI drought index in Uganda for the period 1986 – 2099 (source: WB, CLIMATE RISK COUNTRY PROFILE) 66
Figure 4-10: Top: projected trend per decade changes of precipitation (annual) under SSP2-4.5. bottom: precipitation trend under different SSP scenarios 67
Figure 4-11: The maximum water levels don't affect the water abstraction area 68

Figure 4-12. Planimetry and hydraulic results of the simulated water levels in correspondence of 5 sections of the River Nile. The water abstraction point is between sections 820 and 381. 69
Figure 5-1: Rainfall distribution in the project area 57
Figure 5-2: The geology of the project area 59
Figure 5-3: Map showing the nature of soils in the project are 65
Figure 5-4: Map showing the topography of the project area 67
Figure 5-5: Hydrology of the project area 69
Figure 5-6: The Nile River Intake 70
Figure 5-7: Kiyanja wetland in Miirya Subcounty 70
Figure 5-8: Seasonally flooded grassland in Wakisanyi Village 71
Figure 5-9: Subcatchments' delineation (brown lines) and the main runoff directions (blue arrows) based on morphology 72
Figure 5-10: Location of major drainage basins in Uganda, & major lakes and rivers 73
Figure 5-11. Annual Flow Volume at Kyoga outlet (Source: Nile Basin Water resources Atlas, 2016) 75
Figure 5-12. Monthly Flow Distribution, statistics and flow duration curve at Kyoga outlet and inlet (Source: Nile Basin Water resources Atlas, 2016) 76
Figure 5-13.Seasonal trend at Masindi Port 76
Figure 5-14: Noise assessment at the proposed project site 80
Figure 5-15: Air quality measurement at different project site locations 85
Figure 5-16: The swamp are that is part of the Nile River wetland system 87
Figure 5-17: The swamp area that is part of the Nile River wetland system 87
Figure 5-18: The swamp area that is part of the Nile River wetland system 87
Figure 5-19: Pine woodlot within the proposed project area 87
Figure 5-20: Farm trees at Kiiza farm in Wakisanyi Village 87
Figure 5-21: Panicum-Pennisetum grassland fallow at Ebenezer farm 87
Figure 5-22: Livestock farms-Ebenezer farm 88
Figure 5-23: Bushed grassland with scattered trees 88
Figure 5-24: Kaduku Central Forest Reserve 88
Figure 5-25: Sugar cane plantations that are project beneficiaries 89
Figure 5-26: Wooded grassland Within scattered fallow land 89
Figure 5-27: Maize gardens in Miirya subcounty 89
Figure 5-28: Cassava plantations for Soul Agric Farm in Kaduku 90
Figure 5-29: Savanna grassland with spread out cactus trees at Kesi farm 90
Figure 5-30: Land Use Land Cover map 92
Figure 5-31: Cat Fish obtained from the Nile at Masindi Port 94
Figure 5-32: Livestock reared by the communities 95
Figure 5-33: Gender of Respondents 97
Figure 5-34: Reasons for the Absence of Household Heads 99
Figure 5-35: Religious Affiliation of the Population in the Geographic Area 101

Figure 5-36:Marital Status 104
Figure 5-37: Household size 108
Figure 5-38: The housing conditions in the project area 111
Figure 6-1: Consultations with the Water Office - Kiryandongo District 139
Figure 6-2: Consultations with the CAO's office - Kiryandongo District 139
Figure 6-3: Consultations with the District Chairperson's office represented by the District Vice Chairperson 140
Figure 6-4: Consultations with the RDC - Kiryandongo District 140
Figure 6-5: Team in a discussion with management team at Soul Agric Business Company (Beneficiary) 141
Figure 6-6: Consultations with the District Chairperson – Masindi District 141
Figure 6-7: Courtesy visit to RDC – Masindi District 142
Figure 6-8: Consultative and sensitization meetings with communities in the project area-Kididma and Karangwe Village Sensitisation in Kimengo Subcounty 142
Figure 10-1: Location of the proposed MWACRID Project 402
Figure 10-2: Google image showing transects used and sampling points 403
Figure 10-3: Aquatic sampling points 409
Figure 10-4: Plant-Life Composition of the Project Area 422
Figure 10-5: Bird species per habitat type 426
Figure 10-6: Victoria Nile surrounded by riparian vegetation (wetland) 427
Figure 10-7: Bird species per project site 428
Figure 10-8: Species per genera 430
Figure 10-9: Reptile species richness within the different project components 431

THE ESIA TEAM

The ESIA study team was led by persons registered to practice ESIA by NEMA as per requirements of the National Environment (Conduct and Certification of Environmental Practitioners) Regulations of 2001. These were supported by specialists in various thematic areas. The following Environmental Practitioners carried out this ESIA study:

Name and Position/Specialist Area	Signature
Mr. Karumuna Rollanda ***CC/EIA/750/25*** ***ESIA Team Leader*** Solid Waste and Wastewater Management, Environmental Health and Safety, Water and Sanitation Assessments	
Mr. Musa Ssegaabwe **CC/EIA/243/25** ***ESIA Team Member*** Natural Resources Management Specialist	
Ms. Irene Nammanda **CC/EIA/235/25** ***ESIA Team Member*** Land Use Planning with Remote Sensing and GIS, Biodiversity surveys, Waste Management	

The above practitioners were supported by the following Technical Contributing Specialists

S/N	Name	Position
1.	**Mr. Andrew Kivunike**	Sociologist (Social Impact Assessment, Stakeholder Engagement, Gender Assessment) / Quality Control
2.	**Mr. Noah Denis Higenyi**	Sociologist (Social Impact Assessment, Stakeholder Engagement, Gender Assessment) / Quality Control
3.	**Ms. Lydia Mukasa Ndibalekera**	Occupational Health and Safety Specialist
4.	**Mr. Ian Bahiirwa**	Waste Management and Pollution Control

S/N	Name	Position
5.	**Eng. Amanullah Tarin**	Project Manager/Team Leader
6.	**Eng. Alessandro Cacciatori**	Design Engineer
7.	**Eng. Fred Jura**	Agronomist/ Irrigation Engineer
8.	**Ms. Francesca Ramazzina**	Hydrologist
9.	**Dr. Jonnah Rao Owen**	Economic and Financial Specialist
10.	**Mr. Munanura Joel**	Environmentalist
11.	**Eng. Balenzi Enoch**	Geotechnical Engineer
12.	**Mr. Crispus Ogwal**	Surveyor
13.	**Mr. Kintu James**	Biodiversity Specialist

ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
BMP	Biodiversity Management Plan
DWD	Directorate of Water Development
EIA	Environment Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
FC	Financial Cooperation
FGDs	Focus Discussion Groups
GIS	Geographic Information System
GOU	Government of Uganda
GPS	Global Positioning System
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
LC	Local Council
M&E	Monitoring and Evaluation
MoU	Memorandum of Understanding.
MWE	Ministry of Water and Environment
NEMA	National Environment Management Authority
NGOs	Non-Government Organizations
OHS	Occupational Health and Safety
PPE	Personal Protective Gear
RAP	Resettlement Action Plan
RGCs	Rural Growth Centers
SOPs	Standard Operating Procedures
ToR	Terms of Reference

E. EXECUTIVE SUMMARY

The Government of Uganda, through the Ministry of Water and Environment (MWE), has secured funding from the African Development Bank (AfDB) to undertake a feasibility study for the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project. This strategic initiative aims to develop a sustainable bulk water supply system that supports multiple uses, with a particular focus on irrigation and potable (domestic) water provision to enhance climate resilience, food security, and public health in Uganda.

The MWACRID Project targets sub-counties in Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District, all within the Bunyoro sub-region. The project seeks to: Irrigate approximately 15,000 hectares of land to benefit both smallholder and commercial farmers, thereby improving agricultural productivity and resilience to climate variability; provide safe and clean drinking water to rural and peri-urban communities, serving households, institutions, livestock, and rural industries.

Uganda's agriculture is overwhelmingly dependent on rain-fed systems, yet only 0.1% of total agricultural land is currently irrigated. This makes the sector highly vulnerable to the adverse impacts of climate change, including erratic rainfall and prolonged droughts. These disruptions have caused substantial economic losses for instance, the 2008 and 2010/11 droughts resulted in crop losses worth up to USD 470 million, or 16% of the total value of food and cash crops. With over 80% of Uganda's population relying on subsistence farming, such climate-induced losses threaten livelihoods, food security, and the national economy.

In the Bunyoro sub-region, subsistence farmers rely heavily on increasingly unreliable natural water sources like streams, shallow wells, and boreholes. The MWACRID Project is designed to introduce a climate-resilient bulk water infrastructure that can meet both production and consumption demands, marking a major step toward integrated water resource management.

In addition to supporting agricultural productivity, the project addresses critical public health challenges. According to the Uganda Water and Environment Sector Performance Report (2022), 39% of rural households still depend on unsafe or unimproved water sources, exposing communities to waterborne diseases such as cholera, typhoid, and dysentery, especially among children under five. By delivering treated drinking water, the project will significantly improve hygiene, reduce disease burden, and raise the standard of living in the targeted communities.

This multi-purpose initiative is aligned with Uganda's Vision 2040 and the Third National Development Plan (NDP III), both of which prioritize climate-resilient infrastructure, universal access to safe water, and improved agricultural productivity. It supports the country's broader goals of economic transformation and human development by: Enhancing food and nutrition security through irrigation; Safeguarding the right to water for domestic use; Reducing the time and labor burden especially for women and children associated with water collection; Building resilient livelihoods and reducing vulnerability to climate shocks.

In summary, the MWACRID Project represents a transformative investment in Uganda's water sector, offering a holistic and integrated solution to the interlinked challenges of water scarcity, climate change, food insecurity, and public health. Through its dual focus on irrigation and potable water supply, the project aims to foster sustainable development and resilience for communities in Masindi and Kiryandongo Districts.

The main components of the project include: construction of intake works and raw water abstraction infrastructure on the Victoria Nile; transmission of both raw and treated water via over 37 kilometers of ductile iron pipelines; water treatment systems comprising a drinking water plant (5,000 m^3/day) and a sedimentation facility for irrigation water (320,000 m^3/day); construction of storage reservoirs at Kaduku Hill and potentially on farms; a pressurized and gravity-fed irrigation distribution network; a 33kV power line extension of about 40 kilometers; and integration of a SCADA-based automation system for real-time monitoring and control. Additional support infrastructure will include administrative offices, laboratories, workshops, and housing for technical staff.

To ensure the environmental and social sustainability of the project, various implementation activities will be undertaken, including stakeholder engagement, community sensitization, contractor management, and establishment of Water User Associations (WUAs). The project will also promote efficient on-farm irrigation practices and provide training in climate-smart agriculture to farmers and extension workers. These activities aim to reduce water loss, improve irrigation efficiency, and build institutional capacity for long-term sustainability.

However, to safeguard the environment and communities affected by the project, an Environmental and Social Impact Assessment (ESIA) has been conducted in accordance with NEMA's guidelines. This ESIA ensure that the project is implemented with minimal environmental and social harm. The Ministry of Water and Environment (MWE) has commissioned Ardent Technical Services Limited, a team of certified environmental practitioners, to prepare this Environmental and Social Impact Assessment.

This report particularly presents the activities of the Environmental and Social Impact Assessment for Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project in Masindi District and Kiryandongo District, Uganda.

The proposed project is one of those listed in the fifth schedule of the National Environment Act 2019 that is section 4: utilization of water resources and water supply that need to be subjected to an Environmental and Social Impact Assessment before implementation. Section 6: Large scale irrigation of more than 20 hectares.

According to African Development Bank; (AfDB) Integrated Safeguards System 2023 (ISS), the project is considered as "Category 1", (High-risk operations likely to cause significant and/or irreversible adverse environmental and/or social impacts on a large scale, which requires the preparation of an Environmental and Social Impact Assessment (ESIA). The main objective of the study will be to identify and assess the potential environmental and social impacts that are associated with the proposed development, with a view of suggesting viable remedial measures for addressing the non-conformances while enhancing positive attributes.

E.1 The Developer details

This project is being implemented by;

Ministry of Water and Environment through the Directorate Of Water Dvelopment
Address: Plot 3-7 Kabalega Crescent Road, Luzira, P.O.Box 20026, Kampala,Uganda.

E.2 Project site and study locations

The proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project for both small holder farmers and commercial farmers is located in the sub counties Masindi-Port, Kigumba -Kiryandongo District and Mirya and Kimengo sub counties in Masindi District. The proposed water source for this project is the Nile River, with Masindi Port identified as a catchment point. Masindi Port is in Masindi District in the Western Region of Uganda, along the western banks of the Victoria Nile River. Masindi district is located in the mid-western part of Uganda and covers an area of approximately 4200 square kilometres. It is bordered by Kiryandongo District to the east, Nwoya District to the north, Buliisa District to the west, Hoima District to the southwest, Kyankwa, Nakaseke and Nakasongola District to the southeast. Kiryandongo District is located in western Uganda and covers an area of approximately 3600 square kilometres. It is bordered by Nwoya District to the north, Masindi District to the northeast, Oyam, Apac and Nakasongola District to the east.

The project influence area includes critical environmental and social components (VECs), such as wetlands around the Victoria Nile, forested areas on Kaduku Hill, and sensitive community infrastructure. Baseline studies indicate the presence of endemic plant species and moderate biodiversity richness in the project corridor. Socioeconomically, the region faces challenges such as low access to clean water (39% in rural households), youth unemployment, and high dependence on rain-fed agriculture. Maps indicating land cover, critical habitats, and project infrastructure layout are included in Annex G and C.

E.3 ESIA Methodology included; document review, field visits including direct observations, Impacts Evaluation and analysis and photography, measurement of physical environmental

parameters, as well as biological and socioeconomic survey. Key stakeholders were consulted. Potential impacts were identified and analyzed.

E.4 This ESIA report presents: Executive summary, Introduction, ESIA methodology, , Policy, legislation and institutional framework section, Project description, a description of the environmental and socio-economic baseline, Stakeholder consultations, Analysis of alternatives, Evaluation of Environmental and Social Impacts and Mitigation / Enhancement Measures, Environment and Social Management and Monitoring Plan.

E.5 Relevant policies, laws and Institutional Framework including International conventions
There is an established policy, legal and institutional framework for environmental management in Uganda. The National Environmental Act (NEA Nr. 5) of 2019 provides for Environmental and Social Impact Assessment for projects which have significant adverse impacts on the environment. According to the NEA (2019), the proposed project is listed under Schedule 5 (Projects for which Environmental and Social Impact Assessment are mandatory) and under Category 4, "Utilisation of water resources and water supply", Part (a) "Abstraction or utilisation of surface water for agricultural, industrial or urban use of more than 1000 m3/day." Part (c) Diversion of water from a river or stream, where the water discharged is more than 400m3/day or 30% of Internal Renewable Water Resources over the river catchment. Section 6: Large scale irrigation of more than 20 hectares.

Some of the polices, laws and institutions that will guide the project implementation:

Policy Framework

a) Applicable Ugandan Policies National Environment Management Policy, 1994; the overall goal of this policy is the promotion of sustainable economic and social development, mindful of the needs for future generations. The management and monitoring plans developed because of the findings of this study will serve for sustainability of the project.
b) Uganda National Land Policy, 2013; the overall goal of the Policy is to ensure an efficient, equitable and optimal utilization and management of Uganda's land resources for poverty reduction, wealth creation and overall socio-economic development, hence the ESIA.
c) National Gender Policy, 2007; the goal of this policy is to mainstream gender issues in the national development process, particularly women. A gender management plan to guide women inclusion and equal employment opportunity is recommended to be developed by the project contractor. The policy also identifies Gender Department under Ministry of Gender, Labour and Social Development (MGLSD) as a key project stakeholder.
d) National Water Policy, 1997; the goal of this policy is to provide guidance on development and management of the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and

economic needs, with full participation of all stakeholders and mindful of the needs of future generations.

e) Occupational Health and Safety (OHS) Policy, 2017; this policy calls for labour conditions safeguards such as, the contractor bearing an Occupation, Safety & Health Management Plan, Emergency Response and Incident Management Plan, Induction of all workers, toolbox meetings, and PPE usage.

f) National AIDS Policy, 2004; It is anticipated that the project will employ people from different parts of the country, indiscriminate of their HIV/AIDS status. Interaction with the community may result in an increase in the spread of the disease. Measures shall therefore be instituted by the contractor and supervising agencies to ensure that the spread of HIV/AIDs is controlled through activities like sensitization of the workers and communities and providing free counselling and testing services among other measures. Environment Health Policy, 2005 The Environmental Health policy will guide implementation of public health and hygiene intervention measures on the project.

g) National Sanitation Policy, 1997; the Goal of this policy is to promote and preserve the health of the community through improved sanitation. The policy will guide implementation of good sanitary intervention measures on the project, mainly for the construction crew.

h) Uganda National Culture Policy, 2006; the policy delineates the cultural heritage of Uganda as artistic and cultural expressions. The policy also identified Department of culture under MGLSD as a key project stakeholder. Uganda National Climate Change Policy, 2012 Sector-Specific priorities for Agriculture and Livestock, irrigation systems that use water sustainably for agriculture such as this project, are encouraged to promote climate change adaptation strategies that enhance resilient, productive and sustainable agricultural systems in Uganda.

i) National Agricultural Policy, 2013; this project seeks to support farming communities in Masindi and Kiryandongo by improving agricultural productivity, food security and livelihoods through providing water for agriculture aimed at achieving policy objective; achieving food and nutrition security and improve household incomes through coordinated interventions that focus on enhancing sustainable agricultural productivity. The same policy defines Ministry of Agriculture Animal Industry and Fisheries (MAAIF) as a key stakeholder for this project.

j) The National Fisheries Policy, 2004; the Overall fisheries sector goal is to ensure increased and sustainable fish production and utilization by properly managing capture fisheries, promoting aquaculture, and reducing post-harvest losses.

Further, according the funder's (African Development Bank; AfDB) Integrated Safeguards System 2023 (ISS), the project is considered as category 1 (High-risk operations likely to cause significant

and/or irreversible adverse environmental and/or social impacts on a large scale) which requires the preparation of an Environmental and Social Impact Assessment ESIA.

The African Development Bank (AfDB) Operational Safeguard (OS) policies such as;

OS 1: Environmental and Social Assessment

This safeguard is triggered due to the large-scale nature of the project, which involves bulk water supply infrastructure and irrigation development.

A comprehensive Environmental and Social Impact Assessment (ESIA) has been prepared to evaluate risks such as ecosystem degradation, social displacement, pollution, and stakeholder concerns. The project has prepared an Environmental and Social Management Plan (ESMP) to outline mitigation measures.

OS 2: Involuntary Resettlement, Land Acquisition, Population Displacement, and Compensation

Triggered if land acquisition is required for water infrastructure, transmission pipelines, and irrigation zones, potentially displacing households or farmers. A Resettlement Action Plan (RAP) will be necessary to address compensation, livelihood restoration, and community engagement. Particular attention will be given to vulnerable groups, ensuring equitable compensation and alternative livelihoods.

OS 3: Biodiversity and Ecosystem Services

Triggered due to potential impacts on aquatic and terrestrial ecosystems, particularly around the Nile at Masindi Port and surrounding wetlands. A biodiversity impact assessment has been done to determine effects on flora, fauna, and ecosystem services. Mitigation measures include habitat restoration, buffer zones, and biodiversity offset programs.

OS 4: Pollution Prevention and Control, Hazardous Materials, and Resource Efficiency

Triggered due to potential pollution from construction activities, increased water abstraction, and risks of chemical contamination from irrigation. The project will implement a water quality management plan, monitor pollution levels, and promote sustainable water use. Measures such as sediment control, proper disposal of hazardous materials, and energy-efficient technologies will be adopted.

OS 5: Labour Conditions, Health, and Safety

Triggered due to the involvement of a large workforce, construction risks, and occupational hazards. The project will adhere to international labour standards, ensuring fair wages, non-

discrimination, and safe working conditions. The project will implement a Health and Safety Management Plan (HSMP) and conduct training on occupational health and community safety.

OS6: Habitat and Biodiversity Conservation and Sustainable Management of Living and Natural Resources

This safeguard is triggered due to the project's proximity to ecologically sensitive areas, including wetlands and forested hills such as Kaduku Hill, which is part of the Central Forest Reserve. The MWACRID Project involves abstraction from the Nile River and development of irrigation infrastructure that may affect aquatic and terrestrial ecosystems. A biodiversity and critical habitat assessment was conducted to identify species of conservation concern, including those listed under the IUCN Red List. The project has integrated mitigation measures such as buffer zones, restricted access during sensitive breeding seasons, and habitat restoration plans. The Environmental and Social Management Plan (ESMP) includes provisions for monitoring biodiversity indicators and implementing compensatory conservation actions in alignment with the AfDB's OS6.

OS7: Vulnerable Groups

The MWACRID Project recognizes the presence of vulnerable groups in the project area, including female-headed households, the elderly, persons with disabilities, and youth. These groups may be disproportionately affected by land acquisition, restricted access to water, or project-related employment opportunities. In line with OS7, the project has conducted a vulnerability analysis as part of the socio-economic baseline and Resettlement Action Plan (RAP). Targeted engagement and tailored livelihood restoration measures have been proposed, including priority hiring, support for alternative income-generating activities, and access to social protection services. Participation of vulnerable groups is being ensured through inclusive consultation mechanisms and culturally appropriate communication tools.

OS8: Cultural Heritage

The project area includes both tangible and intangible cultural heritage assets, such as sacred sites, burial grounds, and community rituals. A Physical Cultural Resources (PCR) survey and ethnographic assessments were conducted to document potential impacts. In compliance with OS8, the project has developed a Cultural Heritage Management Plan (CHMP) to guide chance find procedures, protection measures, and ongoing community involvement. Consultations with cultural and religious leaders, as well as the Department of Culture and Museums, informed mitigation planning. No relocation of PCRs is currently anticipated; however, the CHMP outlines clear steps in case of accidental discovery of artefacts or heritage sites during construction.

OS10: Stakeholder Engagement and Information Disclosure

In accordance with OS10, the MWACRID Project has undertaken a comprehensive and iterative stakeholder engagement process, beginning from project design through to the ESIA phase. Stakeholders consulted include government agencies, district authorities, sub-county representatives, community leaders, farmers (both smallholder and commercial), and vulnerable groups. The project has established a Stakeholder Engagement Plan (SEP) and a Grievance Redress Mechanism (GRM) to ensure meaningful, timely, and accessible information sharing and feedback channels. The SEP outlines strategies for continuous engagement during implementation, including disclosure of ESIA findings in local languages, participatory monitoring, and capacity building for local institutions.

UN Sustainable Development Goals (SDG 6, 13, and 15):

- SDG 6 (Clean Water and Sanitation): The project will contribute to SDG 6 by ensuring access to reliable water sources for irrigation and community use.
- SDG 13 (Climate Action): Incorporating climate-resilient infrastructure will help mitigate climate change impacts.
- SDG 15 (Life on Land): By promoting sustainable water use and preventing wetland degradation, the project will support the conservation of terrestrial ecosystems.

Convention on Biological Diversity (CBD): This global treaty focuses on conserving biological diversity, sustainable use of its components, and fair sharing of benefits. The Masindi project will adopt measures to protect local biodiversity by implementing thorough environmental impact assessments and aligning with conservation priorities.

United Nations Framework Convention on Climate Change (UNFCCC): By integrating climate change mitigation and adaptation strategies, the project will contribute to international efforts to combat climate change, ensuring that water management practices align with broader climate resilience goals.

IUCN Red List and Guidelines: These guidelines help identify and protect species at risk. The Masindi project will reference the IUCN Red List to safeguard endangered species in the project area and adapt project plans accordingly to avoid critical habitat disruption.

FAO Irrigation and Drainage Papers: These papers provide guidelines for sustainable and efficient irrigation practices. The project will use these guidelines to implement water-efficient irrigation systems that optimize water usage, ensuring minimal waste and promoting sustainable agriculture.

Equator Principles: These principles help ensure that projects financed by participating institutions adhere to high environmental and social standards. By aligning with the Equator Principles, the project will be positioned for potential international funding and demonstrate its commitment to responsible development practices.

b) Legal Framework

- The Constitution of the Republic of Uganda; 1995; amended as at 15th February 2006, Government of Uganda.
- The National Environment No. 5 2019
- The Water Act, Cap 152 and The Water Resources Regulations, 1998
- The Land Act, Cap 227
- The National Environment (Environmental and Social Assessment) Regulations, 2020
- National Environment (Conduct and Certificate of Environment Practitioners Regulations (2003)
- The National Environment (Waste Management) Regulations (2020)
- The National Environment (Noise Standards and Control) Regulations, 2003.

c) Institutional Framework

- Ministry of Water and Environment (MWE)
- Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)
- National Environmental Management Authority (NEMA)
- Ministry of Gender, Labour & Social Development (MGLSD)
- Uganda Investment Authority (UIA)
- Ministry of Lands, Housing and Urban Development (MoLHUD)
- Masindi District Local Administration Structures
- Kiryandongo District Local Administration Structures

d) Private Sector Institutions

- Non-Governmental Organizations (NGOs), Civil Society Organizations (CSOs) and Community based organizations
- Farmers' Organizations which include community groups, associations and cooperatives among others
- Commercial and smallholder farmers
- Households/Beneficiaries

E.6 Project Description

The Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project aims to enhance water availability for irrigation, domestic use, livestock watering, and rural industries in Masindi and Kiryandongo Districts. The project will abstract water from the Nile River at Masindi Port and utilize a combination of submersible pumps, sedimentation and treatment facilities, storage tanks, and a gravity-fed distribution system to meet diverse water needs.

Project Scope and Components

The project is designed to serve an estimated 87,000 people, provide irrigation for 12,700 hectares of farmland, and supply water to 10,340 livestock heads. Key components include:
Intake Works: A diversion sump on the Nile River with offshore abstraction pipelines.
Raw and Treated Water Transmission: Over 37 km of ductile iron pipelines to storage reservoirs.
Water Treatment Facilities: A drinking water treatment plant (5,000 m^3/day) and sediment removal system for irrigation water (320,000 m^3/day).
Power Supply: A 33kV power line extension (40 km) to support pumping stations.
Storage and Distribution: Reservoirs at Kaduku Hill and on-farm storage to regulate supply and pressure.
Automation & SCADA: Integration of smart monitoring and control systems.
Support Infrastructure: Administrative offices, laboratories, workshops, and staff housing.

Water Demand and Supply

The project will abstract a total of 375,000 m^3/day from the Nile, a small fraction (0.6%) of the available flow (60 Mm^3/day) after environmental considerations. Hydrological analyses confirm that the abstraction will have minimal impact on downstream users and ecological balance.

Portable Water Supply Infrastructure Components

- Diversion Canal
- Water Intake and Pump Station For Portable Water
- Domestic Water Treatment Plant (DWTP)
- The DWTP will include several key buildings and facilities:
- Process Buildings: Containing the treatment units and machinery for coagulation, sedimentation, and filtration, and disinfection.
- Control Room: Equipped with advanced monitoring systems to oversee plant operations and water quality parameters.
- Electrical Building: Housing electrical systems, including power supply and backup generators to ensure uninterrupted operation.
- Maintenance Buildings: Providing storage for maintenance tools, spare parts, and equipment for ongoing operations.
- Office and Administrative Buildings: Supporting the management of the WTP and associated systems.
- Guard Room
- Transmission pipeline
- Pump Stations at the Water Intake
- Distribution pipelines

- Main Reservoir tanks

Irrigation Water Supply Infrastructure Components

- Diversion Canal
- Water Intake and Pump Station For Irrigation
- Irrigation Water Treatment Plant (IWTP)
- Buildings within the IWTP compound
- The WTP will include several key buildings and facilities:
    - Process Buildings: Containing the treatment units and machinery for coagulation, sedimentation, and filtration, and disinfection.
    - Control Room: Equipped with advanced monitoring systems to oversee plant operations and water quality parameters.
    - Electrical Building: Housing electrical systems, including power supply and backup generators to ensure uninterrupted operation.
    - Maintenance Buildings: Providing storage for maintenance tools, spare parts, and equipment for ongoing operations.
    - Office and Administrative Buildings: Supporting the management of the WTP and associated systems.
    - Guard Room
- Transmission pipeline
- Pump Stations at the Water Intake
- Distribution pipelines
- Main Reservoir tanks for Irrigation
- Distribution Line to the farm gates for irrigation

Climate Change Considerations

Future climate projections indicate variability in water availability due to changing precipitation patterns. The project design incorporates measures to ensure sustainable water management, including regulated storage, efficient irrigation technologies, and contingency planning for extreme weather events.

E.7 Project Alternatives

In considering the development options, analysis of the alternative conducted.

a) 'No Project' Scenario

The 'No Project' scenario is neither tenable nor beneficial for the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project for several reasons, especially given the project's focus on increasing water access for multipurpose

use. The 'No Project' scenario would lead to continued water scarcity, reduced agricultural productivity, economic stagnation, and increased vulnerability to climate change, making it neither a viable nor beneficial option for the communities in Masindi and Kiryandongo Districts.

b) Alternatives Considered

Other alternatives that were examined are location of intake options, Location of the treatment plant, location of the reservoir tank, transmission main options and comparison was made of such alternatives, in technical, economic, social and environmental terms.

- ***Project Alternatives:*** Three distribution system alternatives were evaluated, each affecting water storage at Kaduku Hill, on-farm reservoirs, and pipeline diameters:

Option 1: 16-hour daily operation with a 40,000 m^3 reservoir at Kaduku Hill and 188,000 m^3 on-farm storage.

Option 2: 16-hour daily operation, supplying farms weekly, with 40,000 m^3 at Kaduku Hill and 821,000 m^3 on-farm storage.

Option 3: 24-hour pump operation, 18-hour daily distribution, with a centralized 188,000 m^3 reservoir at Kaduku Hill and no on-farm storage.

Key comparison criteria included ecological impact, social considerations, land use, and operational feasibility. Option 3 minimizes on-farm land use and maintenance but requires a large reservoir at Kaduku Hill. Option 1 balances storage flexibility with moderate environmental impact, while Option 2 maximizes water security but demands significant land use for reservoirs.

- ***Intake and Treatment Alternatives:***

Groundwater Intake (Minimal Treatment): Involves drilling nine boreholes with limited treatment, reducing chemical use but risking groundwater depletion.

River Water Intake (Comprehensive Treatment): Draws from the Nile, ensuring higher supply reliability but requiring extensive land and treatment infrastructure, with potential aquatic ecosystem impacts.

Conclusion on Alternatives:

Based on technical, environmental, and socio-economic considerations, Option 1 was preferred due to its balance between storage flexibility and manageable environmental impact. River water intake was selected over groundwater due to higher yield reliability and lower ecological risk from abstraction. The final alternative ensures sustainable bulk water delivery with optimized infrastructure and minimal disruption.

E.8 Stakeholder Consultations and Disclosure

The stakeholder consultation process for the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project was conducted as part of the Environmental and Social Impact Assessment (ESIA). The primary objective was to document stakeholder concerns regarding the project's planned interventions, focusing on environmental and social impacts. The engagement process involved government agencies, local authorities, commercial farmers, and community representatives to ensure inclusivity in decision-making.

Stakeholder Analysis

Key stakeholders included:

- **Government Entities**: The Ministry of Water and Environment (MWE), the Department of Water Development (DWD), Occupational Safety and Health in the
- Ministry of Gender and Social Development, Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), the National Environmental Management Authority (NEMA), the National Forestry Authority (NFA), Nile Basin Commission and the Uganda Investment Authority (UIA).
- **Local Government Authorities**: The District Local Governments of Masindi and Kiryandongo, including Chief Administrative Officers (CAOs), Resident District Commissioners (RDCs), District Water Officers, and sub-county leaders.
- **Community Stakeholders**: Representatives from Masindi Port, Kigumba, Mirya, and Kimengo sub-counties.
- **Commercial and smallholder Farmers**.

Consultation Approach

The engagement was carried out through:

- Meetings with relevant stakeholders,
- Key informant interviews,
- Community engagements, and
- Observational assessments.

Consultations were conducted at both district and community levels, ensuring broad participation. Field visits occurred in two phases: December 17–18, 2024, and March 15–18, 2025, covering key government offices and community representatives.

Key Findings from Stakeholder Consultations

Need for Water

i. Both Masindi and Kiryandongo districts experience severe water shortages, impacting households, agriculture, and livestock farming.

ii. Past interventions, such as borehole drilling and valley tank construction, have proven insufficient.
iii. Sub-county officials in Kimengo noted that the area has no reliable water source and has struggled with failed borehole projects.
iv. The District Water Officer in Kiryandongo emphasized that the project would support both smallholder and commercial farmers.

Stakeholder Willingness and Support

i. Strong local government and community support were evident, with leaders pledging assistance in mobilization, awareness creation, and conflict resolution.
ii. The RDC of Kiryandongo committed to addressing potential disputes and ensuring smooth community engagement.
iii. Masindi District's CAO highlighted that the project aligns with the community's needs and would likely receive widespread acceptance.

Grievance Management and Potential Conflicts

i. Stakeholders raised concerns about potential land disputes and environmental impacts.
ii. The RDCs of both districts assured project teams of their readiness to handle grievances related to land ownership and project implementation.
iii. It was emphasized that clear communication, sensitization, and collaboration with NEMA would be necessary to address environmental and social issues.

Farmers' Perspectives

i. Commercial farmers expressed strong support for the project, citing benefits for irrigation and livestock watering.
ii. Water scarcity was identified as the biggest constraint to agricultural productivity.
iii. Different irrigation practices were noted, including manual watering, unprotected dams, and solar-powered boreholes.
iv. Employment opportunities varied, with some farms employing over 500 workers, while others had fewer than 20. Women's participation in agricultural employment was highlighted as an area requiring improvement.

Community Concerns

The consultation process identified key concerns and corresponding resolutions:

i. **Access to Water**: Concerns about prioritizing large companies over community needs. Assurance was given that the project would cater to both.
ii. **Land Acquisition**: Fears of displacement were raised, and stakeholders were assured of adherence to national land acquisition and compensation guidelines.
iii. **Employment Opportunities**: Community members sought job opportunities, and the project pledged to provide both skilled and unskilled positions.
iv. **Water Pricing and Billing**: Clarity was requested on cost implications, with assurances that pricing would be based on fair consumption models.

v. **Water Quality**: Some residents expressed concerns about "hard water"; authorities confirmed that water treatment would comply with national and WHO standards.

E.9 Impact Identification

Impact identification began with a thorough review of the project's activities, such as construction, operation, and decommissioning phases. The identification process included: Desk Studies, Field Surveys and Stakeholder Engagement.

E.10 Impact Prediction

Impact prediction involved forecasting how identified project activities will interact with environmental and social receptors. Prediction tools included: Baseline Data Analysis and Expert Judgment.

E.11 Impact Evaluation Criteria

Identified impacts were evaluated using several key criteria:

a) **Nature of the Impact**: **Positive**: An impact that improves conditions or provides benefits; **Negative**: An impact that degrades conditions or creates risks.
b) **Type of Impact**: **Direct**: Impacts that occur as a direct result of project activities (e.g., habitat destruction due to construction); **Indirect**: Impacts that occur as a secondary result (e.g., increased population pressures due to new infrastructure); **Cumulative**: Combined impacts from this and other existing or planned projects in the area (e.g., strain on water resources due to multiple developments).
c) **Magnitude**: The degree of change caused by the impact (Minor, Moderate, Major).
d) **Extent**: The spatial scale of the impact (Local, Regional, National).
e) **Duration**: The length of time the impact will last (Short-term, Long-term, Permanent).
f) **Reversibility**: The degree to which an impact can be undone or mitigated (Reversible, Irreversible).
g) **Probability**: Likelihood of the impact occurring (Unlikely, Likely, Certain).

E.12 Significance of Impacts

The significance of an impact is a function of both the magnitude of the impact and the sensitivity of the affected receptor. Significance was categorized as:

a) **Negligible**: No significant impact on environmental or social conditions.
b) **Low**: Minimal impacts with limited or no lasting effects.

c) **Moderate**: Noticeable impacts that require mitigation but are unlikely to have severe long-term consequences.
d) **High**: Major impacts with potentially severe, long-lasting, or irreversible consequences

E.13 Potential environmental and social impacts

The project is expected to affect approximately 20 hectares of vegetation, including 5 hectares within a Central Forest Reserve. Up to 18 endemic or vulnerable flora and fauna species could be disturbed. Approximately 200 households may be impacted by land acquisition processes, including potential displacement or loss of livelihood. Over 50 trees are estimated to be affected. Without adequate mitigation, the project could elevate risks of soil erosion, water contamination, and community health burdens during construction.

The ESIA study team identified that the proposed project will have both positive and negative environmental and social impacts. Enhancement and mitigation measures have been proposed for positive and negative impacts respectively. A comprehensive Environmental and Social Management and Monitoring Plan (ESMMP) has been developed and is detailed in Chapter 9 of the report.

Below is a summary of the potential project impacts and their enhancement/mitigation measures;

Table 1-1: Summary of the potential project impacts and their enhancement/mitigation measures

Impact	Description	Enhancement/Mitigation Measures
CONSTRUCTION PHASE		
Income for Suppliers & Contractors	Local sourcing of construction materials provides financial benefits.	Source materials from licensed quarries in Masindi and Kiryandongo.
Employment Opportunities	Over 100 jobs generated for local youths (ages 18-30) during construction; long-term roles during operation.	Prioritize local hires, ensure timely payments, and maintain good contractor-employee relationships.
Revenue for Government	Increased tax revenue for central and local governments.	
Land Take	Permanent land acquisition for infrastructure; temporary land take along pipeline.	Ensure fair and prompt compensation by MWE for affected people.

Impact	Description	Enhancement/Mitigation Measures
Dust and Air Emissions	Temporary localized increase in air emissions from construction activities.	Implement water sprinkling, control truck speeds, provide safety gear for workers, maintain equipment, and monitor dust emissions.
Soil Degradation	Erosion and soil quality deterioration from construction activities.	Develop a waste management plan, store soils properly, prevent equipment leaks, compact backfill material, and facilitate natural revegetation.
Water Pollution	Risks of contamination from sediments, fuels, and domestic waste during construction.	Maintain equipment, provide adequate wastewater facilities, store materials away from watercourses, handle hazardous wastes responsibly, and conduct monthly water quality tests.
Improper Waste Management	Generation of various wastes leading to contamination and health risks.	Prepare a Waste Management Plan, provide waste bins, manage hazardous wastes through certified contractors, and collaborate with local governments for disposal.
Introduction of Invasive Species	Potential introduction of invasive species through vehicles and materials.	Inspect and clean vehicles, and remove identified invasive species.
Deterioration of Landscape & Visual Quality	Visual impacts from sourcing earth materials, with potential health risks from unrestored pits.	Source materials from licensed suppliers, restore borrow pits, and implement a murram extraction plan.
Loss and Degradation of Natural Habitats	Minimal disturbance expected, but critical ecosystems like the Victoria Nile require protection.	Restrict activities to necessary areas, avoid tree cutting in reserves, implement tree replacement for removals, and ensure unobstructed water flow during installation.
Risk of Seismic Activity	Moderate seismic risk necessitating precautionary measures.	Design structures for seismic resilience, adhering to appropriate design codes.

Impact	Description	Enhancement/Mitigation Measures
Risk of Traffic Accidents	Increased traffic risks due to construction activities, particularly at pipe crossings.	Develop a traffic management plan, employ safe traffic control measures, and set speed limits for vehicles.
Unsustainable Use of Resources	Extraction of murram and water may lead to resource depletion and local service strain.	Raise awareness on resource conservation, acquire necessary permits, source materials from NEMA-approved sites, restore borrow pits, and develop catchment management plans.
HIV/AIDS and STDs	Influx of migrant workers increases the risk of HIV/AIDS and other STDs, straining local health systems and impacting community livelihood and cohesion.	Implement an HIV/AIDS policy as a contractual obligation, including a framework and responsible staff during project execution.
Prostitution, Crime, and Drug Abuse	Increased male worker influx may lead to higher demand for sex, raising concerns about prostitution, crime, and drug abuse in the community.	Develop a workers' code of conduct, involve local leaders in security plans, and conduct awareness campaigns on responsible behavior and community risks.
Potential for Child Abuse and School Dropouts	Proximity of workers to schools raises risks of child abuse and increased school dropouts due to economic pressures.	Report abuse cases, minimize child-worker interactions, conduct awareness campaigns, and develop a child protection plan in collaboration with community leaders and schools.
Disruption of Families	Increased disposable income among workers can lead to extramarital affairs and family breakdowns, resulting in social issues like single motherhood and street children.	Institute administrative controls, create awareness about the impact of disposable income, establish codes of conduct for employees, and implement grievance redress mechanisms and regular community engagement.
Gender Concerns	Risks of sexual harassment, denial of opportunities, and inadequate facilities for women at the workplace, leading to an	Provide training on laws against sexual offenses, install gender-sensitive facilities, appoint a gender

Impact	Description	Enhancement/Mitigation Measures
	unsafe environment and exposure to STIs.	specialist, and conduct sensitization on gender rights and responsibilities.
OPERATION PHASE		
Employment	Creation of jobs for local communities, reducing unemployment.	Recruit local workers, ensure legal contracts and prompt payment.
Provision of market for locally available goods	Increased demand for materials, boosting local businesses.	Continue purchasing locally available materials, encourage local entrepreneurship.
Increased Agricultural Productivity and Food Security	The irrigation of 15,000 hectares will significantly increase crop yields and extend growing seasons, improving food security for local populations.	- Promote sustainable farming practices - Provide agricultural training on efficient water use - Establish cooperatives for better market access
Economic Growth and Job Creation	Job creation during both construction and operation phases, alongside agribusiness growth, will boost local economies and contribute to Uganda's GDP.	- Prioritize local employment - Provide capacity-building programs for local entrepreneurs - Strengthen linkages between farmers and agribusinesses
Climate Resilience and Drought Mitigation	The provision of reliable water sources will help communities adapt to climate change, reducing the vulnerability of agriculture to droughts and erratic rainfall.	- Incorporate climate-smart agricultural techniques - Promote efficient irrigation methods (e.g., drip irrigation) - Establish early warning systems for droughts
Sustainable Water Supply for Domestic and Industrial Use	The project will explore developing a sustainable water source for domestic consumption, rural industries, and livestock to meet the needs of a growing population.	- Ensure equitable access to water for underserved communities - Promote sustainable water use for industries and livestock
Increased Agricultural	The irrigation of 15,000 hectares will significantly increase crop yields and extend growing	- Promote sustainable farming practices - Provide agricultural training on

Impact	Description	Enhancement/Mitigation Measures
Productivity and Food Security	seasons, improving food security for local populations.	efficient water use - Establish cooperatives for better market access
Economic Growth	Boost local economies and contribute to Uganda's GDP.	- Prioritize local employment - Provide capacity-building programs for local entrepreneurs - Strengthen linkages between farmers and agribusinesses
Improved accessibility to safe drinking water	Availability of treated water improving community health and reducing waterborne diseases.	Set affordable tariffs for vulnerable groups.
Soil and water pollution	Potential contamination from chemicals and waste affecting soil quality and water sources.	Implement cut-off drains, train staff on waste management, and test effluent periodically.
Waste generation from water treatment plant	Disposal of sludge and other by-products from water treatment operations.	Proper waste collection by licensed firms, provide adequate waste management facilities.
Pollution of water resources	Spills or leaks from operations affecting nearby rivers, lakes, and streams.	Maintain equipment to prevent leaks, ensure proper wastewater disposal, and test effluent regularly.
Improper management of waste	Inadequate handling of solid and liquid waste from operations.	Prepare a Waste Management Plan, segregate and manage hazardous waste, provide adequate facilities.
Dust and air emissions	Air pollution from vehicles and machinery causing respiratory issues and environmental degradation.	Water sprinkling, speed control, routine maintenance, and regular monitoring of emissions.
Noise emissions	Excessive noise from machinery and daily operations affecting workers and nearby residents.	Fit noise suppressors, provide PPE for workers, maintain machinery, restrict operations to daytime.
Poor sanitation at the water treatment plant	Lack of proper sanitation facilities leading to unhygienic conditions for workers.	Provide sufficient waste bins, train workers on proper waste management.
Pollution of soil, surface and groundwater	Spillage of fuels and oils affecting nearby soils and groundwater systems.	Construct trenches, install grease interceptors, limit onsite repairs, and

Impact	Description	Enhancement/Mitigation Measures
		relocate fueling activities away from water bodies.
Health and safety of workforce and community	Risks of accidents, injuries, or illness among workers and surrounding community members.	Provide safety training, implement health and safety policy, conduct risk assessments, and ensure medical facilities are on standby.
Fire outbreaks	Potential fire hazards from electrical faults or flammable materials at the site.	Conduct fire safety training, install fire signage and safety exits, implement fire drills, mark fire hazard areas.
Resource depletion and demand on local services	Increased pressure on local resources such as water, power, and other services due to project demands.	Implement sustainable resource management, monitor resource use, and establish partnerships with local service providers.
HIV/AIDS and other STDs	Increased transmission risks among workers and nearby community members due to interactions during the project.	Implement an HIV/AIDS policy and action plan for workers, conduct awareness campaigns.
Prostitution, crime, and drug abuse	Rise in social vices such as prostitution, theft, and drug use due to influx of workers and disposable income.	Implement worker code of conduct, involve local authorities in security planning, create awareness on responsible behavior.
Child abuse and school dropouts	Children may be exploited or may drop out of school due to interactions with project workers.	Report abuses, limit child-worker interaction, conduct awareness campaigns, develop child protection plans.
Disruption of families	Family structures may be affected due to influx of income and changing social dynamics.	Sensitize the community on effects of disposable income, implement codes of conduct, enhance grievance redress mechanisms.
Gender concerns	Gender inequality in task allocation, facilities, and opportunities for women and men.	Conduct gender sensitivity training, implement gender action plan, install gender-sensitive facilities, and ensure equal task allocation.
Cumulative Impacts		

Impact	Description	Enhancement/Mitigation Measures
Habitat Degradation and Loss of Biodiversity	The construction and operation of the project may degrade habitats, especially near the Victoria Nile and Kaduku CFR, and introduce invasive species, reducing biodiversity.	Implement strict cleaning protocols for vehicles/equipment to prevent invasive species; Restore habitats post-construction and replace vegetation with native species; Monitor ecosystems regularly
Increased Traffic and Road Safety Risks	Increased traffic during construction and operation may lead to more accidents, congestion, and pedestrian safety risks along major roads.	Develop a traffic management plan; Conduct road safety awareness campaigns for residents and school children; Install traffic control measures (e.g., speed bumps, signage, pedestrian crossings)
Unsustainable Resource Extraction and Demand	The project's demand for materials (murram, sand, gravel, water) may lead to resource depletion and long-term impacts on local renewable and non-renewable resources.	Ensure proper permits for resource extraction; Monitor resource use and its ecological impact; Encourage water conservation practices among staff
Habitat Degradation and Loss of Biodiversity	The construction and operation of the project may degrade habitats, especially near the Victoria Nile and Kaduku CFR, and introduce invasive species, reducing biodiversity.	Implement strict cleaning protocols for vehicles/equipment to prevent invasive species; Restore habitats post-construction and replace vegetation with native species; Monitor ecosystems regularly

E.13 Conclusion

The Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project is a transformative initiative designed to address the growing demand for both safe and reliable drinking water and sustainable water for irrigation in Masindi and Kiryandongo districts. Driven by rapid population growth including natural increase and refugee influx these districts face mounting pressure on existing water sources, many of which

are unsafe, seasonally unreliable, or insufficient for the needs of expanding rural and peri-urban communities.

By targeting both domestic water supply and the irrigation of 15,000 hectares of farmland, the project offers a holistic solution to critical water-related challenges. The potable water component will help reduce the prevalence of waterborne diseases, improve sanitation and hygiene, and alleviate the daily burden especially on women and children of fetching water from distant or unsafe sources. Meanwhile, the irrigation component aims to improve agricultural productivity, food security, and household incomes by supporting smallholder and commercial farmers, including enterprises such as Soul-Agric Farm and Kisarizi Excellence Farm.

Agriculture, the backbone of the local economy, is currently undermined by erratic rainfall and water scarcity. The introduction of a reliable and climate-resilient water supply system for irrigation will not only enhance economic stability and rural development but also increase resilience to climate shocks.

The ESIA team generated this report after a comprehensive ESIA exercise which involved document review, key stakeholder consultations, site visits including direct observations, baseline sampling, impact evaluation and analysis and photography.

The project presents environmental and social impacts, such as soil and water pollution, waste generation, noise, dust, and community health concerns. To mitigate these impacts, the ESIA report recommends measures to minimize negative impacts while enhancing the project's benefits. Effective stakeholder engagement, particularly with local leaders and farmers, will be crucial to its success.

Overall, the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project is transformative and will enhance agricultural productivity, improve socio-economic conditions, and strengthen resilience to climate change. By addressing water scarcity, it will contribute to Uganda’s economic growth and sustainability, improving the quality of life for over 600,000 people in Masindi and Kiryandongo districts.

1 INTRODUCTION

1.1 Background

Uganda's population, estimated at 43.7 million as of mid-2022 (UBOS), is growing rapidly at an annual rate of 3.2%. With approximately 85–90% of the population residing in rural areas and heavily dependent on agriculture for their livelihoods, the country faces mounting pressure on natural resources particularly water. This pressure is compounded by the effects of climate change, which have made rainfall increasingly erratic and water resources less predictable and reliable.

Access to safe and reliable domestic (potable) water remains a significant challenge, especially in rural communities where water infrastructure is often inadequate, aging, or altogether lacking. According to the Ministry of Water and Environment's Sector Performance Report (2022), only 70% of the rural population has access to improved water sources, and an even smaller proportion has access to safe drinking water falling short of national targets. In Masindi and Kiryandongo districts, communities such as Kimengo and Masindi-Port continue to face chronic water shortages, relying on distant, unsafe, or seasonal sources. These challenges are further exacerbated in areas within Uganda's cattle corridor, where both people and livestock are affected by the scarcity of clean water.

Simultaneously, Uganda's agriculture sector is largely rain-fed, with only 0.1% of production relying on irrigation. This overdependence on rainfall has left the sector highly vulnerable to climate variability, leading to poor crop yields, reduced livestock productivity, and diminished livelihoods. The 2008 and 2010/11 droughts alone caused losses of up to USD 470 million equivalent to 16% of the value of food and cash crops and projections indicate that climate change could cost the country as much as USD 1.5 billion in lost food crops without timely interventions. In the Bunyoro sub-region, including Masindi and Kiryandongo, subsistence farming dominates, and the need for irrigation is becoming increasingly critical to improve food security, boost productivity, and build climate resilience.

In response to these challenges, the Government of Uganda, through the Ministry of Water and Environment (MWE), with funding from the African Development Bank (AfDB), has initiated the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project. The project seeks to provide an integrated and sustainable water supply system to serve multiple uses most notably:

Provision of clean, treated water for domestic use in the sub-counties of Masindi-Port and Kigumba (Kiryandongo District) and Mirya and Kimengo (Masindi District), improving public health, hygiene, and livelihoods.

Development of irrigation infrastructure for approximately 15,000 hectares of farmland, benefitting smallholder and commercial farmers and enhancing agricultural productivity and food security.

The Masindi Port Multi-Purpose Water Supply Infrastructure Project is aligned with Uganda's National Development Plan III and Vision 2040, which prioritize integrated water resource management, universal access to safe water, and sustainable agricultural transformation. By addressing both potable and production water needs, the project offers a holistic solution to the interlinked challenges of water scarcity, public health, and climate-vulnerable agriculture contributing to the country's broader socio-economic development and resilience agenda.

However, like any other developmental project, the project is anticipated to cause some environmental and social impacts, which need to be assessed, and mitigation measures provided. To safeguard the environment and communities affected by the project, an Environmental and Social Impact Assessment (ESIA) was conducted in accordance with NEMA's guidelines. The ESIA will ensure that the project is implemented with minimal environmental and social harm. The Ministry of Water and Environment (MWE) has commissioned Ardent Services Limited, a team of certified environmental practitioners, to prepare the ESIA. This report particularly sets out the activities of the ESIA study for Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project in Masindi and Kiryandongo District.

1.2 Objectives of the ESIA Study

The main objective is to carry out a comprehensive environmental and social impact assessment for the proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project in Masindi and Kiryandongo District.

This ESIA study will specifically fulfill the following objectives:

i. Identify the project's potential environmental and social impacts and recommend measures to mitigate them;
ii. Evaluate the impacts of alternative options and advise the design consultant accordingly;
iii. Determine the necessary actions for MWE and other stakeholders to effectively address these impacts;
iv. Describe the biophysical and socioeconomic environment of the proposed project area.
v. Establish the relevant policy and legal framework for the proposed project.
vi. Identify and focus the key environmental and social issues to be assessed by the ESIA.
vii. Recommend suitable material source sites with the least environmental impact and cost for the project.
viii. Formulate relevant management plans to mitigate any adverse impacts of the project.

1.3 Project Categorization

1.3.1 National Categorisation

The proposed project falls under the Fifth Schedule of the National Environment Act, Cap 181, specifically Section 4: *Utilization of Water Resources and Water Supply*, which outlines categories of developments that require an Environmental and Social Impact Assessment (ESIA) prior to implementation. The project triggers sub-sections 4(a): *Abstraction or Utilisation of surface water for agricultural, industrial or urban use of more than 1000m^3*, 4(i): *Construction of water pipelines of more than 20kilometres in length and capacity of more than 500,000m^3 per day of water*, and 4(k): *support facilities to (a) to (j)*. Accordingly, this ESIA has been undertaken to assess the potential environmental and social impacts associated with the proposed development and to recommend viable mitigation measures for managing adverse effects while enhancing project benefits.

1.3.2 African Development Bank categorization

According to African Development Bank (AfDB) Integrated Safeguards System 2023 (ISS), the project is considered as "Category 1", (High-risk operations likely to cause significant and/or irreversible adverse environmental and/or social impacts on a large scale, which requires the preparation of an Environmental and Social Impact Assessment (ESIA).

1.4 Project Justification

The proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project is a critical and transformative initiative aimed at addressing the dual challenge of agricultural water scarcity and inadequate access to safe drinking water in Masindi and Kiryandongo Districts. Designed as a multi-purpose water transfer system, the project will serve both production and domestic needs, thereby promoting integrated water resource management and maximizing development impact.

On the agricultural front, the project will support the irrigation of approximately 15,000 hectares of farmland across the sub-counties of Masindi-Port, Kigumba, Kimengo, and Mirya. This includes provision for smallholder farmers as well as large commercial enterprises such as Soul-Agric Farm (2,500ha), Kisirizi Excellence Farm (750ha), Afro-Kai (1,200ha), and Kitaleba Agribusiness. In a context where over 80% of the population depends on rain-fed agriculture—highly vulnerable to the increasing variability of rainfall due to climate change—bulk water supply for irrigation is urgently needed. This infrastructure will strengthen climate resilience, improve agricultural productivity, enhance food security, and boost household incomes. With Uganda's population projected to double by 2050, the demand for food is expected to increase dramatically, necessitating a 100% rise in food production (FAO, 2006). The project directly supports this goal by enabling year-round agricultural activity and reducing reliance on erratic rainfall patterns.

At the same time, the project addresses the critical need for safe and reliable potable water supply in rural and peri-urban communities that remain underserved. Sub-counties targeted by

the project—while agriculturally productive—struggle with chronic water scarcity, deteriorating infrastructure, and distant or unprotected water sources. Women and children, who typically bear the burden of water collection, are particularly affected, often walking long distances to access water, with negative implications for health, education, and productivity. The Potable Water Supply Infrastructure Component aims to close this gap by delivering clean, treated water to rural households, institutions, and trading centers through climate-resilient, community-based distribution systems.

The integrated nature of the project—combining water for production, livestock, rural industries, and domestic consumption—aligns with Uganda's Vision 2040, the Third National Development Plan (NDP III), and Sustainable Development Goal 6 (Clean Water and Sanitation). It is also consistent with the African Development Bank's High 5 priorities, particularly "Feed Africa" and "Improve the quality of life for the people of Africa."

By simultaneously addressing the challenges of food insecurity, water scarcity, public health, and climate vulnerability, the project is expected to significantly improve the well-being of over 600,000 people in the targeted districts. It will contribute to economic growth, enhance gender equity, and build resilient rural livelihoods, making it a high-impact investment in Uganda's sustainable development agenda.

1.5 Developer details

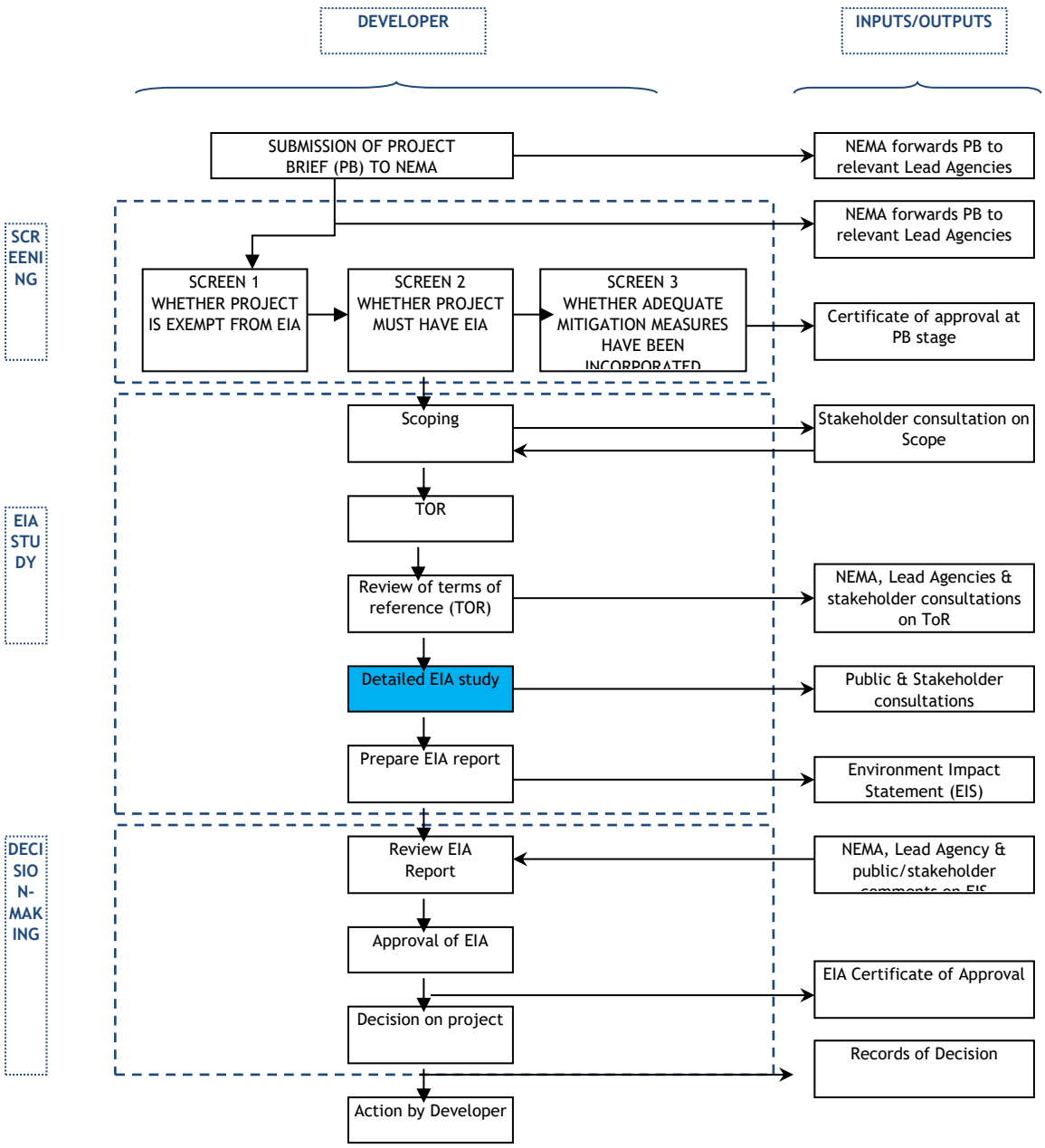
This project is being implemented by;

Ministry of Water and Environment through the Directorate Of Water Development
Address: Plot 3-7 Kabalega Crescent Road, Luzira, P.O.Box 20026, Kampala, Uganda.

1.6 Overview of ESIA process

Since the project is located within Uganda. It is appropriate to comply with the EIA Regulations (2020). In particular, these regulations provide an overview of what is required for producing an ESIA. Regulation 12 of the EIA Regulations, 2020 requires that the EIA shall be prepared by the Project Proponents in consultation with NEMA and the lead.

The flow chart in Figure 1 summarizes the ESIA process as followed by the developer.



(Source: Study Team)

Figure 1-1: EIA Process followed by the ESIA team

2 ESIA Methodology

2.1 Introduction

An Environmental and Social Impact Assessment (ESIA) was undertaken in accordance with the National Environment Act, Cap 181 of the laws of Uganda and the Environmental Impact Assessment Regulations (NEMA 2020). The National Environmental Act established NEMA and entrusted it with the responsibility to ensure compliance with ESIA process and procedures in planning and execution of development projects. The study was undertaken by NEMA Certified Environmental Practitioners. The ESIA addresses potential direct and indirect socio-environmental impacts during the pre-construction, construction, operation and decommissioning phases and an environmental and social management plan (ESMP) has also been prepared.

The process was guided by the EIA Guidelines (NEMA 1997). The following activities were undertaken including baseline surveys, identification of impact receptors and their relation to project's site. Consultation with various stakeholders was also undertaken including: Masindi and Kiryandongo District Local Government, Local Councils, and Communities neighbouring the project site among others. Other planned activities included data collection & analysis, review of engineering designs and site layout plans of the proposed project. Impacts of the project were predicted in relation to environmental and social receptors and natural resources. This was accomplished by comparing prevailing conditions ("pre-project") and "post-project" situations.

2.2 General Approach

The study was undertaken by NEMA Certified Environmental Practitioners in accordance with the earlier prepared scoping report and Terms of Reference and the National Environment (Environmental and Social Assessment) Regulation, (2020). The Consultants undertook the task of ESIA for the proposed project by clearly defining the assignment into a number of discrete activities. These activities facilitated development of a workable framework for the speedy and timely execution of the assignment. They included but were not limited to the following.

2.2.1 Environmental screening

This is the stage at which the project was identified as among those that require Environmental and Social Impact Assessment under schedule 5 of the National Environment Act, Cap 181; Projects for which Environmental and Social Impact Assessment are mandatory) and under Category 4, "Utilisation of water resources and water supply", Part (a) "Abstraction or utilisation of surface water for agricultural, industrial or urban use of more than 1000 m3/day." Further, according the funder's (African Development Bank; AfDB) Integrated Safeguards System 2023 (ISS), the project is considered as category 1 (High-risk operations likely to cause significant and/or irreversible adverse environmental and/or social impacts on a large

scale) which requires the preparation of an Environmental and Social Impact Assessment ESIA.

2.2.2 Scoping

Scoping was undertaken to determine the extent of the study and key issues for investigation. In this regard, a scoping report and Terms of Reference were prepared to define the scope of the study. The scoping report was approved by NEMA, the TOR approval letter is attached in appendix A of this report.

2.2.3 Document Review

Literature was reviewed to obtain background and secondary baseline information on the proposed project and the site, the regulatory and institutional context relevant to the project. The proposed project planning documents such as the site layout plan were also reviewed in addition to the contract

a. African Development Bank Group's Integrated Safeguards System 2023;
b. Relevant laws and Regulations of Uganda including International conventions and agreements to which Uganda is a party;
c. African Development Bank Integrated Environmental and Social Impact Assessment Guidelines 2009;
d. Environmental Impact Assessment Guidelines For Water Resources Related Projects In Uganda 2004 (MWE);
e. The Draft Prefeasibility report for Masindi-Port Multipurpose Water Supply Project, March 2024;
f. Demographic aspects, including population density, population characteristics, and settlement trends (the statistical abstract and 2014 census reports);
g. Masindi District Development Plan 2020/2021 - 2024/2025;
h. Kiryandongo District District Development Plan 2020/2021 – 2024/2025;
i. National Water and Sewerage Corporation Customer Satisfaction Survey FY2023/24 Final Report;
j. Third Uganda National Development Plan (NDPIII);
k. Uganda Vision 2040;
l. Water and Environment Sector Development Plan 2015/16-2019/20.

2.2.4 Stakeholder engagement/consultations

Engagement of stakeholders was undertaken by the ESIA study team in accordance with NEMA guidelines in order to seek view, opinions and comments as well as inform the various stakeholders about the project. The findings of this exercise have been documented in appendix B of this report.

2.2.5 Field Surveys

To compliment project information obtained during the desk study, an extensive field survey was carried out in the months of December 2024 and March 2025 to establish the current environmental and social baseline conditions of the proposed site including the biophysical, socio-economic and cultural attributes. Site reconnaissance and inventories assisted in establishing benchmarks that will be used in monitoring compliance to mitigation measures.

2.3 Specialist Studies

Field surveys were carried out in the project area to verify information collected from document reviews and acquire supplementary data to fill gaps realized from the review of existing information. Surveys were done on the different components of the environment, particularly physical (soil, topography and drainage), biological (flora and fauna) and socio-economic environment. To determine the socio-economic status of the project area, informal discussions and key informant interviews (KII) was used to obtain information on the socio-economic conditions of the area.

2.3.1 Physical Environment

The assessment of the physical environment included methodologies that capture aspects of air, soils and geology characteristics, topography and drainage patterns of the area including discharge of surface run off and ground/surface water resources and quality etc.

2.3.1.1 Air quality

The ESIA team carried out a baseline air quality survey at the proposed project site. The key receptors included the site boundaries and the proposed project components. Criteria considered included; Proximity to Sensitive Receptors; Distance from Project Activities and Community and Stakeholder Concerns. Baseline air quality was measured with Temtop M2000C air monitor (Figure 1). Volatile organic compounds (VOCs), nitrogen oxide (NO), nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), Carbon dioxide (CO_2), Carbon monoxide (CO), methane (CH_4), $PM_{2.5}$ and PM_{10} were also monitored.



Figure 2-1: Temtop M2000C air monitor

2.3.1.2 Noise Assessment

The ESIA team carried out a baseline Noise survey at the proposed project site. The key receptors included the site boundaries and at proposed project components. Baseline noise was measured during day using a sound level meter model PCE-322A (Figure 2). The project area is categorized as a residential and it was noted that the average noise levels were not higher than the maximum permissible limits for daytime i.e. 50 dB (A) (residential areas) as prescribed in the first schedule of the National Environment (Noise Standards and Control) Regulations, 2003.



Figure 2-2: PCE-322A sound level meter

2.3.1.3 Surface and Visual Impact Assessment

Under the land surface investigations, the character and resources of the landscape, including effects on the aesthetic values of the landscape, caused by changes in the elements, characteristics, character and qualities of the landscape were investigated. The visual amenity, including effects upon potential viewers and viewing groups caused by change in the appearance of the landscape as a result of the development, was also considered.

The landscape and visual impact assessment methodology was applied, both to the assessment of short-term impacts during the construction of the Project, and to the long-term impacts once completed. The landscape character and resources were considered to be of importance in their own right, and valued for their intrinsic qualities regardless of whether they are seen by people or not. Impacts on landscape are therefore considered as distinct from impacts on visual amenity as perceived by people. For purposes of clarity, Landscape Impacts relate to the effects of the Project on the physical and other characteristics like fabric, character and quality of the existing landscape, whereas Visual Impacts relate to the effects on views from visual receptors (e.g. residents, workers, visitors to the area, etc.) at specific viewpoint locations. The key steps of the methodology for the assessment was as follows:

- The project study area was determined manually with reference to maps and aerial photos data and field observation.
- Local landscape character areas within the study area was identified

- The sensitivity of each landscape and potential visual impact was assessed.
- The project area of influence was digitized and geo-referenced

The magnitude of change in the character of each landscape character area and the magnitude of change in the view at each viewpoint location was predicted.

2.3.2 Biological Environment

2.3.2.1 Vegetation and Flora

Vegetation description of the points were done in terms of phytosocial based on Langdale Brown et al, (1964) for describing plant structure and vegetation types. Illustration of different vegetation cover types, pictures were taken with a camera.

A combination of systematic and informal sampling techniques such as transects, traverses, releve′ and opportunistic sampling were used during this study. The traverses, transects, and releve′ were slowly walked through identifying and recording all the species within the proposed project area. These allow for rapid data collection across the project site. Furthermore, it also allowed for sampling across a habitat gradient to capture maximum amounts of data. All plant species encountered at the site were identified following the Angiosperm Phylogeny Group, (2016) system of classification. The findings of the vegetation survey, including species lists and distribution data, are detailed in section 5.3.1.1 and in appendix C.

2.3.2.2 Fauna

2.3.2.2.1 Birds

The birds were surveyed through point sampling method. Five points were established at the project site and all birds seen and heard from the points were identified and recorded. The identifications were based on Stevenson and Fanshawe (2002). Birds recorded were classified into habitat categories based on the standard habitat classification by Bennun and Njoroge (1996) and Carswell et al. (2005) which is widely used in evaluation of avifauna in Uganda.

2.3.2.2.2 Mammals

Field data was obtained by conducting a survey of mammals in and around the project area using various methods i.e. Visual Encounter Surveys, opportunistic surveys, and local consultations. All species encountered were recorded. The conservation status of the mammal is reported using the IUCN Red Listing (IUCN 2024). These methods were used to ensure that rapid data across project site was collected.

2.3.2.2.3 Herptiles

Herptiles surveys were accomplished by use of Visual encounter and call surveys (VES). These were conducted within the project site. These surveys included purposeful searches in potential habitat features such as; beneath exfoliating leave litter or barks of trees, holes in the ground. Any reptile or Amphibian species seen was immediately identified and recorded.

2.3.2.3 Critical habitats

Sensitive/Critical habitats were characterized based on IFC, (2012) standards and The National Environment Act, Cap 181 definition of critical habitats. Critical habitat or ecosystems were characterized based on areas with presence of taxon or species under major categories of IUCN Red list data (i.e. Critical (CR), Endangered (EN) and Vulnerable (VU)).

2.3.2.4 Species of conservation concern

The conservation status of species was determined by assessments against the IUCN red list IUCN., (2024) and the National red list (MTWA, 2018), (WCS, 2016).

Detailed fauna data, including species composition and conservation status, are presented in section 5.3.1.2 and in appendix C.

2.4 Socio-economic Assessment

A detailed social impact assessment and evaluation of the positive and negative, direct and indirect, immediate and long term, and permanent and temporary impacts due to the operation of the facilities was carried out. We assessed the impacts identified in either qualitative or quantitative terms, according to their inherent nature and the availability of adequate data to enable predictive analysis to be undertaken. Specific methods utilized for socio-economic assessment included:

i. *Key Informant Interview (KII)* - Key informants were interviewed and selected on the basis of their roles as leaders, specialized knowledge and experience on the subject under study. Key Informant Interviews (KIIs) with e.g. local government, local leaders, Government Institutions.
ii. *Secondary sources* - These included: existing data, existing environmental data, existing reports/documents, ESIA reports and ESMPs in place.
iii. *Participatory Stakeholder Analysis* - Stakeholder analysis methodology was used in identifying and analyzing the key stakeholders, including planning for their participation. Therefore, it was the starting point of our participatory processes and provided the foundation for the design of subsequent stakeholder activities throughout this study. However, this was reviewed and refined from time to time, as the details of study become more definite.

Stakeholder analysis sought to answer the following fundamental questions:

a) Who are the key stakeholders (primary/secondary)?
b) What are the interests of these stakeholders?
c) How have they been and or will be affected (positively/negatively)?
d) Which stakeholders are most important for the success of the study?
e) How will various stakeholder groups participate throughout the study?

We identified the likely impacts in and around the project site for screening purposes to ensure that the focus was more on significant impacts. We assessed the social impacts of the facilities using baseline data and planning data. We proposed mitigation/enhancement measures for all identified impacts. We determined baseline conditions and compared them with previous studies especially in the ESIAs done for similar projects *vis-a-vis* the anticipated impacts to build a scenario of likely impacts. An assessment of likely impacts included:

- Identification of the impacts and their effects during operation of the facilities.
- Discussion of the significance taking into account mitigating factors that were naturally inherent in the existing environment such as raw materials, design and engineering of the facility components.
- An evaluation of the overall significance of each identified potential Impacts by assigning values to a set of criteria presented in a matrix for ease of reference (including status, type of impact, duration of impact, intensity/severity/magnitude; spatial extent over which the impact will be experienced, likelihood of the impact occurring, sensitivity of the receptor/affected area).

2.4.1 Resettlement Action Plan (RAP) Methodology

The RAP process for the MWACRID Project followed a participatory and consultative approach in line with national and international resettlement guidelines. The methodology included:

- A comprehensive socioeconomic survey was conducted to identify all PAPs, including landowners, tenants, and users within the proposed project footprint. This was combined with a household-level socioeconomic survey to assess livelihoods, income sources, vulnerabilities, and household composition.
- Trained survey teams recorded and geo-referenced all immovable assets (structures, crops, trees, and other properties) affected by the project using GPS and standardized asset forms. Valuation of assets was carried out in coordination with the Chief Government Valuer's Office, ensuring compliance with the Land Act and other relevant laws.
- Continuous engagement was held with PAPs, local leaders, District Land Boards, and other stakeholders through community meetings, interviews, and feedback sessions to ensure transparency, clarify entitlements, and address concerns.
- A practical and accessible GRM was established to allow PAPs to submit complaints or disputes related to the resettlement process. The GRM included local grievance committees and referral mechanisms for unresolved cases.
- Based on survey findings, an entitlement matrix was developed outlining compensation and livelihood restoration support tailored to different categories of PAPs.

2.4.2 Physical Cultural Resources (PCR) Surveys

2.4.2.1 Paleontological and Archaeological Surveys

To identify and assess any potential paleontological and archaeological resources that may be affected by the MWACRID Project, field surveys were conducted along the project corridor. The survey focused on detecting archaeological records such as artefacts, eco-facts, and structural features, including stone and bone tools, metallurgical implements, potsherds, bones and skeletons, storage pits, hearths, house foundations, and any rock art (paintings or engravings) as described by Humphreys (1986). Guided by pre-field desk reviews and consultations, targeted test pit excavations were performed at locations identified as having moderate to high potential for cultural deposits. Due to minimal prior indications, only one test pit was excavated for ground-truthing, consistent with precautionary ESIA requirements.

2.4.2.2 Ethnographic Surveys

Ethnographic assessments were undertaken to document intangible cultural heritage and community knowledge associated with the project area. Structured consultations, including Focus Group Discussions and Key Informant Interviews, were held with local communities, elders, and cultural and religious leaders to identify culturally significant sites and practices. These engagements were essential in mapping out community-recognized heritage sites that may not be formally recorded. Participants provided critical insights into traditional beliefs, sacred sites, burial grounds, and places of spiritual or historical relevance that may be impacted by project activities. The survey team was also guided by local stakeholders to specific locations of interest and received recommendations for safeguarding cultural heritage in line with the development plans. District leaders and relevant technical officers from the Department of Culture and Museums were also consulted to validate the findings and ensure alignment with national heritage protection protocols.

2.5 Impact Assessment and Evaluation Method

The purpose of this section was to predict and assess the impacts on the environment that may potentially arise as a result of the implementation of the proposed project. An assessment of these impacts was made on the basis of information gathered during the environmental baseline study of the project area, which involved several field visits to the project site and its surroundings, as well as a desk study of relevant existing documents and information pertaining to the project and information describing the nature and design of the proposed project. From this, mitigation measures were drawn up and recommended for incorporation into the implementation of the project so as to minimize, compensate for or avoid the occurrence of anticipated potential impacts.

The potential positive and negative impacts were discussed in terms of the various environmental components. The potential impacts that could occur during the construction and operation phases were categorized and assessed as follows:

i. Type of impact – whether direct or indirect;
ii. Status/Direction Positive or negative;

iii. Duration - Temporary (1 year), short term (1-3 years), medium term (3 -5 years) long term (> 5 years - L) or permanent;
iv. Intensity/Magnitude - Low, medium or Major;
v. Extent: within limited area (1km radius from site), local (up to 5 km) or wide (> 5km radius, district wide, regional or global)
vi. Probability of occurrence: Low (25%), Medium (25-75%) or High (>75%); and
vii. Overall Assessment- Negligible, Minor, Medium or Severe/Significant

Based on the project details and the baseline environmental status, potential impacts as a result of the construction and operation and decommissioning of the proposed facility were identified. We therefore proposed an impacts analysis criterion that considered the magnitude or intensity of impacts based on project activities and sensitivities in the project areas that were identified in the environmental and social baseline.

Table 2-1: Impact Assessment and Evaluation

Criteria	Description
Type of Impact	▪ Direct - An impact that appears immediately as a result of an activity of the project. For example, the loss of vegetation is a direct impact of site clearing. The direct impacts would be experienced mainly during the construction process, and include effects on the physical environment, health and safety of the construction workers. ▪ Indirect - An impact that is related to the facility but arises from an activity of the project at a secondary level. For example, the demand for supplies and services may cause indirect impacts on the local economy by increasing indirect employment opportunities.
Status	▪ Positive ▪ Negative
Duration	The lifetime of the impact; this is measured in the context of the life-time of the proposed development. Whether the Impact will be: ▪ Intermittent – not occurring at all times. ▪ Temporary-only for a short period. ▪ Short term - the impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase. ▪ Medium term - the impact will last for the period of the construction phase, thereafter it will be entirely negated. ▪ Long term - the impact will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter. ▪ Permanent
Intensity	Whether or not the intensity (magnitude) of the impact would be high, medium, low or negligible (no impact). An attempt to quantify the impacts on

Criteria	Description
	components of the affected environment to be described whether destructive to the alter its functioning or harmless: ▪ Negligible ▪ Low - where impact alters the affected environment in such a way that natural processes of functions are not affected in any significant way. ▪ Moderate - where the affected environment is altered, however, function and process continue, albeit in a modified manner. ▪ High - where function or process of the environment is seriously altered and disturbed to the extent where it temporarily or permanently ceases.
Spatial Extent	The physical and spatial size of the impact; a description of whether the impact would occur on a scale described as follows: ▪ Site - whether the impact will be within limited locale of the project site / study area affecting the whole or measurable portion of the area. ▪ Local - whether the impact will affect the environment or communities along the border of the study area or in the extended area adjacent to the site or perhaps outside the immediate environment. ▪ Regional - whether the impact extends beyond the study area affecting areas on a regional scale.
Likelihood	The probability or likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The probability that a certain impact will in fact realize: ▪ Uncertain - insufficient information to determine its probability. Because the precautionary principle is followed, this increases the significance of the impact. ▪ Improbable - the impact is unlikely to occur. ▪ Probable - the impact could possibly happen, and mitigation planning should be undertaken. ▪ Highly probable - it is most likely that the impact will occur at some or other stage of the development. ▪ Certain - the impact will take place regardless of any prevention plans, and only mitigatory actions can be relied on to contain the effect.
Sensitivity	▪ Degree of change effected on natural processes or people's livelihoods; the sensitivity of the receptor of the impact to change ▪ Very low ▪ Low ▪ Moderate ▪ High

Table 4 below presents a quantitative format for ranking impacts based on parameters above, summarised as magnitude and sensitivity.

Table 2-2: Quantitative rating of impacts

Significance			**Sensitivity**			
			Very low	Low	Medium	High
			1	2	3	4
Magnitude	Very low	1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low	2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Moderate
	High	4	4 Minor	8 Moderate	12 Moderate	16 Severe

The table below presents the overall impact rating criteria, with illustrations of such impacts.

Table 2-3: Overall Impact Rating and Description

Overall Impact Rating	**Description of Impact**	**Significance**
Severe	▪ Non-compliance with national policy, environmental laws and regulations; Safeguards Policies on Environment ▪ Highly noticeable, irreparable effect upon the environment and the people ▪ Significant, widespread and permanent loss of resources and livelihoods ▪ Major contribution to a known global environmental problem with demonstrable effects ▪ Causing mortality to individuals of a species classified as globally or regionally endangered ▪ Major exceedance of water/air quality and noise standard quantities representing threat to human health in long and short term ▪ Causing widespread nuisance both on and off site ▪ Extensive property damage or loss, ▪ Widespread effects on livelihoods.	>12

Overall Impact Rating	Description of Impact	Significance
Moderate	▪ Frequent breaches of national regulations, Policies and standards including water quality and noise guidelines, wetlands and river banks regulations causing localised nuisance both on and off site ▪ Noticeable effects on the environment and the population, reversible over the long term ▪ Localised degradation of resources restricting potential for further usage ▪ Sub-lethal effects upon a globally or regionally endangered species with no effect on reproductive fitness and/or resulting in disruption/disturbance to normal behaviour but returning to normal in the medium term ▪ Elevated contribution to global air pollution problem partly due to preventable releases ▪ Unplanned immigration flows ▪ Increased traffic in sensitive environments ▪ Increased serious crime rates ▪ Widespread physical resettlement, affecting livelihoods	6 – 12
Minor	▪ Noticeable effects on the environment and the population, but returning naturally to original state in the medium term ▪ Slight local degradation of resources but not jeopardising further usage ▪ Disruption/disturbance to normal behaviour of a globally or regionally endangered species returning to normal in the short term ▪ Small contribution to global air problem through unavoidable releases ▪ Elevation in ambient water pollutant levels greater than 50% of guidelines ▪ Infrequent localised nuisance ▪ Population increase not expected to stress existing infrastructure	2 – 4
Negligible	▪ No noticeable or limited local effect upon the environment and the population, rapidly returning to original state by natural action ▪ Unlikely to affect resources to noticeable degree ▪ No noticeable effects on globally or regionally endangered species	< 2

Overall Impact Rating	Description of Impact	Significance
	▪ No significant contribution to global air pollution problem ▪ Minor elevation in ambient water/air pollutant levels well below guidelines ▪ No reported nuisance effects. ▪ Temporary or intermittent changes to livelihoods or life quality aspects	

2.6 Environment & Social Management Plan

The Environmental and Social Management Plan (ESMP) in this ESIA report outlines the strategy for mitigating, managing, and monitoring environmental and social impacts associated with the proposed MWACRID project in Masindi and Kiryandongo Districts. It aims to ensure compliance with national environmental laws, particularly the National Environment Act, Cap 181, and relevant AfDB safeguard policies. The ESMP identifies key project activities and their interactions with the physical, biological, and socio-economic environment, drawing from the baseline studies.

The plan provides specific mitigation and enhancement measures for each identified impact, including biodiversity protection, water quality management, occupational health and safety, stakeholder engagement, and cultural heritage preservation. It also highlights positive impacts that will be strengthened through targeted actions such as local employment and improved climate resilience.

A monitoring framework is provided to track the effectiveness of these measures, supported by measurable indicators, defined responsibilities, and implementation timelines. Institutional roles and coordination mechanisms are clearly defined, with the Ministry of Water and Environment taking lead responsibility, supported by district authorities and contractors and subcontractors. Capacity building is planned to address institutional gaps through training and technical support.

Stakeholder engagement is an ongoing priority, supported by a formal grievance redress mechanism to handle project-related concerns effectively. The ESMP includes a detailed cost estimate and an implementation schedule to ensure timely execution and reporting. Overall, the ESMP provides a comprehensive and adaptive tool to guide environmentally and socially sustainable implementation of the project.

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 Introduction

This ESIA report adheres to the requirements of the national policy, legal, and institutional framework. Table 3-1 below outlines the relevant policies, laws, institutional frameworks, and regulations that will be reviewed for the project. Over the past 10-15 years, Uganda's water sector has undergone significant reforms, driven by national instruments aimed at improving service delivery and increasing efficiency in reaching underserved populations. These ongoing reforms have allowed for the adaptation of sector policies and strategies to align with both emerging national and international development agendas, including Uganda's National Development Plan (NDP), Vision 2040, and the United Nations Sustainable Development Goals (SDGs). This section provides a summary of the key national and international policies, laws, regulations, and standards relevant to the project, as well as the institutions responsible for water resource management, environmental protection, health, safety, and social safeguards.

3.2 Policies Relevant to the Proposed Project

The policies relevant to the proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project are presented in Table: 3-1.

Table 3-1: Policies relevant to the proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project

Policy	Policy Goal	Relevance to MWACRID Project
The National Environment Management Policy for Uganda (2014)	The overall policy goal is to ensure sustainable development which maintains and promotes environmental quality and resource productivity for socio-economic transformation. The policy sets out in one of its key objectives to integrate, in a participatory manner, environmental concerns in all development policies, plans, activities and budgets.	This ESIA report represents the second phase for the proposed MWACRID project. With the implementation of the recommended impact mitigation measures, the project is expected to promote economic and social development in a sustainable manner. These measures have been developed through consultations with various stakeholders involved in the project.
The National Water Policy, 1999	To promote an integrated approach to manage the water resources in ways that are sustainable and most beneficial to the people of Uganda	The proposed project aims to provide water for 15,000 hectares of farmland across the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District. It will support both smallholder and commercial farmers, while also providing water for domestic use, rural industries, and livestock.
The National Gender Policy, 1997	Provides a framework and mandate for all stakeholders to address the gender imbalances within their respective sectors.	The gender policy recommends that integration of gender issues in national policies and projects will improve national welfare, contribute towards sustainable development, and improve the work of government ministries. The project will consider gender aspects during the different phases of its implementation.
The National Health Policy (1999)	To prevent transmission of diseases through Primary Health Care (PHC) including Sanitation and Hygiene.	The proposed project will help to improve the sanitation through improved provision and access to safe water to the communities.

Policy	Policy Goal	Relevance to MWACRID Project
The National Land Policy (2013)	The Policy was developed to ensure efficient, equitable and optimal utilisation and management of Uganda's land resources for poverty reduction, wealth creation and overall socio-economic development.	Some project infrastructure like transmission lines reservoirs will be located on people's and public land. Unless where the land is given freely by the community, affected land will be compensated following provision of Uganda's Land laws.
The National Land-Use Policy (2007)	The Policy has an overall goal of achieving sustainable and equitable socio-economic development through optimal land management and utilization in Uganda	The project components will not compromise the existing land use plan and physical development plan of Masindi and Kiryandongo district.
The National Employment Policy for Uganda (2011)	The overall goal is to promote productive and decent employment for all women and men in conditions of freedom, equity, security and human dignity	The proposed MWACRID Project will employ many people who will include casual and technical personnel, including those from the affected community. The MWACRID Project will promote human dignity by providing fair employment opportunities, improving livelihoods, and empowering workers through skills development. Safe working conditions, gender inclusion, and adherence to labor rights will ensure respect and equity. Beyond jobs, the project will enhance community well-being by supporting local infrastructure, environmental sustainability, and social initiatives. Engaging stakeholders and addressing community concerns will foster trust, inclusion, and a sense of ownership, ultimately uplifting both workers and the surrounding communities.

Policy	Policy Goal	Relevance to MWACRID Project
The Environment and Social Safeguards Policy (2018)	The Policy was formulated to ensure that environmental and social concerns are integrated in all stages of project development and all levels including national, district and local levels, with full participation of the people as means of minimizing environmental and social impacts.	This ESIA report represents the second phase for the proposed MWACRID Project. With the implementation of the recommended impact mitigation measures, the project is expected to promote economic and social development in a sustainable manner in line with the principles outlined in the Policy.
Uganda Vision 2040	In 'Vision 2040', Uganda sets goals to achieve by the year 2040 ranging from political, economic, social, energy, water, and environment. With respect to environmental goals, Ugandans aspire to have sustainable social-economic development that ensures environmental quality and preservation of the ecosystem. Vision 2040 recognises water and sanitation infrastructure as a key driver of the economic development and notes that for Uganda to shift from a peasantry to an industrialized and urban society, it must develop its infrastructure. The 2040 vision acknowledges that the slow accumulation of infrastructure i.e. water among others retards the economic development. It must be propelled by water as a factor of production in agricultural and industrial sectors. It estimates that Uganda's water consumption using 2010 as a baseline stands at 26 m^3 per capita and will require it to be raised to 600 m^3 per capita by year 2040 and this can only be achieved by raising percentage of population with access to safe piped water from 15 to 100 by 2040.	To provide the necessary stimulus to the economy, the government through MWE in partnership with AfDB has embarked on the improvement of water supply infrastructure of which Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project is part. Vision 2040 notes that in order to improve access and availability of water to the rural and urban areas, especially to economic zones and other productive areas, new water supply lines should be established at an accelerated rate. Therefore, the proposed project is in line with aspirations of Vision 2040.

Policy	Policy Goal	Relevance to MWACRID Project
The National Policy for the Conservation and Management of Wetland Resources 1995	To curtail the rampant loss of wetland resources and ensure that benefits from wetlands are sustainable and equitably distributed. Wetlands acting as sources of water supply and wastewater treatment should be fully protected.	The transmission line traverses some wetlands therefore MWE will ensure that these ecosystems are not affected during implementation of the project. Interventions in this regard is provided in the Environmental and Social Monitoring and Management Plan (ESMP) which is presented in this ESIA report.
National Development Plan (NDP) III (2020/21–2024/25)	NDP III emphasizes sustainable use and management of natural resources to drive socioeconomic transformation. It highlights water for production as a priority area to support agriculture, industry, and rural development.	The MWACRID Project aligns with NDP III's goal of increasing water for agricultural productivity, promoting climate resilience, and enhancing water security.
National Health Policy (NHP) III and Health Sector Development Plan (HSDP) 2020/21 - 2024/25	The National Health Policy (NHP) III and the Health Sector Development Plan (HSDP) emphasize the importance of integrating water and health services to ensure sustainable development. Access to clean water is a fundamental component of improving public health, particularly in rural communities. The project's objective to develop sustainable potable water sources aligns with NHP III's focus on promoting public health and reducing health disparities across Uganda.	The HSDP outlines priorities for the health sector, including improving water and sanitation services, which the MWACRID Project supports by providing clean water to rural industries and households.
National Irrigation Policy 2017,	The policy goal is to ensure sustainable availability of water for irrigation and its efficient use for enhanced crop production, productivity and profitability that will contribute to food security and wealth creation.	The project enhances irrigated agriculture through infrastructure that increases water availability and supports sustainable farming practices.

Policy	Policy Goal	Relevance to MWACRID Project
National Irrigation Master Plan for Uganda (2010-2035)	The policy is aimed at promoting the use of water in agricultural production through supporting farming system diversification, private investment in bulk water infrastructure and service delivery and more Public-Private Partnerships.	The project contributes to this goal by constructing large-scale irrigation systems and encouraging both public and private sector involvement.
Agriculture Sector Strategic Plan (ASSP) 2015/16-2019/2020,	The plan was developed to implement agriculture priorities in NDPII. The ASSP describes the priorities, strategies and interventions required for the agriculture sector to contribute to wealth creation and employment through implementation of actions for the value chain development of twelve priority and four strategic commodities.	MWACRID project supports agricultural value chains through enhanced water access and infrastructure, directly contributing to increased productivity and job creation.
National Agricultural Policy (NAP) 2013,	This is the overarching policy in agriculture designed to "transform subsistence farming to sustainable commercial agriculture." The overall objective of the policy is to promote food and nutrition security and improve household incomes through coordinated interventions that focus on enhancing sustainable agricultural productivity and value addition, providing employment opportunities, and promoting domestic and international trade. These are essential in building resilience of drought-prone communities.	The project promotes commercial agriculture by providing irrigation and bulk water infrastructure, improving resilience and boosting rural livelihoods.
The Uganda National Land Policy, 2013	This policy aims to ensure efficient, equitable, and sustainable use and management of land resources to support poverty reduction, wealth creation, and socio-economic development. Its key objectives include enhancing the land sector's contribution to development, streamlining complex land tenure systems, clarifying legal frameworks, addressing historical	The project adheres to equitable land use principles and considers the rights of landowners and vulnerable groups during land acquisition and implementation.

Policy	Policy Goal	Relevance to MWACRID Project
	injustices, and protecting vulnerable groups' land rights. The policy also seeks to improve land administration, promote sustainable and equitable land use, support environmentally friendly and planned human settlements, and harmonize land-related laws and institutional capacities across all governance levels.	
National Policy on Elimination of Gender-Based Violence, 2016;	The policy provides a framework for the implementation of comprehensive GBV prevention measures and provision of multi-sectoral support services for survivors. It also outlines the role of various state and non-state actors at local and national levels, strategic actions, and milestones for measuring progress. The new policy plays a key role in addressing critical gaps in GBV response, such as the lack of functioning referral systems that coordinate heath, social, law enforcement, and judicial sectors	The proposed project will implement a dedicated policy to prevent gender-based violence at all stages. It will also actively engage community members, police, teachers, parents, and other stakeholders to address gender-related concerns.
The Uganda Agriculture Policy, September 2013	The overall objective of the agriculture policy is to achieve food and nutrition security and improve household incomes through coordinated interventions that focus on enhancing sustainable agricultural productivity and value addition; providing employment opportunities and promoting domestic and international trade.	The project supports these objectives by increasing agricultural productivity and enabling market access for surplus produce.
Draft Land Acquisition, Resettlement and Rehabilitation Policy (2018)	The policy aims to support sustainable economic development by ensuring fair and equitable treatment of people displaced by land acquisitions, preventing impoverishment and conflict. Its goal is to identify and mitigate all impacts resulting from land	The project will follow responsible land acquisition practices, including compensation and resettlement, in line with the policy to safeguard affected persons.

Policy	Policy Goal	Relevance to MWACRID Project
	acquisition through a balanced approach that protects national development interests and the rights of affected individuals. The policy outlines principles, legal and institutional frameworks, and procedures to guide responsible land acquisition, emphasizing justified use, transparent stakeholder engagement, recognition of property rights, community benefits, livelihood improvement, responsible investment, and minimizing displacement and its negative impacts.	
The National Fisheries Policy, 2004	The policy aims to achieve increased and sustainable fish production and utilization through effective management of capture fisheries, promotion of aquaculture, and reduction of post-harvest losses. Its specific objectives include sustainable fisheries development, community involvement, decentralization, institutional strengthening, environmentally responsible investment, improved data systems, minimized environmental impacts, enhanced fish quality and market value, expanded aquaculture, capacity building, and promotion of research and technology to support fisheries management and development.	The project's bulk water infrastructure may support aquaculture development and contribute to increased fish production and rural livelihoods.
Operation Wealth Creation (OWC)	The program's objectives are centered on advancing commercial agriculture among the population, with the goal of increasing household incomes. This includes ensuring fair and timely access to production inputs to improve productivity. It also focuses on promoting rural technological advancement to help smallholder farmers transition into small-scale industrial producers. Furthermore, the program aims to encourage the	The project aligns with OWC by boosting productivity, supporting rural infrastructure, and economically empowering local farmers and communities.

Policy	Policy Goal	Relevance to MWACRID Project
	growth of local and community-based enterprises nationwide and support the development of rural infrastructure. The overarching goal is to economically empower the 68% of the population currently excluded from the money economy.	

3.3 Legal and Regulatory Framework Relevant to the Proposed Project

The Ugandan laws and regulations applicable to the proposed project are presented in Table 3-2.

Table 3-2: Ugandan laws and regulations relevant to the Proposed MWACRID project.

Law/Regulation	Provision(s)	Relevance to MWACRID Project
The Constitution ofthe Republic of Uganda; 1995; amended as at 15thFebruary 2006, Government of Uganda.	The State shall promote sustainable development and public awareness of the need to manage land, air and waterresources in a balanced and sustainablemanner for the present and future generations. Chapter 15, Article 237, Clauses (1) (2) acquire land anywhere within the country and place it to the best use to benefit the citizens of the country, where deemed necessary (a) & (b) gives the Government the powers as guided by the Parliament to	The developer observes the Constitutional provisions. This is why the developer commissioned the ESIA process prior to implementation of the project. Thewater supply works, as well as transmission to neighbouring areas will be done while following mitigation measures. All land acquisitions will adhere to provisions of the 1995 National Constitution.
National Environment Act, Cap 181 (Previously National Environment Act No.5, 2019)	Section 112 (1), requires a developer of a project to submit an acceptable ESIA report in accordance with the guidelinesin the Fourth Schedule of this Act. The proposed project falls under the Fifth Schedule of the National Environment Act, Cap 181,	In line with the requirements as stated in the National Environment Act, Cap 181, the client commissioned an Environment and Social Assessment, and the findings are presented as indicated in this report. The study was

Law/Regulation	Provision(s)	Relevance to MWACRID Project
	requiring an Environmental and Social Impact Assessment (ESIA) before implementation. It triggers Section 4, particularly subsections 4(a) on large-scale water abstraction, 4(i) on extensive water pipeline construction, and 4(k) on support facilities related to these activities.	undertaken by NEMA Certified Environmental Practitioners in accordance with and National Environment (Environmental and Social Assessment) Regulations, 2020 of Uganda.
The Water Act, Cap152 and The Water Resources Regulations, 1998	Under section 18 (2), a person wishing to construct any works or take and use water may apply to the Director of Water Development Directorate in a prescribed form for a permit to do so. Under Section 31 (1) of the Act, a personcommits an offence who, unless authorized under this Part of the Act, causes or allows wastes to come in contact with, or be discharged into water or allows water to be polluted	The developer will ensure that waste generated during project implementation does not negatively impact water resources in the project area.
The Land Act, Cap227	Section 42 states that Government or Local Government may acquire land in accordance with the provisions of Article26 and clause 237 of the constitution. Section 74 (i) states that where it is necessary to execute public works on any land (for example construction of road), an authorized undertaker shall enter into mutual agreement with occupier or owner of the land in accordance with this act, and where no agreement is reached, the Minister may;compulsorily acquire land in accordance with Section 43 of the Act.	All the required land for the proposed project will be acquired in accordance with this Act.

Law/Regulation	Provision(s)	Relevance to MWACRID Project
The Occupational Safety and HealthAct, 2006	The Act aims at ensuring the existenceof safety and health at all work placesand work environment.	The project shall adhere to occupational safety and health rules according to the mitigation measures suggested in this report.
The Workers' Compensation Act (2000)	This requires compensation to be paidto a worker injured or acquired an occupational disease or has been harmed in any way in the course of his/her work.	The developer shall ensure that all contractors and sub-contractors provide personal protective equipment (PPE) to employees to minimize accidents and injuries. Additionally, compensation will be paid to those affected.
The Town and Country Planning Act, 2014	The Town and Country Planning Act govern land use and land planning inurban and rural areas.	The developer shall use established guidelines for planning bulk water supply systems, to acquire land as well as safeguarding the natural environment.
The Public HealthAct Cap 281	Section 7 provides local authorities with administrative powers to take all lawful, necessary and reasonably practicable measures for preventing theoccurrence of, or for dealing with any outbreak or prevalence of, any Infectious, communicable or preventable disease, to safeguard and promote the public health.	The developer/ Contractor shall provide for adequate sanitary facilities, proper solid and liquid waste management and provide and operate first Aid services especially in public places; and shall ensure that such facilities areavailable in all other privately allocated and developed areas requiring such to possess them. Anybody falling sick and needing services beyond the first Aid shall be referred to the nearest health centre. The developer /Contractor will implement HIV/AIDS prevention and control plan as part of the mitigation measures.

Law/Regulation	Provision(s)	Relevance to MWACRID Project
The Local Governments ActCap 243	Provides for the system of local governments based on the decentralization of district for the enforcement of environmental law. The functions of the Municipal Councils include: land surveying and administration, physical planning, environmental protection (forests and wetlands, streams and so forth and ensuring proper sanitation	The developer shall work closely with officials, in the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District, including other lower local government leaders incarrying out activities related to the project for example monitoring the implementation of the Environment and Social Management and Monitoring Plan (ESMMP) for the project.
National Forestry Act Cap 160 (previously National Forestry and Tree Planting Act, 2003)	The Act replaces the 1951 Forestry Act and addresses modern challenges in forest and tree resource management in Uganda. It aims to promote sustainable forest management, conserve resources, involve local communities, and encourage private sector investment. The Act regulates the harvesting of forest products, and Section 38 mandates environmental and social impact assessments for projects affecting forests.	Specifically, to this project, the Act provides for tree planting which should be undertaken in this project as part of environmental mainstreaming. At restoration, indigenous trees should be replanted. This should be done in consultation with Kiryandongo and Masindi District Environment Officers
Traffic and Road Safety Act, 1998	This is the main law governing road transport in Uganda. It covers licensing of vehicles and drivers, the use of motor vehicles on the road, and the control of traffic. It also establishes the Transport Licensing Board (TLB) and the National Road Safety Council (NRSC). TLB issues licenses to regulate the use of public service vehicles, private omnibuses and goods vehicles. NRSC functions include the promotion of road safety and vehicle registration is performed by the Uganda Revenue	The developer/contractor should ensure that all project vehicles are properly licensed, roadworthy, and operated by qualified drivers with valid permits. A traffic management plan should be implemented to control vehicle movements, particularly near construction sites, and minimize disruptions or accidents.

Law/Regulation	Provision(s)	Relevance to MWACRID Project
	Authority, therefore, the Traffic and Road Safety Act is relevant for the management and control of traffic on roads.	
The National Environment (Environmental and Social Assessment) Regulations, 2020	Regulation 12(1) requires the developer of a project under section 113 of the Actand set out in Schedule 5 of the Act to undertake scoping and an environmental and social impact study in accordance with these Regulations. Regulation 16(1) requires the developer to carry out consultations with relevant stakeholders, communities likely to be affected by the project and the public while undertaking the environmental and social impact study.	The study has been conducted inline to the provisions of the Regulations. Various stakeholders in the project area were consulted to find out their views on the proposed project.
The National Environment (Wetlands, RiverBanks and Lake Shores Management) Regulations, 2000	Regulation 12(1) prohibits any person from carrying out an activity in a wetland without a permit issued by theExecutive Director of NEMA. Under regulation 34(1), a developer desiring to conduct a project which may have significant impact on a wetland (for example dredging), river bank or lake shore, shall be required to carry out an environmental impact assessment in accordance with sections 20, 21, and 22 of the NES.	The proposed water abstraction point is at Masindi Port along Victoria Nile. The developer shall apply for water abstraction permit.
The National Environment (Conduct and Certificate of Environment Practitioners Regulations (2003)	Regulation 176 (1) states that no person shall conduct an EIA or carry outany activity relating to the conduct of anenvironmental	The Consultants who carried out this assessment are certified practitioners by NEMA.

Law/Regulation	Provision(s)	Relevance to MWACRID Project
	impact study, or environmental audit asprovided under the Act, unless the person has been duly certified and registered in accordance with the regulations	
The National Environment (Waste Management) Regulations (2020)	Regulations outline the requirements for the management of hazardous and non-hazardous waste including transport, storage, treatment, and disposal and licensing of waste contractors. Regulations require waste disposal in a way that would not contaminate water, soil, and air or impact public health.	The Project Developer should be aware of regulation requirements and legal standards when designing waste storage facilitates, avoiding inappropriate handling and disposal of waste.
The Water (Waste Discharge) Regulations, 1998	The water (Waste Discharge) Regulations of 1998, are aimed at regulating the effluent or discharge ofwastes on to land or into water. Under regulation 5(1), a waste dischargepermit is required for a person who owns a facility which discharges or will discharge effluent or waste into the aquatic environment or on land. The alum sludge and backwash water from the water treatment works will have to be discharged responsibly.	In case of any waste discharged, a waste discharge permit shall be acquired from the relevant authorities.
The National Environment (Control of Smokingin Public Places) Regulations,2004.	Section 3 entitles every person to a healthy environment, free from second- hand smoke. It further obliges all persons to safeguard the health of non-smokers. Sections 4 & 5 prohibit smoking in public places.	The developer/Contractor shall enforce a no-smoking ban in all public work places during construction and operation phasesof the project and will ensure that there are clear

Law/Regulation	Provision(s)	Relevance to MWACRID Project
		signs indicating that smoking is restricted and prohibited in such areas.
The National Environment (Noise Standards and Control) Regulations, 2003.	Regulations 6 & 7 (II) sets permissible noise levels, Part III (Regulations 8, 9, 10 & 11) calls for the control and mitigation of noise; Regulation 9 specifically prohibits the generation of noise by place and time. Part IV instructs for a license for noise in excess of permissible levels.	Contractor and developer must enforce noise standards and working hours at the site allocated for development, both during the construction stage, as well as during operation and maintenance.
National Environment (Air Quality Standards) Regulations, 2024	The Standards provides for permissible limits air quality parameters such as carbon dioxide, Nitrogen oxides, Sulphur oxides, Volatile Organic Compounds and particulates	The Developer and Contractor must implement and enforce mitigation measures for air pollution during the entire lifecycle of the project
The National Environment (Audit) Regulations 2020	Section 12 (4) states that "The developer shall ensure that an environmental and social compliance audit is undertaken by an environmental and social audit team of persons duly certified and registered in accordance with the National Environment (Conduct and Certification of Environmental Practitioners) Regulations, 2003".	To adhere to this regulation, a team of experts who are registered with the National Environment Management Authority (NEMA) should undertake the Environmental and Social Audit on behalf of the Client to check its level of compliance.

3.4 Institutional Framework

3.4.1 Ministry of Water and Environment (MWE)

Ministry of Water and Environment (MWE) is responsible for ensuring sound environmental management that in turn ensures that there is sufficient water for domestic, agricultural and industrial uses. MWE has the responsibility for setting national policies and standards, managing and regulating water resources and determining priorities for water development and management.

MWE plays a central role in the MWACRID project as the lead implementing agency, responsible for overseeing water resource planning, regulation, and ensuring the sustainable use of water for agriculture. It will guide the design, implementation, and monitoring of irrigation infrastructure and water supply systems.

3.4.1.1 The Directorate of Water Resources Management (DWRM)

The Directorate of Water Resources Management (DWRM) is part of the Ministry of Water and Environment and is responsible for developing and maintaining national water laws, policies and regulations; managing, monitoring and regulation of water resources through issuing water use, abstraction and wastewater discharge permits; Integrated Water Resources Management (IWRM) activities; coordinating Uganda's participation in joint management of transboundary waters resources and peaceful cooperation with Nile Basin riparian countries.

DWRM is responsible for issuing water abstraction permits and wastewater discharge licenses for the project. It will also lead integrated water resource planning to ensure sustainable extraction from the Nile River at Masindi Port, while monitoring impacts on water quality and quantity.

3.4.1.2 The Directorate of Water Development (DWD)

The Directorate of Water Development (DWD) under MWE is the lead agency responsible for coordinating and regulating all water supply and sanitation activities. It provides technical support services and capacity development to local governments and other water resources service providers. DWD comprises three Departments; Rural Water Supply and Sanitation; Urban Water Supply and Sanitation and Water for Production.

DWD supports the MWACRID project by providing technical assistance and oversight in the design and implementation of rural and agricultural water supply systems. It will also guide local capacity-building efforts for water for production infrastructure.

3.4.2 Albert Water Management Zone (AWMZ)

The Albert Water Management Zone is one of the four Water Management Zones established by the Directorate of Water Resources Management under the Ministry of Water and Environment as part of Uganda’s strategy for Integrated Water Resources Management. The AWMZ covers the catchments draining into Lake Albert and the Albert Nile, including key

districts such as Masindi and Kiryandongo, where the MWACRID project is being implemented.

The primary role of the AWMZ is to coordinate water resources planning, monitoring, and regulation within its geographic scope. This includes managing water abstraction, ensuring equitable water allocation, safeguarding water quality, and promoting stakeholder engagement in water governance at the catchment level.

3.4.3 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)

Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) plays a vital role in promoting irrigation and agricultural water management, which is central to the project's goals of enhancing agricultural productivity.

MAAIF will collaborate with MWE to ensure alignment of irrigation systems with national agricultural goals. It will provide technical support on water use for crop production, help identify suitable irrigation technologies, and where need be support farmer mobilization and training.

3.4.4 National Environment Management Authority (NEMA)

The National Environment Management Authority (NEMA) is a semi-autonomous institution, established under the National Environment Act, Cap. 153, in 1995, as the principal agency in Uganda, charged with the responsibility of coordinating, monitoring, regulating and supervising environmental management in the country. This agency spearheads the development of environmental policies, laws, regulations, standards and guidelines; and guides Government on sound environmental management in Uganda. Air quality, effluent and noise standards issued by NEMA are key to project implementation.

NEMA is responsible for reviewing and approving the project's Environmental and Social Impact Assessment (ESIA). It will monitor environmental compliance throughout the project lifecycle, particularly in managing noise, effluent discharge, and ecosystem impacts.

3.4.5 Ministry of Gender Labor & Social Development (MoGLSD)

This ministry promotes issues of social protection, gender equality, equity, human rights, culture, decent work conditions and empowerment for different groups such as women, children, the unemployed youth, internally displaced persons, the older persons and persons with disabilities. The Ministry works with institutional structures at district levels including probation offices, community development offices, and labour offices. The Department of Occupational safety and health of this ministry administers and enforces the Occupational Safety and Health Act, No.9, 2006, the Laws of Uganda and its subsidiary Legislation. Mandated to Evaluate and Control the Physical, Chemical, Physiological, Social and Technical factors that affect persons at Work and the Working Environment. As such it is a requirement for the project to obtain a Workplace registration certificate and certificates of examination of lifting equipment from this department during the contractor mobilization phase. Additionally,

it is mandatory to report fatal accidents and any lost time injuries of three days or more to this department.

MoGLSD is key to ensuring gender inclusion, occupational health and safety, and social safeguards. It will support the development of workplace safety systems and oversee compliance with labour laws, especially during construction and resettlement activities.

3.4.6 Ministry of Energy and Mineral Development (MEMD)

MEMD is responsible for the sustainable management and utilization of energy and mineral resources in Uganda. This includes the development of policies, regulations, and strategies related to electricity generation, transmission, and distribution, as well as petroleum and mineral resource management.

The MWACRID project will involve electrical installations for pumping and distributing water, especially at the intake point at Masindi Port and along irrigation networks. The MEMD will be key in guiding energy access, ensuring safe and reliable power connections, and supporting energy efficiency measures, which are crucial for the sustainability and cost-effectiveness of the project.

3.4.7 Ministry of Works and Transport (MoWT)

The Ministry is mandated to plan, develop, and maintain Uganda's public works and transport infrastructure, including roads, bridges, and ferries. It oversees transport policies and ensures road safety and access standards are upheld.

The ministry will play a role in ensuring proper road standards, access permits, and traffic safety measures, especially for the movement of construction equipment and materials during project implementation.

3.4.8 Ministry of Lands, Housing and Urban Development (MLHUD)

The Ministry is a cabinet-level institution mandated to provide policy guidance, establish national standards, and coordinate all issues related to land management, housing, and urban development in Uganda. It is also responsible for land valuation services in government-related transactions.

It will play a critical role in land acquisition processes for the MWACRID Project, particularly in conducting property valuations, ensuring proper land tenure documentation, and overseeing fair and lawful resettlement or compensation of affected persons.

3.4.9 The Uganda Land Commission (ULC)

The Commission is mandated to manage public land on behalf of the Government of Uganda. It holds and allocates land for Government use and supports the documentation and titling of public land.

The ULC is critical where the MWACRID project involves use or allocation of public land for example, land along the Nile River intake point, reservoir sites, or pipeline routes. Coordination with ULC is necessary to secure land rights, avoid encroachments, and ensure compliance with land tenure regulations for infrastructure development.

3.4.10 National Forestry Authority (NFA)

The National Forestry and Tree Planting Act of 2003 created NFA as semi-autonomous body responsible for management of central forest reserves. NFA divided the country into sectors and manages forest reserves through its sector managers.

The National Forestry Authority (NFA) is a key institutional stakeholder in this project because the reservoir tanks for the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure will be located on Kaduku Hill, which is part of the Kaduku Central Forest Reserve. NFA will guide environmental safeguards, authorize land use, and monitor any forest-related impacts or compensatory measures.

3.4.11 Uganda Investment Authority (UIA)

Uganda Investment Authority (UIA) set up under the Investment Code 1991 (revised in 2019) is a statutory agency mandated to initiate and support measures that enhance investment in Uganda and advise Government on appropriate policies conducive for investment promotion and growth. The changing investment environment and Government priorities have necessitated the modification of UIA's mandate. Uganda Investment Authority is a semi-autonomous government agency which drives national economic growth and development in partnership with the private sector. As an Investment Promotion Agency, UIA mainly: markets investment opportunities; promotes packaged investment projects; ensures local and foreign investors have access to information, especially about the business environment so as to make more informed business decisions; and offers business support, advisory and advocacy services.

The majority of the project area encompasses two agricultural parks, one in Kiryandongo (6 square miles) and another in Masindi (20 square miles), both managed by the Uganda Investment Authority (UIA). UIA formally requested the Ministry of Water and Environment (MWE) to provide water for production and irrigation to support the farmers in these areas.

3.4.12 National Water and Sewerage Cooperation (NWSC)

The National Water and Sewerage Corporation (NWSC) Statute establishes the NWSC as a Water and Sewerage Authority and gives it the mandate to operate and provide water and sewerage services in areas entrusted to it on a sound commercial and viable basis. NWSC is a parastatal that operates and provides water and sewerage services for 111 urban centres across the country. Sector reforms in the period 1998-2003 included commercialization and modernization of the NWSC operating in cities and larger towns as well as decentralization and private sector participation in small towns. NWSC also operates small conventional sewage treatment plants in a series of towns.

NWSC is working on a project aimed at improving sanitation and water delivery in Lira, Hoima, and Fort Portal and this project is considering the Nile River at Masindi Port as the intake. Although primarily urban-focused, NWSC may provide technical insights for water treatment infrastructure. NWSC's experience with Nile River water abstraction at Masindi Port for other towns provides lessons relevant to the MWACRID water intake and treatment design.

3.4.13 Masindi District Local Government (MDLoG) and Kiryandongo District Local Government (KDLoG),

The proposed project falls within jurisdiction of Kiryandongo District and Masindi District. Technical District personnel directly involved on the project include the District Water Officer, Natural Resources Officer, District Health Officer and the Environment Officer. *These will be instrumental in project implementation through community mobilization, land acquisition facilitation, environmental and health inspections, and monitoring of construction activities. Local technical officers will be part of project coordination and supervision.*

3.4.14 District Land Boards

District Land Boards are independent bodies established under the Constitution of Uganda to manage land matters at the district level. Their functions include allocating land in the district, which is not owned by any person or authority, facilitating the registration of land titles, and advising the Uganda Land Commission on land matters.

DLBs in Masindi and Kiryandongo will support the identification, acquisition, and verification of land parcels needed for the project. They are instrumental in ensuring local level compliance with land laws and in resolving land related issues that may arise during land acquisition for project infrastructure such as access roads, and reservoirs.

3.4.15 Nile Basin Commission (NBC)

The Nile Basin Commission (NBC) is purposed to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.

NBC plays a central role in the MWACRID project of facilitating notification of Nile Riparian states about the project under development in international waterways. The commission is critical in relaying information between the Nile Riparian countries and the Project.

3.5 Permits and Licenses Required by Project Proponent

Table 3-3: Permits and Licenses

Permit type	Description	Issuing Institution
ESIA certificate	The certificate will be provided after approval of the ESIA report	National Environment Management Authority (NEMA)
Workplace Registration Certificate	Every workplace is required to be registered and must commit to abide by all of the country's labour laws	Ministry of Gender, Labor & Social Development
License to handle and store hazardous waste	Every establishment producing hazardous waste in their production line/ processes need to acquire a license for handling and storage of hazardous waste	National Environment Management Authority (NEMA)
Water Abstraction Rights	For water abstraction, it is a requirement for the project to obtain water abstraction rights	Directorate of Water Resources and Management (DWRM)
Road cutting permit, permit for working in road reserves	The project plans to construct a water pipeline which will most likely need to crossroads or be laid in the road reserve boundary, this shall require a permit from the Roads Authority	MoWT and Masindi and Kiryandongo District Local Governments
Development Planning Permission	The project is within the jurisdiction of the Kiryandongo District Local Governments, which will require to approve the designs and the plans for the proposed water supply infrastructure	Masindi and Kiryandongo District Local Governments

3.6 International Conventions and Agreements

3.6.1 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992)

This convention fosters cooperation for the sustainable management of shared water resources. It emphasizes the prevention, control, and reduction of transboundary impacts from water abstraction and pollution.

Although Uganda is not a party, this convention provides guiding principles for the MWACRID project's water abstraction from the Nile River, which is part of a major transboundary watercourse shared among several riparian states. The project must ensure that water use is equitable and does not negatively impact downstream users, aligning with Nile Basin cooperative principles.

3.6.2 United Nations Convention to Combat Desertification (UNCCD)

This convention aims to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.

The project enhances resilience to climate variability in the project area by providing reliable irrigation water. This will improve vegetation cover, reduce soil erosion, and promote climate-smart agriculture, directly contributing to Uganda's obligations under the UNCCD.

3.6.3 Convention on Biological Diversity (CBD)

This obliges member states to establish a system of protected areas, develop guidelines for the selection, establishment and management of protected areas, and promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings and integration of sustainable utilization of natural resources in national strategies.

Infrastructure development must take into account biodiversity-rich areas such as Kaduku Central Forest Reserve, where reservoir construction is planned. The project must avoid disrupting habitats of endemic or endangered species and promote agroforestry or buffer zones around critical ecosystems.

3.6.4 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES is a multilateral treaty established to protect endangered plants and animals from the adverse impacts of international trade. Initiated from a 1963 IUCN resolution and opened for signature in 1973, it entered into force on 1 July 1975. CITES regulates the international trade of over 40,900 species of wild fauna and flora ranging from live animals and plants to products derived from them such as leather goods, food, and traditional medicines.

While the project does not involve trade, construction and land clearing activities must identify and protect any CITES-listed species (e.g., certain birds, reptiles, or tree species) that may be present in riparian or forested zones and follow NEMA's biodiversity protection protocols.

3.6.5 Convention on the Conservation of Migratory Species of Wild Animals (CMS)

This treaty promotes conservation of migratory species that cross international borders, including through protection of critical habitats. CMS provides a legal framework and strategic toolsvsuch as action plans, resolutions, and binding agreements for countries to collaborate in conserving habitats and managing threats like habitat fragmentation and human-wildlife conflict.

Wetland areas and the River Nile corridor are known to support migratory bird species, such as the grey crowned crane (Uganda's national bird). The project must avoid disruption to migratory pathways and nesting areas during pipeline installation or reservoir construction and may consider seasonal timing restrictions during sensitive periods.

3.6.6 The Ramsar Convention

The Ramsar Convention is an international treaty focused on the conservation and sustainable use of wetlands, particularly those of international importance as habitats for waterfowl. Commonly referred to as the Convention on Wetlands, it promotes the designation of Ramsar Sites, encourages wise use of all wetlands, and fosters international cooperation on transboundary wetland systems.

Project components near or within wetland systems along the Nile or in flood-prone zones, must be designed to minimize wetland encroachment, preserve natural hydrology, and implement wetland restoration plans where degradation is unavoidable.

3.6.7 Strategic Approach to International Chemicals Management (SAICM)

SAICM is a comprehensive global policy framework that promotes the sound management of chemicals throughout their lifecycle, with the goal of minimizing their adverse effects on human health and the environment. Hosted by the United Nations Environment Programme (UNEP), SAICM brings together governments, NGOs, industry, and civil society to implement practices that support sustainable development and the safe use of chemicals.

The project is expected to introduce or increase use of agrochemicals (fertilizers, pesticides) in irrigated agriculture. Therefore, proper chemical storage facilities, training of farmers on safe use, and establishment of pesticide runoff management systems are required to safeguard soil and water quality.

3.7 The African Development Bank Group's (AfDB) Integrated Safeguard System (ISS) 2023

In 2023, the African Development Bank Group updated their policy to improve clarity, coherence and consistency as well as overall operational effectiveness regarding Environmental and Social (E&S) sustainability by adopting 10 Operational Safeguards (OSs). The ten Environmental and Social Operational Safeguards (E&S OSs) establish the standards that Borrowers should meet, as appropriate, in projects, activities, and initiatives supported through Bank financing throughout the life cycle of operations. Table 3-4 outlines the E&S OSs triggered by this project.

Table 3-4: AfDB Environmental and Social Operational Safeguards

Operational Safeguard/Performance Standard	Key issue	Relevance/Applicability
E&S OS 1: Assessment and Management of Environmental and Social Risk and Impact	Mainstream environmental and social considerations, including those related to climate change vulnerability and thereby contribute to sustainable development in the region. It governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements.	An environmental and Social Impact Assessment (ESIA) has been conducted for this project where potential impacts have been identified and mitigation measures proposed. This will ensure that the project is implemented in a sustainable way.
E&S OS 2: Labour and Working Conditions	Protection of workers' rights and provision of their basic needs. It establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation of the labourers.	The project will abide by the labour laws to protect the interests of workers. This will include for example: providing contracts to all hired workers, providing workers with personal protective equipment, setting up a grievance handling mechanism to enable workers express their complaints, among others.
E&S OS 3 (OS3): Resource Efficiency and Pollution Prevention and Management	Manage and reduce pollution in AfDB funded projects. It covers a range of key impacts including pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, to be followed to safeguard the environment and humans from being polluted as a result of the development activities.	The project will set up a waste management plan to handle liquid and solid wastes, including those of hazardous nature.

Operational Safeguard/Performance Standard	Key issue	Relevance/Applicability
E&S OS 4: Community Health, Safety and Security	Projects, activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration or intensification of impacts due to a project or activities.	During the implementation of the project, workers (both skilled and unskilled) will be required; this will introduce new people with different backgrounds in the project communities. The project implementation will also involve the movement of vehicles, and therefore, risks associated with such must be minimized to safeguard both the community and the workers at all times.
E&S OS 5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement	Project-related land acquisition, restrictions on land access or land use, and loss of property/assets can have adverse impacts on communities and persons. Project-related land acquisition and restrictions on land use may cause physical displacement (relocation, loss of residential land or loss of shelter), economic displacement (loss of land, assets or access to assets, leading to loss of income sources or other means of livelihood), or both	All people whose land is to be affected for example at the proposed water abstraction site, transmission mains, reservoir sites and some areas along the proposed pipeline route will be compensated prior to start of construction works.
E&S OS 6: Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources	It highlights the importance of maintaining the ecosystem services and protecting and conserving biodiversity.	Mitigation measures have been proposed in this ESIA report to minimize probable impacts of this project on biodiversity, including water resources so that their ability to provide ecosystem services to people and fauna are not compromised.
E&S Operational Safeguard 7: Vulnerable Groups	The objective is to ensure that vulnerable individuals and groups such as women and girls, persons with disabilities, elderly people, children, ethnic and religious minorities, female-headed households, the	The project should ensure that vulnerable groups are identified early and meaningfully engaged throughout the project lifecycle. Given the project's focus on water access,

Operational Safeguard/Performance Standard	Key issue	Relevance/Applicability
	landless, and Highly Vulnerable Rural Minorities (HVRM), including indigenous peoples are identified early in project planning and meaningfully engaged throughout the project lifecycle. It seeks to affirm and protect their rights, ensure culturally appropriate benefit-sharing, promote inclusive development, and prevent or mitigate adverse project impacts.	irrigation, and climate resilience, it is essential to promote inclusive development.
E&S Operational Safeguard 8: Cultural Heritage	It emphasises the need to protect and preserve cultural heritage from the adverse impacts of project activities and for current and future generations.	So far in this ESIA no PCRs like graves or shrines have been found above ground along the project corridor. However, with excavations chance finds of archaeological/paleontological value may be found. Hence a chance finds procedure has been developed for this project
E&S Operational Safeguard 10 (OS10): Stakeholder Engagement and Information Disclosure.	It emphasizes the importance of open and transparent stakeholder engagement as a key aspect of good international practice. Conducted throughout the project life cycle, effective engagement fosters strong, constructive relationships that support the successful management of environmental and social risks.	A structured stakeholder engagement for meaningful consultation and disclosure of appropriate information was established, considering the specific challenges and needs associated with the project. Similarly, it will provide affected persons and communities accessible and inclusive means to raise concerns and grievances.

4 PROJECT LOCATION, DESCRIPTION AND DESIGN

4.1 Project Location

The proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project for both small holder farmers and commercial farmers is located in the sub counties Masindi-Port, Kigumba -Kiryandongo District and Mirya and Kimengo sub counties in Masindi District. The table 4-1 below shows the villages covered under the Multi-Purpose Water for Climate Resilience and Irrigation Development (MWACRID) Project.

Table 4-1: The villages covered under the Multi-Purpose Water for Climate Resilience and Irrigation Development (MWACRID) Project

Village	Pop Size
Waibango Parish (Masindi Port Sub County) – Kiryandongo District	
Waibango	484
Rwenkunye	196
Nyakarongo	96
Kimoika	200
Barkwoyo	116
Kisenyi	55
Kitukuza	100
Kibirani	35
Rwempondo	60
Kyera	15
Kikaito	179
Kaduku I	131
Kaduku II	218
Kitaleba	215
Nyinarwenkunyi	140
Myeba	65
Wakisanyi	64
Katugo/Nkokoitwa	50
Kemiyambi	71
Miirya Sub County – Masindi District	
Bisenyi	840
Kitwetwe	300
Kinumi	250
Kimengo Sub County – Masindi District	
Myeba (Kiiryana)	1128
Kididima (Karwara)	500
Kalangwe	447
Kigumba Sub County Kiryandongo District	

Kaduki II	306
Nyama	200

(Source: National Population and Housing Census, 2024)

Masindi District, located in the mid-western region, covers approximately 4,200 square kilometers and is bordered by Kiryandongo to the east, Nwoya to the north, and several other districts. Kiryandongo District, also in western Uganda, covers around 3,600 square kilometers and shares borders with Nwoya, Masindi, and other neighboring districts. Masindi Port, the project's proposed water source catchment area, lies along the western banks of the Nile River, about 194 km northwest of Kampala and 49 km from Masindi town. Known for attracting tourists for various leisure, religious, and business purposes, Masindi Port is strategically located near the Nile River, which serves as the primary water source for the project. Its coordinates are 1°41'54.0" N, 32°04'40.0" E.

4.2 Project components

The Masindi Port Bulk Water Supply and Irrigation Infrastructure is designed as electricity powered multipurpose water system to meet the water demand of 15,000 ha net irrigation area, 10,340 livestock heads and 87,000 population in the sub counties of Masindi Port in Kiryandongo District, Mirya and Kimengo sub counties in Masindi District.

The first phase of the project considers supply of raw water to the farms of Soul Agric, Afrokai, Kazire, Zamburi, Kisiriza Excellence Ltd, CMG, Muhazi Heritage, Norma Agric, Lochab, Asiri, Medium scale farms and Kimengo area. Treated Drinking water shall also be supplied to Kimengo Town, Masindi Port town, Misenyi, Mile10 and Kiziba TC.

The main project components include the following:

4.2.1 Portable Water Supply Infrastructure Components

- Diversion Canal
- Water Intake and Pump Station For Portable Water
- Domestic Water Treatment Plant (DWTP)
- The DWTP will include several key buildings and facilities:
- Process Buildings: Containing the treatment units and machinery for coagulation, sedimentation, and filtration, and disinfection.
- Control Room: Equipped with advanced monitoring systems to oversee plant operations and water quality parameters.
- Electrical Building: Housing electrical systems, including power supply and backup generators to ensure uninterrupted operation.
- Maintenance Buildings: Providing storage for maintenance tools, spare parts, and equipment for ongoing operations.
- Office and Administrative Buildings: Supporting the management of the WTP and associated systems.
- Guard Room
- Transmission pipeline

- Pump Stations at the Water Intake
- Distribution pipelines
- Main Reservoir tanks

4.2.2 Irrigation Water Supply Infrastructure system

- Diversion Canal
- Water Intake and Pump Station For Irrigation
- Irrigation Water Treatment Plant (IWTP)
- Buildings within the IWTP compound
- The WTP will include several key buildings and facilities:
    - Process Buildings: Containing the treatment units and machinery for coagulation, sedimentation, and filtration, and disinfection.
    - Control Room: Equipped with advanced monitoring systems to oversee plant operations and water quality parameters.
    - Electrical Building: Housing electrical systems, including power supply and backup generators to ensure uninterrupted operation.
    - Maintenance Buildings: Providing storage for maintenance tools, spare parts, and equipment for ongoing operations.
    - Office and Administrative Buildings: Supporting the management of the WTP and associated systems.
    - Guard Room
- Transmission pipeline
- Pump Stations at the Water Intake
- Distribution pipelines
- Main Reservoir tanks for Irrigation
- Distribution Line to the farm gates for irrigation.

The intake from the River Nile will be equipped with submersible pumps to meet the demand for irrigation, domestic use, livestock watering, and rural industries. Raw water from the intake will be transmitted through Galvanized Iron (GI) pipes to the treatment plants and pumped to storage tanks located at Kaduku hill. From there, a by-gravity distribution system will supply water to the delivery points, ensuring sufficient water supply for various purposes.

The following are the components for Masindi Port Bulk Water Supply and Irrigation Infrastructure in Masindi and Kiryandongo District and their proposed location points.

Component	Easting	Northing
Abstraction Point	399176.11 m E	187377.93 m N
Treatment Unit	397217.02 m E	188027.82 m N
Reservoir	381192.32 m E	193929.09 m N

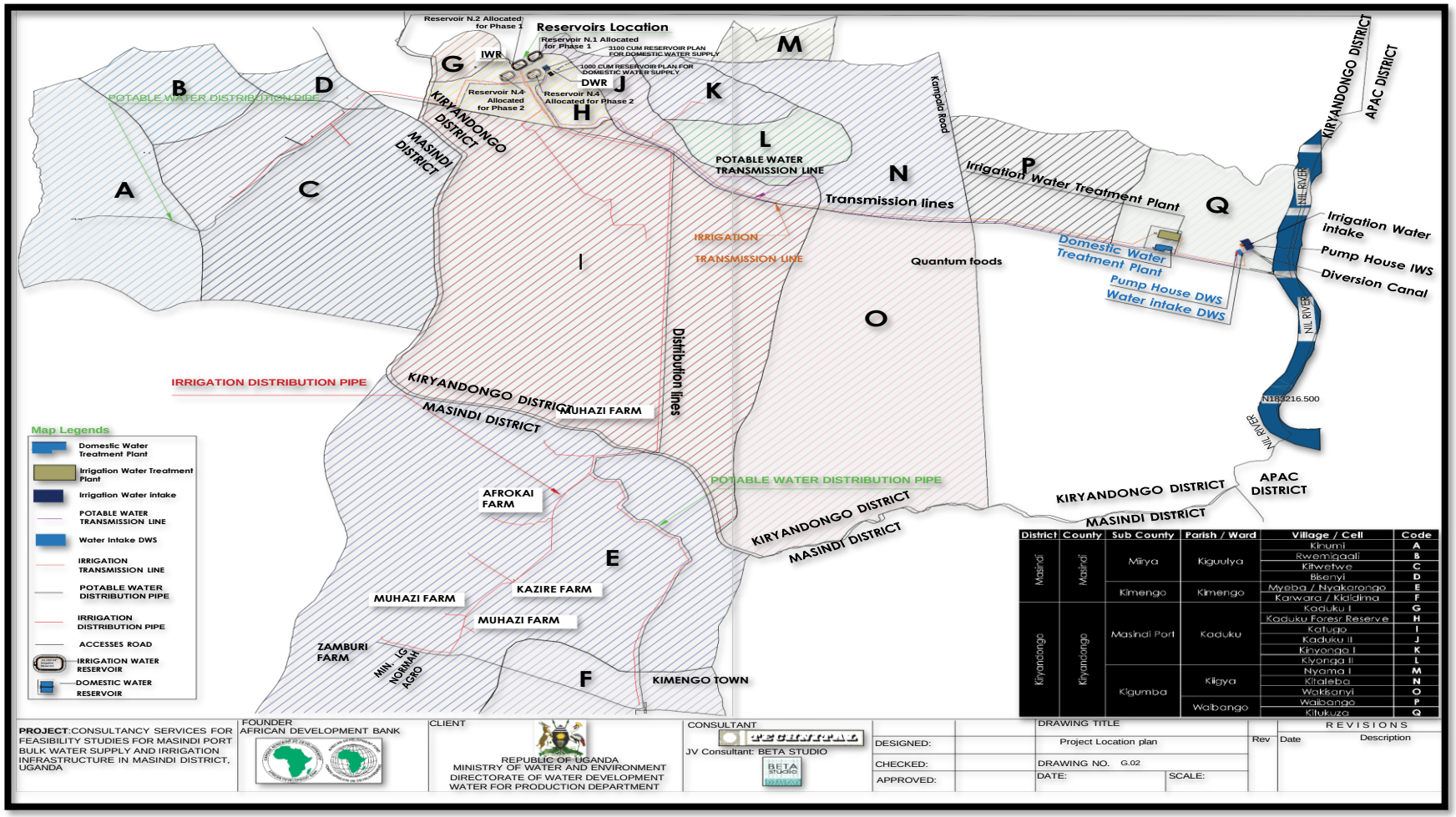


Figure 4-1: Map showing the location of the proposed MWACRID Project Site
(Source: Study Team)

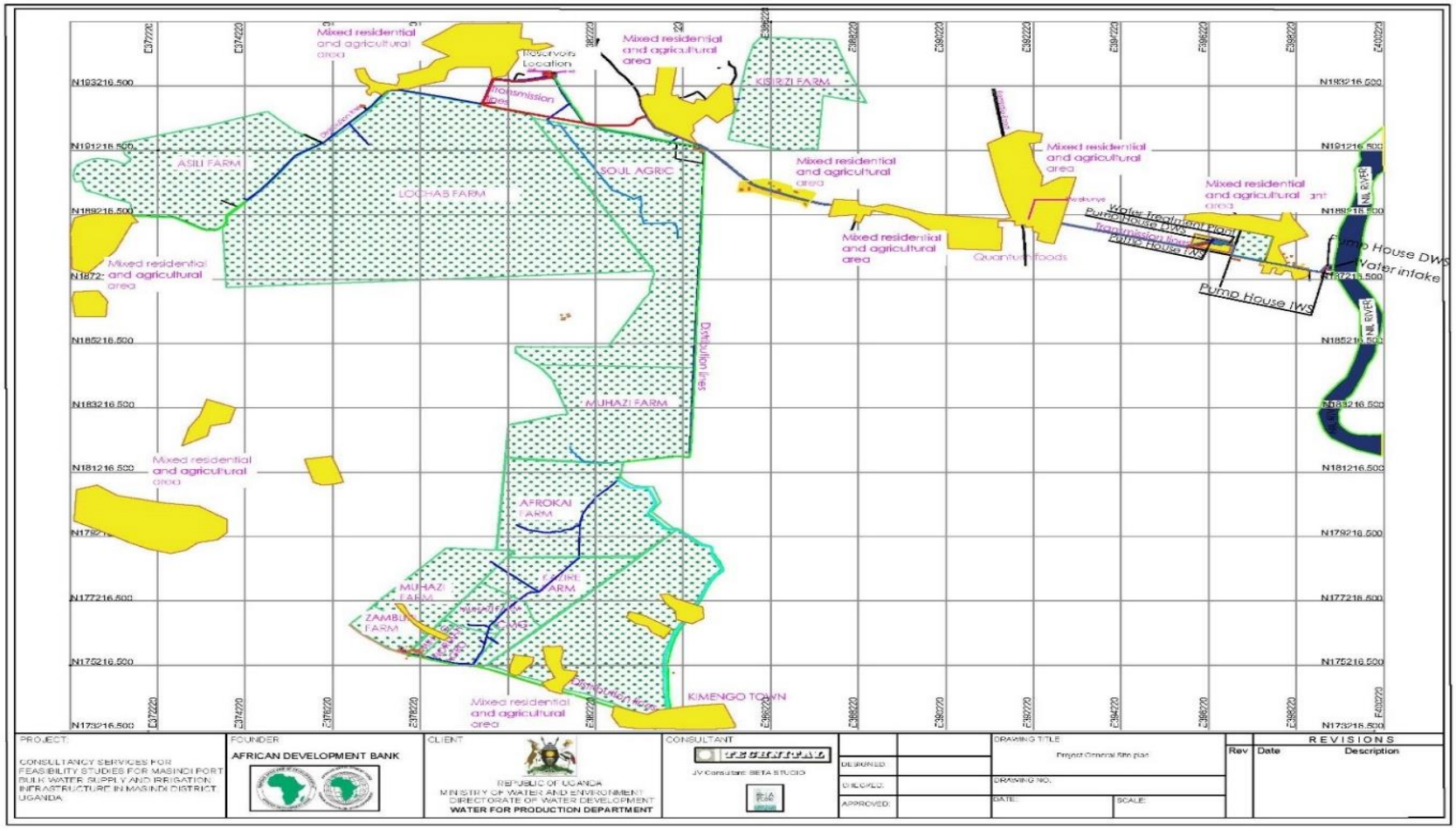


Figure 4-2: Map showing the location of the proposed MWACRID Project components
(Source: Study Team)

4.2.3 Proposed Water source

The abstraction point of the water supply project is located along the Kyoga Nile in Masindi Port, 18 km downstream the outlet of Lake Kyoga (Kimyoga Village, Waibanga Parish, Masindi Port Sub County, Kibanda County, Kiryandongo District at UTM Coordinates 36N 399074.31 187379.09). The Nile River Basin in Uganda covers massive wetlands and forms dense rivers, lakes and marshes.

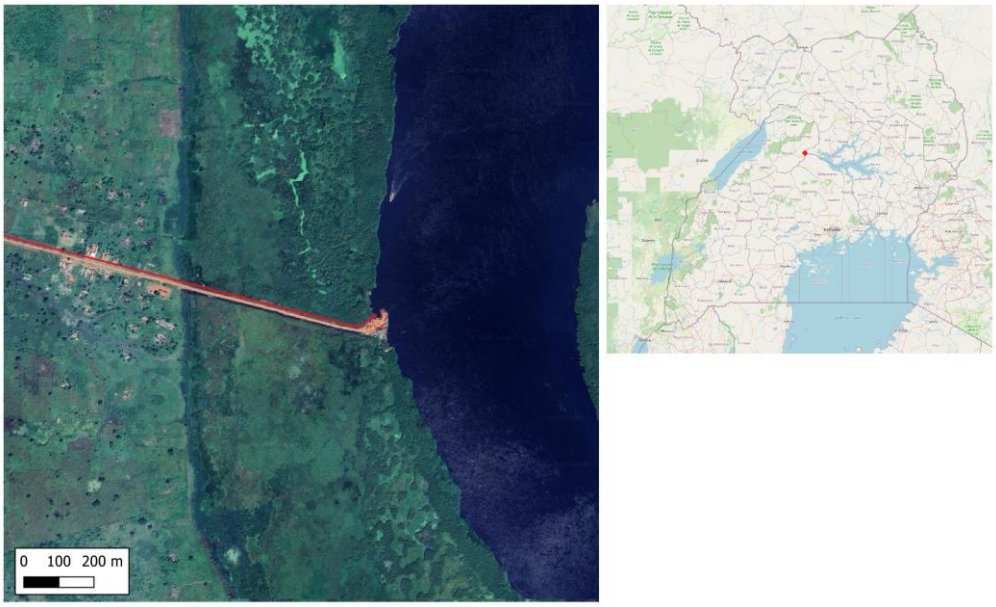


Figure 4-3: Abstraction point location
(Source: Study Team)



Figure 4-4: Proposed location for the project abstraction point on River Nile

The water intake system is crucial for extracting and delivering water efficiently. Factors such as water availability, sediment transport, environmental regulations, and constructability were carefully considered during the project studies process. The intake will be located next to the

Nile River, with two pump stations transferring water to the sediment and water treatment plant.

To ensure sustainable water extraction, detailed hydrological studies and historical data analysis are essential. Ownership of the intake source is also crucial to avoid disputes and ensure access. Intake location must consider security threats and pollution risks.

Proper protection measures, including fencing, stormwater drains, and access control, are necessary for intake design. Intake structures must prevent clogging, scouring, and maintain stability under varying flow conditions. Pumping options like suction pumps and submersible pumps are considered depending on river water levels.

Based on feasibility study findings, the Masindi Port bulk water multipurpose project is designed to serve 50,000 people for 25 years. The intake from River Nile will consist of 7 submersible pumps with a capacity of 370,333 m^3/day each for irrigation and livestock, and 2 other pumps for domestic water supply with a capacity of 4,667 m^3/day. The total flow from the intake will be 375,000 m^3/day. Raw water will be transmitted through various pipes to meet demands for irrigation, domestic use, livestock watering, and rural industries.

For the pump selection, high-efficiency centrifugal or vertical turbine pumps are considered. Intake structure design includes type, location, dimensions, screens, and filtration. Pumping systems should be capable of handling flow rates and accommodate maintenance. Materials should be corrosion-resistant, and environmental considerations are crucial.

Additional features like flow measurement and control systems are recommended for efficient operation. Safety measures should be in place for construction and operation. Overall, the design aims to provide a reliable and sustainable water supply system.

This submission includes a detailed description of the water intake and supply system, pump station, treatment plant, and transmission lines. The system serves municipal water supply and irrigation purposes, with treatment processes tailored to each. Transmission lines and reservoirs are designed to ensure efficient water distribution and storage for urban and agricultural needs.

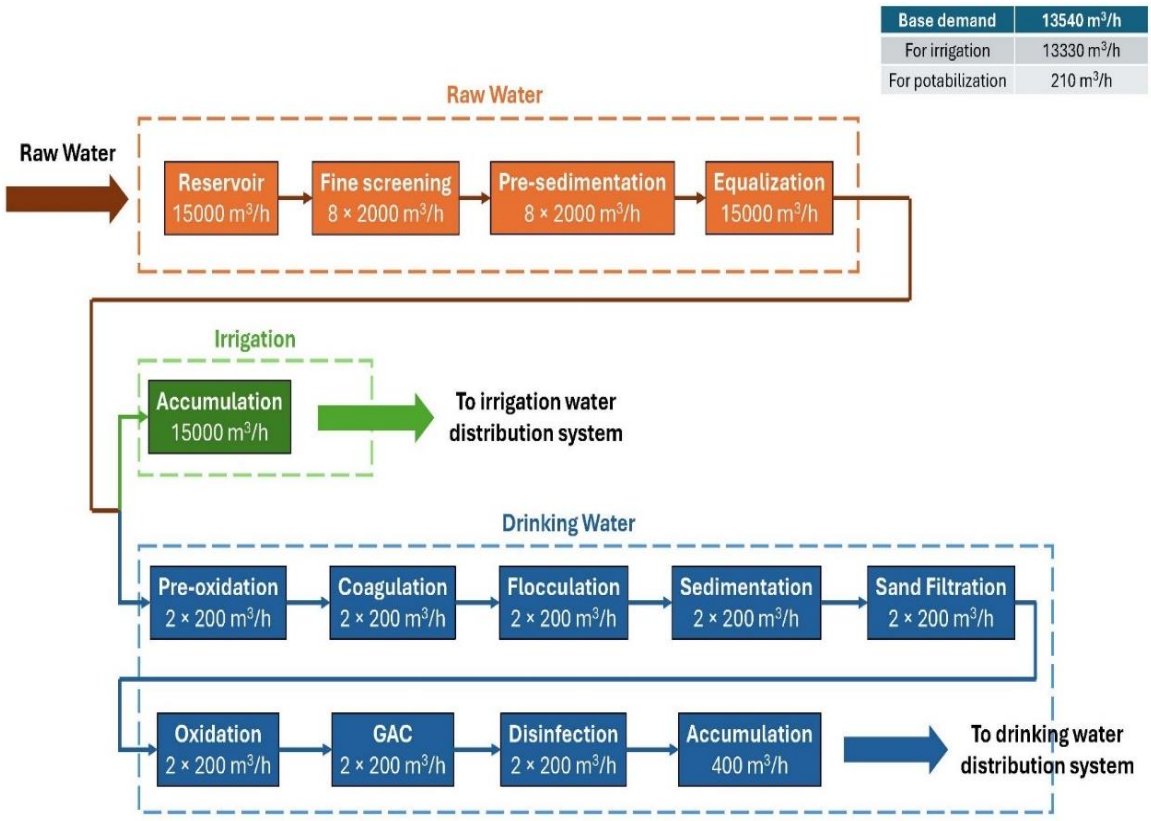
4.2.4 Treatment Plant

The incoming raw water from the pumping station in Masindi Port will have to meet a demand of 325.000 m3/day, of which 320.000 m3/day will be for irrigation and 5000 m3/day for drinking water consumption. Treatment for the drinking water section will be more stringent to ensure excellent quality drinking water output, while for water intended for irrigation will undergo a treatment that removes the sediments that can cause problems of clogging the electromechanical parts of irrigation systems.

Raw water arriving at the plant will be conveyed to an equalization/homogenization tank, capable of providing a useful volume of at least 15.000 m3, considering a retention time of about one hour. From that tank, the water will proceed to:

- Fine screening: 8 parallel lines providing a flow rate of 8 × 2.000 m3/h with mesh openings around 20 mm, to retain suspended particles having larger sizes. The retained material is sent to a compactor by augers and bagged.
- Pre-sedimentation: 8 circular sedimentation tanks with a diameter of 40 m, ensuring a capacity of 8 × 2000 m3/h with a retention time of about 90 minutes, which allow the removal of suspended solids by gravity.

After pre-sedimentation, the water will reach a flow divider/equalizer and then be sent to the treatments. Water destined for irrigation use (approximately 13.330 m3/h) will reach a storage tank capable of regulating the outflow and managing any changes in the flow rate, before being sent to the lifts and fed into the distribution network.



(Source: Study Team)

Figure 4-5: Water Treatment Process and Flow Diagram

The proposed site for the treatment plant is located along Masindi Port road at GPS coordinates UTM 36N 397217.02 m E, 188027.82 m N on open grassland with shrubs and scattered trees.



Figure 4-6: The proposed site for the water treatment plants

4.2.5 Transmission Mains

The proposed transmission line begins from the Masindi port water source towards the Kampala Gulu Highway and then crosses the Kampala Gulu Highway up to Kaduku Hill. An extra transmission line is proposed to connect the proposed reservoir at Kaduku Hill to the sub-reservoir at Soul Agric farm.

The section of the proposed transmission mains from the source to Kampala Gulu highway is characterized by, initially a gentle ascend towards the main road followed by a short steep section leading towards the last section running along the highway junction. This section was also characterized by moderate to sharp horizontal and vertical curves. The adjacent areas are mainly comprised of savanna grassland with some lined trees, gardens and lined settlements, especially in the section located within town centres. The section of the transmission mains along the Masindi Port to Kampala Gulu highway generally passes through mainly Flat terrain sections and is therefore characterized by gentle to steep vertical curves. Furthermore, due to the nature of the terrain, a significant portion of the area adjacent to the road along which the transmission main is proposed to be installed is flat, with no embarkments created during the process of road construction. Most of the areas outside the road reserve are used for the cultivation of crops.

From the intake to the treatment and sedimentation plants the irrigation pipeline sized as DN 1600 mm PN 10 and the drinking water pipeline sized as DN 300 mm PN 10 are approximately 800 m long.

From the plants, the main transmission pipelines reach the reservoirs on NFA hill following a path 18’700 m long. The irrigation pipeline is sized as DN 1600 PN35. The proposed transmission main for the treated water from the treatment plant to the reservoir at Kaduku hill is sized as DN 400 mm PN 30.

2No. surge tanks will be provided to absorb sudden rises of pressure (water hammer effect) caused by rapid changes in water velocity, to protect the conduit system from high internal pressures and assisting the pumps with regulation characteristics.

4.2.6 Storage Reservoirs

The proposed reservoir site is located approximately 8km from Masindi Port road and it crosses the Kampala Gulu highway to Kaduku Hill. The site is located on a hilly terrain of Kaduku Central Forest Reserve.



Figure 4-7: Proposed location for the reservoir tanks

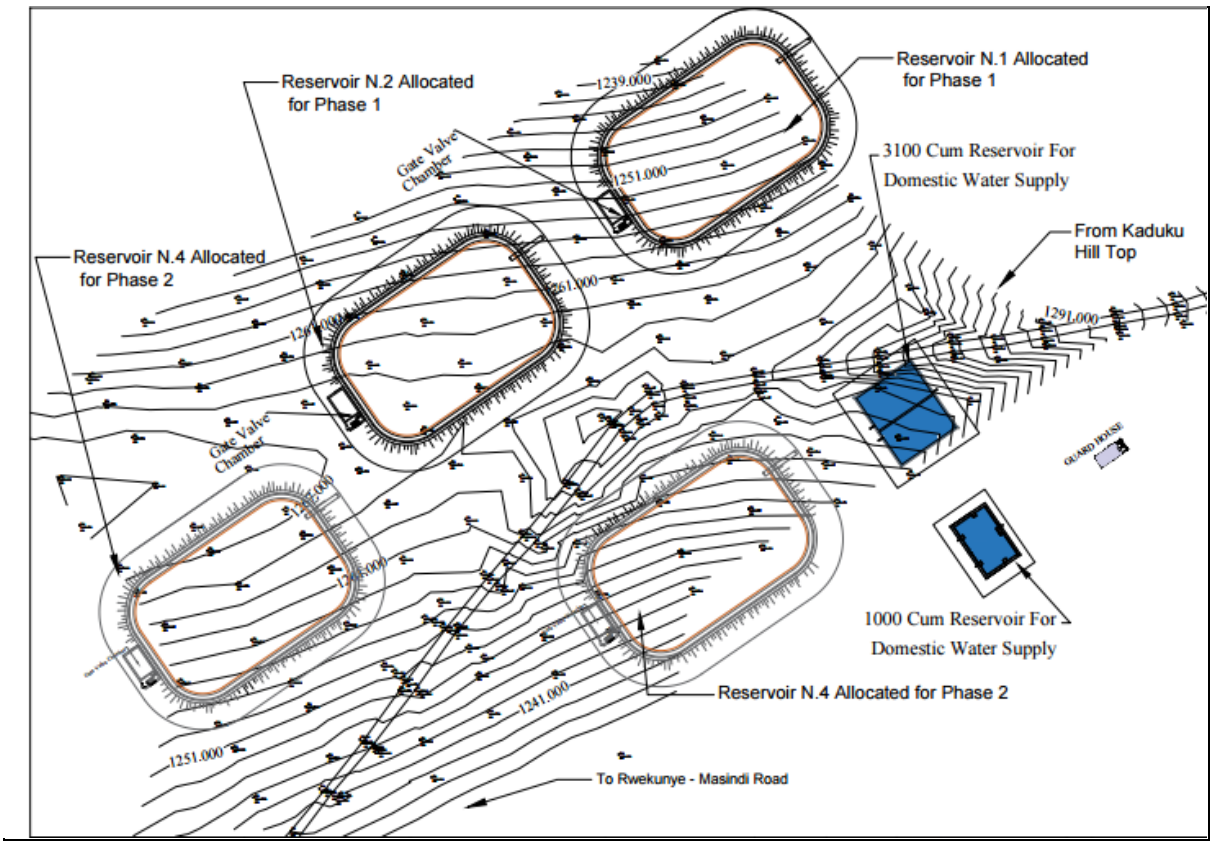


Figure 4-8: Overview of the reservoir tanks

Three options of the water scheme have been analysed. The alternatives mainly differ by operating time, storage capacity, pressure at the farms as seen in the analysis of alternatives.

4.2.7 On-farm storage tanks

The on-farm storage tanks shall be excavated and will be of varying capacity and will protect with a dam liner as summarized in Table 4-2. They consist of two scenarios i.e. Option 1 where the demand is met daily for each farm and Option 2 where the demand for the week is supplied once or twice a week. The required volume per week is estimated considering the irrigation water requirement and an irrigation efficiency of 70%.

Table 4-2: On farm storage tanks' volume

Farm	Net irrigation area (Ha)	Required Volume Per week	Proposed Storage (Option 1 ≈ 50% daily demand)	Proposed Storage (Option 2 ≈ 30% weekly demand)
Soul Agric	1,640	297,561.6	21,254	86380
Afrokai	1,220	231,897.6	16,564	73366

Farm	Net irrigation area (Ha)	Required Volume Per week	Proposed Storage (Option 1 ≈ 50% daily demand)	Proposed Storage (Option 2 ≈ 30% weekly demand)
Kazire	392	115,153.9	8,225	36431
Zamburi Farm	130	23,587.2	1,685	7462
Kisiriza Excellence Ltd	750	115,171.2	8,227	39066
CMG	81	13,296.96	950	4,510
Muhazi Heritage	1,562	377,879	26,991	118,075
Norma Agric	130	21,340.8	1,524	6,574
Lochab	4,000	967,680	69,120	308,200
Asiri	1,448	237,703.7	16,979	71,355
Medium scale farms	320	52,531.2	3,752	16,182
Kimengo area	1,000	172,800	12,343	53,231

(Source: Study Team)

4.2.8 Farmers Summary

Below is a table summarizing the **stakeholder farmers**, their respective farm sizes, and main crops. This table provides an overview of each farm's cropping pattern.

Table 4-3: Stakeholder Farmers and Cropping Patterns

Name of Farm/Stakeholder	Enterprises	Coverage (Ha)
Soul Agric	Maize	671
	Banana	81
	Coffee	219
	Pawpaw	81
	Macadamia	121
	Hass Ovacado	405
	Guava	20
	Fruits	20
	Soyabeans	20
	Apiary (bee keeping)	2

Name of Farm/Stakeholder	**Enterprises**	**Coverage (Ha)**
	Total	**1,640**
Afrokai	Hass Ovacado	243
	Macadamia	162
	Cashew nuts	105
	maize	710
	Total	**1,220**
Kazire	Medicinal (Cactus)	81
	Lemon	126
	Pasture for Cows	81
	Maize	104
	Total	**392**
Zamburi Farm	Coffee	40
	Hass Ovacado	40
	Maize	49
	Total	**130**
Kisiriza Excellence Ltd	Grain and Tubers	200
	Citrus/Oranges/Horticulture	80
	Pasture	150
	Agro-forestry	120
	Exotic Cattle and Goats	200
	Total	**750**
CMG	Maize	81
	Goat and Cows	
Muhazi Heritage	Sugarcane	**1,562**
Norma Agric	Maize	**130**

Name of Farm/Stakeholder	Enterprises	Coverage (Ha)
Lochab	Sugarcane	**4,000**
Asiri	Maize	**1,448**
Quantum Foods	Poultry Farm (200,000 birds)	**360**
Presidential Hub	100	**40**
Uganda Investment Authority		
Kimengo Area	Maize and High Value Crops	**1,000**
Others Identified from Masindi and Kiryandongo DLG	Maize	**320**

(Source: Study Team)

4.2.9 Potential command areas

4.2.9.1 Water Source and Command Area Overview

The project Crop farming area covers a total of 13,033 hectares, while livestock farms cover 2,311 hectares. The main water source is projected to be the Nile River.

4.2.9.2 Overview of Crop Farms in the Command Area

The crop farms in the project area grow a variety of staple and high-value crops. Maize, soybeans, sugarcane, Hass avocado, and macadamia dominate the landscape, benefiting from the irrigation system's reliable water supply.

Table 4-4: Crop Farms

Name of Farm/Stakeholder	Enterprises	Acreage (Ha)
Soul Agric	Maize, Banana, Coffee, Pawpaw, Macadamia, Hass Avocado, Guava, Fruits, Soybeans, Apiary (bee keeping)	1,640
Afro-Kai	Hass Avocado, Macadamia, Cashew Nuts, Maize	1,220
Kazire	Medicinal (Cactus), Lemon, Pasture for Cows, Maize	392
Zamburi Farm	Coffee, Hass Avocado, Maize	130

Name of Farm/Stakeholder	Enterprises	Acreage (Ha)
Kisirizi Excellence Ltd	Grain and Tubers, Citrus/Oranges/Horticulture, Pasture, Agro-forestry, Exotic Cattle and Goats	750
CMG	Maize	81
Muhazi Heritage	Sugarcane	1,562
Norma Agric	Maize	130
Lochab	Sugarcane	4,000
Asiri	Maize	1,448
Quantum Foods	Poultry Farm (200,000 birds)	360
Kimengo Area	Maize and High Value Crops	1,000
Others Identified from Masindi and Kiryandongo DLG	Maize	320

(Source: Study Team)

Livestock Farms

Livestock farming occupies a significant part of the command area, with 2,311 hectares dedicated to raising cattle, goats, sheep, pigs, and poultry. These farms are vital to the region's economy and rely heavily on the irrigation system to meet their daily water requirements. Table 14 below summarizes the key livestock holdings.

Table 4-5: Key livestock holdings

No.	Farm	Location	Holding (Ha)
1	Nuwahereza	Myeeba	516
2	Gen. Kashaka	Kitaleba	377
3	Quantum Foods	Masindi Port	360
4	Kamugunda Eric	Nyinarwenkunyi	202
5	Gen. Birungi	Wakisanyi	121
6	Elites (Eng. Davis)	Wakisanyi	60
7	Sande Katarahiya	Kitaleba	60
8	Mbabali Zeverio	Kitaleba	60

No.	Farm	Location	Holding (Ha)
9	Nuwe	Katuugo	52
10	Ebenezar	Myeeba	48
11	Nkamuhabwe Fred	Kiryanseka	48
12	Kiiza Kensi	Wakisanyi	40
13	Hon. Kiiza Godwin	Kimyoka	40
14	Ntatunda George	Rwenkunyi	40
15	Nuwagira Godfrey	Katuugo	40
16	Bataringaya Fred	Katuugo	36
17	Save More	Wakisanyi	32
18	Mugisha Patrick	Kitaleba	32
19	JERAP (Pamela farm)	Kitaleba	28
20	Wandera Stephen	Waibango	28
21	Butale George	Nyinarwenkunyi	23
22	Mahooro Justine	Rwenkunji	23
23	Martin Matsiko	Kitukuza	20
24	Eden	Namilyango	20

(Source: Study Team)

4.2.10 Water balance and availability

The maximum water demand for "Port bulk water supply and irrigation infrastructure in Masindi District" is 375,000 m^3/day (peak monthly demand).

As described at previous paragraph, the Flow Duration Curve at the Kyoga outlet shows that the 80% dependable flow is 74.4 Mm^3/day. Taking into consideration environmental flow estimated at 20% of the dependable flow the available discharge for abstraction is 60 Mm^3/day.

The available flow largely covers the maximum water demand for Masindi Port Bulk Water Supply and Irrigation system, which is results about 0.6% of the available flow.

Based on the results of the hydraulic model, the water abstraction effect is translated in a decrease of the water level of 1 centimeter. This is considered insignificant in terms of impacts.

Downstream Masindi Port, the available data from NBI at Kyoga lake and Albert lake (https://nilebasin.org/nile-basin-flow-forecast-system) show no significant flow differences at the two stations, but a balance between the water losses, abstractions and additional contribution from the inter-catchment. Furthermore, considering that the main planned systems that might affect the river flows and dynamics between Kioga and Albert Lakes are:

- Tochi irrigation scheme supplied by Tochi river (1000 ha net area);
- Karuma hydropower plant is located 80 km downstream Masindi Port;
- Feasibility Study & Preliminary Design for the Development of Water Supply and Sanitation Infrastructure for the new Cities of Fort Portal, Hoima and Lira, which is still at initial stage.

It is concluded that the impact of abstraction on downstream users at large scale is not significant.

4.2.11 Considerations on Climate change.

The catchment's water availability trend can be referred to the Lake Victoria water level, whose seasonal and inter-annual fluctuations are mainly due to precipitation.

Figure 4-9 shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI) through the end of the century. The SPEI is an index which represents the measure of the given water deficit in a specific location, accounting for contributions of temperature-dependent evapotranspiration and providing insight into increasing or decreasing pressure on water resources – i.e., negative values for SPEI represent dry conditions. At an aggregated national level, Uganda is projected to maintain its current level of wet conditions, however, while some areas of the country will experience heightened wetness, other areas will experience significant increases in aridity.

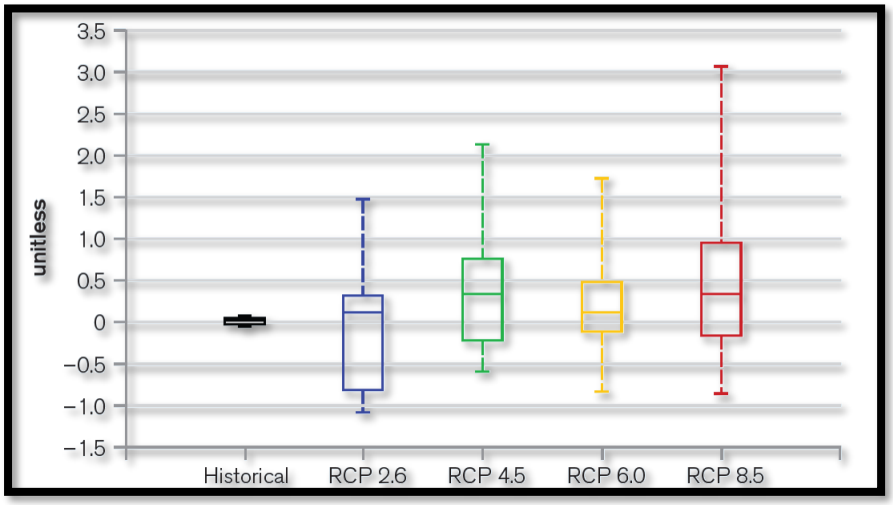


Figure 4-9. Annual SPEI drought index in Uganda for the period 1986 – 2099 (source: WB, CLIMATE RISK COUNTRY PROFILE)

With regard to the study area, the WB Climate Change Knowledge Portal provides the projected precipitation and temperature trends under various Shared Socioeconomic Pathways (SSPs) scenarios. As shown in figure 7, for the project area it is observed an increased trend in precipitation meaning that the natural water balance should not change and affect the project water abstraction.

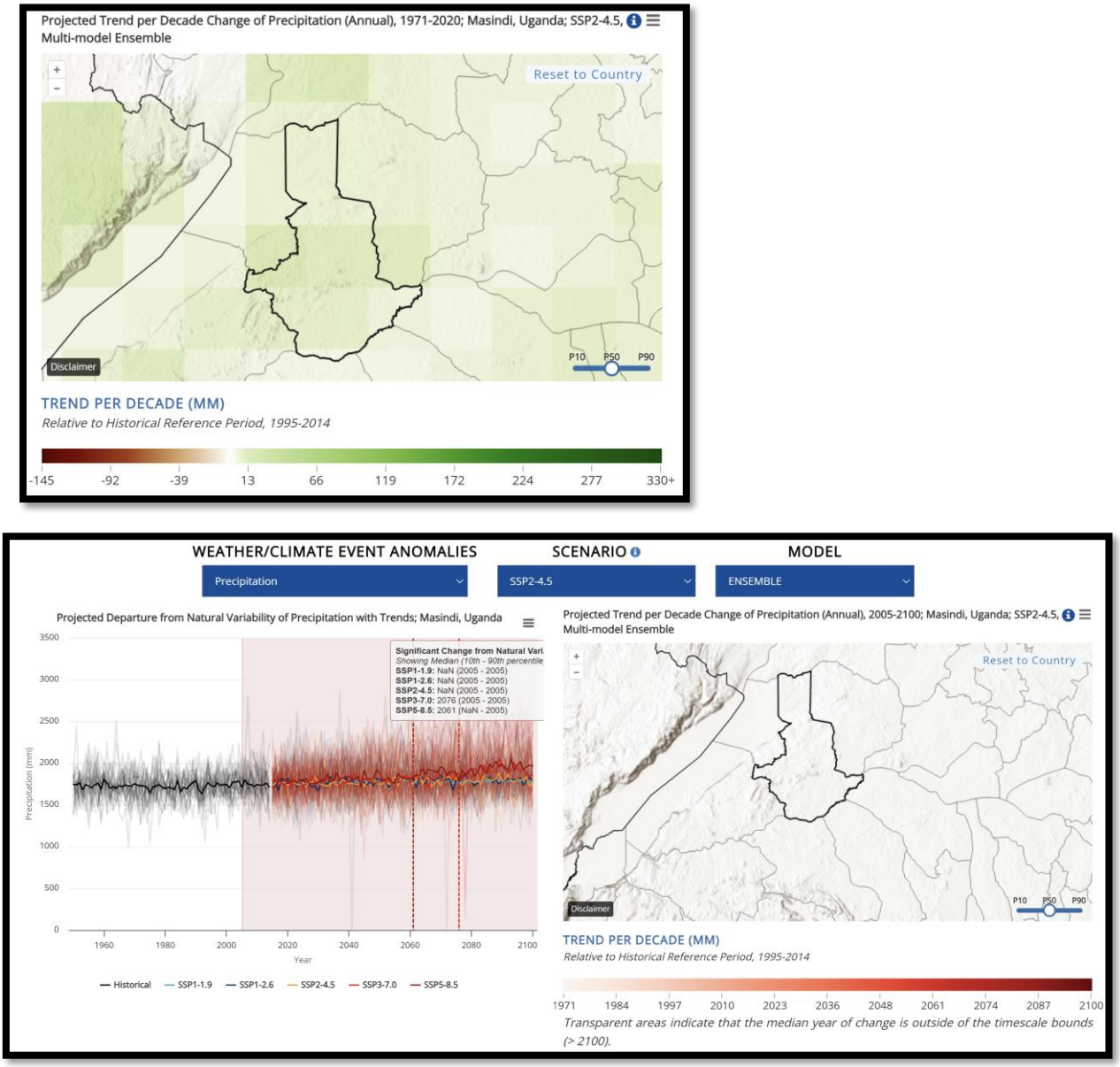


Figure 4-10: Top: projected trend per decade changes of precipitation (annual) under SSP2-4.5. bottom: precipitation trend under different SSP scenarios (Source: World Bank Climate Change Knowledge Portal)

4.2.12 Flood risk

The rainy seasons in the study area occur in March ~ May and August ~ November. Flood events at Masindi Port consists of the outflow of Lake Kyoga, River Kafu and the floods within

the interval basin from Kyoga Lake to Masindi Port. Both Lake Victoria and Lake Kyoga have an attenuation effect on the peak flood that results flattened.

The Project for Master Plan Study on Hydropower Development in the Republic of Uganda (JICA, 2011) analysed the probable flood of the Nile River at Masindi Port by taking the annual maximum discharge from the year 1896 to 2008 and fitting the maxima to the log Pearson type III probability distribution function. The probable flood of the Nile River obtained by probable distribution function results as follows:

- 100-year flood： 2,400 m3/s
- 200-year flood： 2,650 m3/s
- 1,000-year flood：3,400 m3/s.

The analysis of probable floods (100-, 200-year floods) was carried out by implementation of the hydraulic model HEC-RAS; the geometry of the model is based on the bathymetric survey carried out in January 2025. As presented in figure below, the maximum water levels don't affect the water abstraction area.

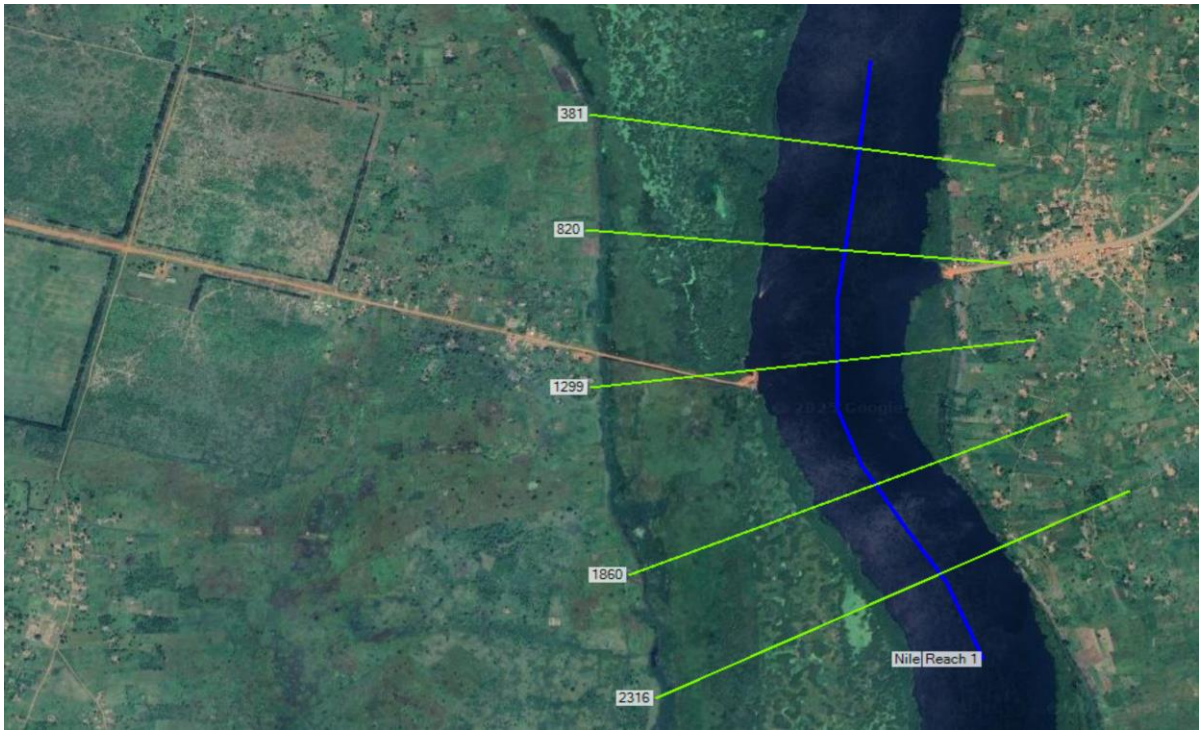


Figure 4-11: The maximum water levels don't affect the water abstraction area

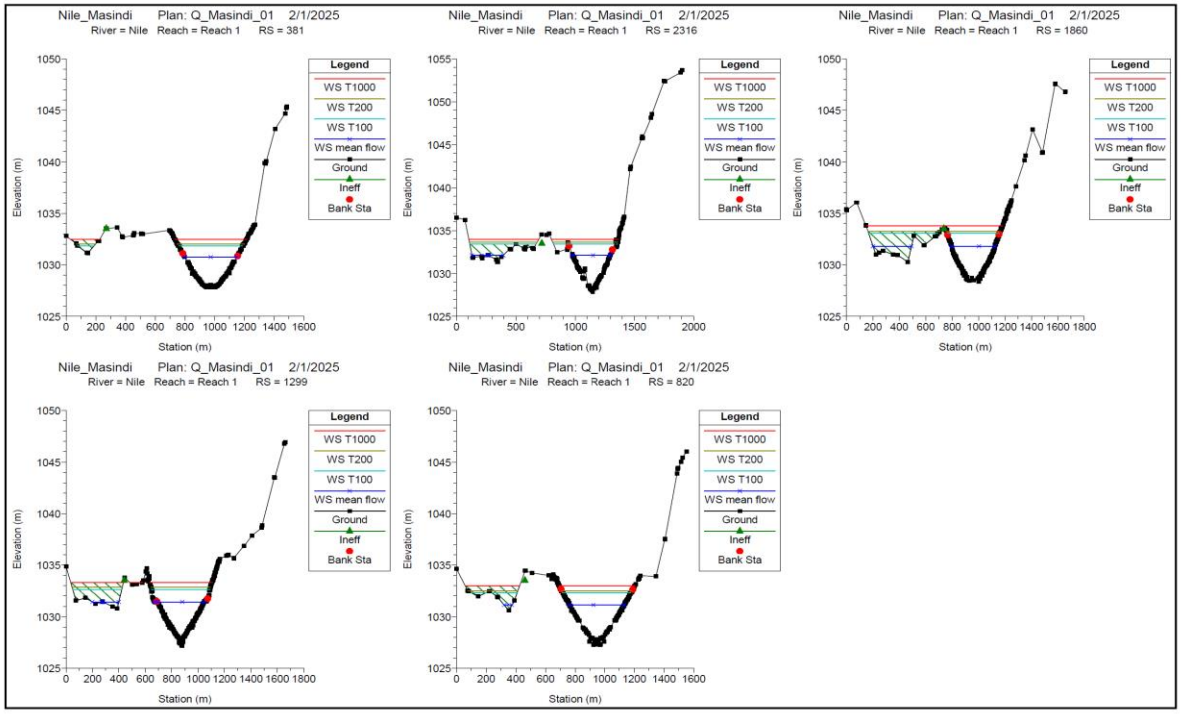


Figure 4-12. Planimetry and hydraulic results of the simulated water levels in correspondence of 5 sections of the River Nile. The water abstraction point is between sections 820 and 381.

4.3 Construction phase

4.3.1 Overview of components to be constructed

The Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project involves the phased construction of a fully integrated system to deliver reliable irrigation and domestic water supply. The infrastructure includes a wide range of components, each playing a vital role in the delivery, treatment, storage, and distribution of water.

4.3.1.1 River diversion works

The construction of the dam begins with a river diversion process to enable dry working conditions. This involves two primary steps. First, a diversion channel is excavated with sufficient capacity to carry floodwater based on a selected return period. Second, the material from this excavation is used to construct a temporary coffer dam that blocks the river's natural path and redirects its flow through the diversion channel downstream of the construction site.

4.3.1.2 Dam construction process

The dam will be constructed following a structured sequence of activities. It starts with site investigations to gather geotechnical and hydrological data necessary for the design. Engineering works then translate these findings into detailed designs for the dam body, spillway, intake, and outlet structures. Site clearing removes vegetation and topsoil from the construction area, followed by the preparation of borrow pits to provide construction materials like clay, gravel, and rock.

The dam foundation will be excavated and treated to ensure stability before embankment construction begins. The embankment will be compacted in layers, with time allowed for natural settlement. A key structural element is the cut-off trench or keyway excavated beneath the dam to prevent seepage. Vegetation will be planted on the downstream face to prevent erosion, while the upstream face will be protected from wave action using riprap or concrete lining.

An outlet pipe and intake structure will be embedded in the dam body to regulate water releases. Once all structures are complete, the dam will be gradually filled, with continuous monitoring for structural integrity. A maintenance and inspection program will be established to ensure long-term safety and functionality.

4.3.1.3 Irrigation scheme

Water for irrigation will be abstracted from the Nile River through a dedicated intake structure equipped with coarse and fine screens to remove debris and sediments. This intake is connected to a raw water pumping station housing seven horizontal split-case centrifugal pumps, each operating at 125 kW. These pumps are designed to transfer water at a flow rate of 526 L/s and a total dynamic head of 20 meters. To ensure reliability, the system will incorporate variable speed drives (VSDs), backup generators, and anti-cavitation protections.

From the intake, water will be conveyed to the Irrigation Water Treatment Plant (IWTP) via a transmission pipeline of DN 1600, PN 32, extending 1.75 km to the plant and an additional 18.1 km (including 2.1 km above ground) from the plant to the storage reservoirs. The IWTP will treat the water using a sequence of coagulation and flocculation, sedimentation, and filtration processes, making it suitable for agricultural irrigation. Sedimentation reservoirs located adjacent to the IWTP will allow heavy particles to settle before water proceeds through treatment.

Treated water will be pumped from the IWTP to four high-elevation irrigation reservoirs, each with a capacity of 24,000 m^3, resulting in a total capacity of 96,000 m^3. These reservoirs are strategically positioned to supply the irrigation network via gravity. A clear water pump station, equipped with seven large-capacity pumps (each with power ratings up to 2,115 kW), will

ensure water delivery to these reservoirs under peak demand conditions. Pumps will operate up to 24 hours daily during the irrigation season and will be supported by SCADA-integrated VSDs for energy-efficient performance and remote monitoring.

The irrigation distribution network has been designed to serve approximately 12,673 hectares of farmland through a pressurized system operating 18 hours per day. The pipeline diameters range from 200 mm to 1,600 mm, with pressure ratings from PN 10 to PN 32, optimized to maintain flow velocities between 0.6 and 3.0 m/s and pressure heads of 20–50 meters at the delivery points. The network includes pressure-reducing valves to control excess pressure at delivery points (especially in farms such as Soul Agric, Kisirizi Excellence, Afrokai, and Asili), and gate valves for isolating sections during maintenance.

To manage system air and sediment, air valves (D80) will be placed at high points, and washout valves (D250) will be installed at low points, allowing for system flushing and sediment removal. Water hammer protection is provided through two surge tanks that buffer against pressure surges caused by rapid changes in flow. Thrust blocks will be constructed at pipeline bends and junctions to resist hydraulic forces.

Complementing the irrigation infrastructure, a drainage system will be developed to collect and safely dispose of excess irrigation and stormwater, especially in low-lying or poorly draining fields. The entire network will be managed via SCADA systems, providing real-time control over flow rates, pressures, and operational status, ensuring high service reliability and reduced energy consumption.

4.3.1.4 Water supply system

4.3.1.4.1 Water intake and treatment

The domestic water supply system operates independently from the irrigation network and is designed to provide potable water to over 87,000 people by 2049. A dedicated intake structure on the Nile River will abstract raw water at a continuous rate of 56 liters per second (equivalent to 4,838.4 m³/day). The intake is connected via a 600 mm HDPE pipeline to the treatment facility and includes coarse screens (20–30 mm) and fine screens (5 mm) made from stainless steel (SS304) to remove debris and suspended solids. Two submersible slurry pumps, each rated at 3 kW and capable of delivering 10 L/s, will convey raw water from the intake reservoir to the Domestic Water Treatment Plant (DWTP).

At the DWTP, water will undergo a multi-stage treatment process to meet WHO potable water standards. Treatment steps include coagulation and flocculation to agglomerate fine particles, sedimentation in settling tanks, filtration through dual-media sand and gravel layers, activated carbon filtration to remove taste and odor compounds, and final disinfection using both chlorine dosing and ultraviolet (UV) light systems. The plant is designed for a steady

operational capacity of 56 L/s, operating 18 hours per day to meet average and peak daily demands, with provision for future scalability.

4.3.1.4.2 Storage and transmission

After treatment, potable water will be stored in a primary reservoir with a capacity of 3,100 m³, supported by an emergency reservoir of 1,000 m³. These reservoirs are constructed using reinforced concrete and include overflow drains, outlet pipes, and maintenance access features. From these storage facilities, water will be transmitted via DN 400 GI PN 32 pipelines, designed for a flow velocity of 0.8 m/s and maximum head losses of 2.01 m/km. The transmission line extends from the treatment facility to elevated tanks located at key distribution points to ensure adequate pressure across the network.

A set of multistage centrifugal pumps will be installed to lift treated water from the DWTP to the elevated tanks. Each pump will operate under a Total Dynamic Head (TDH) of 220 meters, delivering up to 26.2 L/s. The system requires pump motors in the 90–200 kW range, operating at 80–90% efficiency. Pumps and impellers will be constructed from corrosion-resistant materials such as stainless steel, cast iron, or bronze to withstand prolonged exposure to high pressure and treated water.

4.3.1.4.3 Distribution and control systems

The distribution system will serve the parishes of Kimengo, Kaduku, Waibango, Bigando, and Kiguulya, as well as growing towns including Asiri, Bisenyi, Mile 10, Kiziba, and Masindi Port. The population to be served is projected to increase from approximately 41,620 in 2024 to 87,143 by 2049. Pipes will be laid at an average trench depth of 2 meters and supported by sand bedding and backfill. They will be equipped with air valves at high points and washout chambers at low points to manage air release and sediment flushing. Pressure-reducing valves and flow meters will be installed to regulate supply and monitor consumption patterns.

A Supervisory Control and Data Acquisition (SCADA) system will be integrated into all critical infrastructure to provide real-time data on flow rates, reservoir levels, pressure, turbidity, and chlorine dosing. The control panel will include IP65-rated enclosures with protection relays, emergency shut-off, and level sensors. This system will enhance operational efficiency and enable remote monitoring and troubleshooting.

4.3.1.4.4 Operation and resilience

The domestic water supply system is designed for 24/24-hour operation, with a distribution time of 18 hours per day. It will accommodate daily and seasonal variations in demand, with contingency measures for peak flows and emergency storage. To enhance system resilience, the project includes grid-based power supply with provision for diesel-powered backup

generators at key nodes. Energy efficiency will be optimized using Variable Speed Drives (VSDs) on pumps to adjust flow rates in response to real-time demand.

A phased implementation approach will prioritize service delivery to high-need communities in the early stages while allowing for modular expansion. Maintenance protocols will be established, including scheduled inspection of pumps, valves, control panels, and pipelines. Preventive maintenance logs and SCADA alarm histories will support long-term sustainability and cost-effective operation of the water supply system.

4.3.2 Construction activities

4.3.2.1 Site Clearing, Excavations and levelling

The first stage of the construction phase is site clearing for both section of the proposed project construction and for stock piling material covered with tarpaulin to reduce material erosion. Site clearance should be only limited to areas required for construction to reduce on the impact on biodiversity.

This is followed by setting out of site for construction alignment and leveling using various survey and construction equipment and materials. This is then followed by the excavation phase that will generate a lot of cut and spoil material to be removed from the site.

4.3.2.2 Compaction works

Compaction works follow the excavations stage which involves use of machinery e.g. compactors and generators for energy supply. This stage of construction will be essential prior to constructing the foundation through creation of a stable working space. It will also be the major determining factor for the alignment of the station.

4.3.2.3 Materials Mobilization, Handling and Storage

Materials such as concrete, cement, hoop iron, sand, gravel stone aggregates, pipes and the like will basically be acquired from the nearest and suitable site giving materials and licensed traders that meet the specifications. Transportation will be by road. Provision will be made for bulk storage of materials on site.

4.3.2.4 Concrete works

Concrete columns will be erected to provide structural support and a stable foundation for key infrastructure such as pump stations, treatment plant buildings, and elevated water tanks. Additional concrete works will include the construction of slabs, drainage channels, platforms, and support bases. Wall construction will primarily use concrete blocks, complemented by cement mortar, sand, and reinforcement bars. Roofing works will involve timber trusses and iron sheets, while finishing works will use materials such as glass panes and metal fixtures. Most of these materials are expected to be sourced from the local and regional markets.

The table below presents the main construction materials expected to be used on-site. The exact quantities of material to be used will be specified in the detailed Bills of Quantities (BoQ).

Table 4-6: Major construction materials and proposed sources

Material Type	Indicative Volume (Est.)	Proposed Source Location	Source Type and ESIA Consideration
Marram (for backfilling, access roads, and sub-base layers)	To be confirmed in BoQ	Kimengo area (local borrow pit)	To be extracted from acquired site subject to ESIA approval
Rock Fill and Aggregates	To be confirmed in BoQ	Kiryandongo Stone Quarry	Private supplier – NEMA certified
Sand (for concrete and plastering)	To be confirmed in BoQ	Masindi Riverbeds or nearby licensed sites	Private supplier – NEMA certified
Clay (for specific applications, e.g., lining or block making)	To be confirmed in BoQ	Identified nearby farm plots	On-site or nearby extraction – ESIA required if thresholds are exceeded

4.3.2.4.1 Material Sourcing and Environmental Compliance

All materials for concrete works will be sourced in compliance with national environmental regulations. Marram and clay will likely be sourced from locally acquired borrow pits that will require a separate site-specific ESIA will be conducted in line with the requirements of the National Environment Act, Cap 181 and the National Environmental and Social Assessment) Regulations, 2020.

Sand, aggregates, and rock fill will be procured from licensed private suppliers with valid NEMA clearances. Preference will be given to nearby certified quarries and sand suppliers to minimize transportation impacts and stimulate local economic participation.

The contractor shall be required to submit documentation confirming the legal and environmental compliance of all material sources prior to mobilization. Additionally, all borrow pits will be rehabilitated post-use to prevent erosion, ponding, or other adverse environmental effects..

4.3.2.5 Mechanical Works

i. **Water source station**

The water source stations will comprise of pumps and power source most like solar, pipe line, including guard house and sanitary facilities. All exposed pipe work leading into; within and out of the pump house shall be galvanized iron pipe. Fittings to be provided include non-return valve, gate valves, meter and pressure gauges. The whole installation shall be earthed and provided with lightning protection.

ii. **Installation of storage reservoir tank**

This will involve excavations for the tank foundation footings, building of footprints, transporting of the tank parts / components and installation of the reservoir tank.

iii. **Installation of transmission and distribution water lines**

This will involve excavation of shallow trenches in the identified areas that is through bush lands, gardens (with consent from owners) road reserve along some of the roads in the area to route the water transmission and distribution lines, installation of the water transmission and distribution lines and backfilling of trenches. Being generally rural, there may not be existing underground service lines for water, electricity, optic fibre, and the like likely to be affected in the project area.

4.3.3 Civil works

This will involve ferrying, to the water source location site, materials (cement, bricks, sand and roofing materials), foundation excavations and building works, chain link fencing and power generator/solar installations. On the station will be a chlorination room connected to the reservoir tank. The chlorination room will be a concrete floor, rendered block work structure. The water will be disinfected by dosing with calcium hypochlorite solution.

4.3.4 Electrical services

The station will be connected to Hydro power which will be supplemented by solar power.

4.4 Operation and Maintenance of the Proposed Water Supply System

The proposed bulk water supply system will require full time technicians to manage the scheme on a daily basis to be able to ensure the system is running well, clean tanks when necessary, repair any breakages as they happen, ensure security for the installed infrastructure. A designated team of technicians will co-ordinate the operation and management of water supply systems. It is anticipated that the client and partners will handle O&M costs.

4.4.1 Periodic Upgrading/Maintenance of the Energy Supply

One of the areas that are likely to cause great injury to the environment if not addressed well is the sanitation and energy system at the station. Major activities to this effect will be geared towards periodic upgrading of the energy systems to avert any would be fire occurrence from electric short circuits. The reservoir tank will be periodically maintained. Rain water from the roofs (of infrastructure on site) will also be harvested and used for sanitary purposes on site.

4.4.2 Emergency/safety support systems

The project operator will ensure periodic monitoring of the safety support systems. The structure will be fitted with fire extinguishers and fire alarms for emergency firefighting. These will periodically be upgraded to maintain their functionality. A functional first aid kit and Emergency contacts should be put in place to cater for any emergency cases at the site.

4.4.3 Solid and liquid waste management

Housekeeping will be key in promoting tidiness, preventing disease outbreak, accidents and environmental pollution during operation/occupancy of the facilities. Effective collection, storage and disposal of all wastes will be given priority and periodically undertaken. Maintenance and periodic cleaning of the toilet and bathroom will be undertaken to ensure a hygienic environment. Proper maintenance of the physical structures will also be among the regular activities that will be carried out during the operation phase to ensure a tidy operating environment.

4.4.4 Security, Health and Safety provisions

During the operation phase, there will be health and safety as well as security concerns which will need attention. These will include noise, dust, disease and accidents as well as communicable diseases. Security of the site and premises, security of workers and security of equipment. Stringent measures such as engineering controls, training of personnel, provision of appropriate and adequate PPE like nose masks, ear muffs, gloves and safety clothes, installation of safety signage among others should be put in place.

The community will be safe guarded by fencing off the site, installation of safety signage and through conducting of sensitization programmes.

4.5 Decommissioning and Rehabilitation

Decommissioning and rehabilitation activities will focus on the removal of temporary construction-related structures and facilities that are not part of the permanent MWACRID project, and on the restoration of the construction footprint in compliance with environmental regulations and landowner expectations. At the end of the construction phase, all temporary facilities established to support project implementation will be dismantled and removed from the site. These include: contractor’s workers’ camps; workshops and fabrication yards; site offices and temporary storage areas; mobile sanitary facilities; temporary access roads (if not integrated into access routes) and waste management and fuel storage facilities.

All construction debris, unused materials, and waste (including scrap metal, plastics, and timber) will be collected, sorted, and disposed of in accordance with NEMA-approved waste handling procedures. Non-hazardous waste will be taken to licensed disposal sites, while any hazardous waste, if generated, will be handled by registered hazardous waste handlers. Waste tracking documentation will be maintained for accountability.

Structures that form part of the operational MWACRID project and the water supply system will remain intact and functional. These permanent structures are critical for the long-term function of the irrigation and water supply system.

Once decommissioning of temporary facilities is complete, affected areas will be rehabilitated to restore ecological stability and allow for continued agricultural use or natural regeneration, depending on the landowner's preferences. Rehabilitation measures will include regrading, backfilling borrow pits, and replanting with native vegetation and grasses such as elephant

grass to stabilize soils and prevent erosion. In areas where trees were cleared, environmentally suitable tree species will be replanted to support biodiversity and landscape recovery.

All decommissioning and rehabilitation activities will be guided by a NEMA-approved Decommissioning Plan, and will include stakeholder engagement, especially with local landowners and authorities, to ensure the process meets social and environmental expectations.

5 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL ECONOMIC BASELINE

5.1 Project Location

The project area spans both Masindi and Kiryandongo Districts in Uganda. Masindi District, located in the mid-western region, covers approximately 4,200 square kilometers and is bordered by Kiryandongo to the east, Nwoya to the north, and several other districts. Kiryandongo District, also in western Uganda, covers around 3,600 square kilometers and shares borders with Nwoya, Masindi, and other neighboring districts. Masindi Port, the project's proposed water source catchment area, lies along the western banks of the Nile River, about 194 km northwest of Kampala and 49 km from Masindi town. Known for attracting tourists for various leisure, religious, and business purposes, Masindi Port is strategically located near the Nile River, which serves as the primary water source for the project. Its coordinates are 1°41'54.0" N, 32°04'40.0" E.

5.2 Physical Environment

5.2.1 Climate

Both Masindi and Kiryandongo districts experience a tropical climate, with two main rainfall seasons (March-May and September-November). The mean annual rainfall ranges between 1,200 mm and 1,500 mm. The area experiences high evaporation rates during the dry season (December-February).

In Kiryandongo District, which has a bimodal rainfall pattern, the long-term average annual rainfall is about 1,200 mm, with peaks from March to May and August to November. The district enjoys fertile soils, making it favorable for agriculture. However, it is divided into three climatic zones:

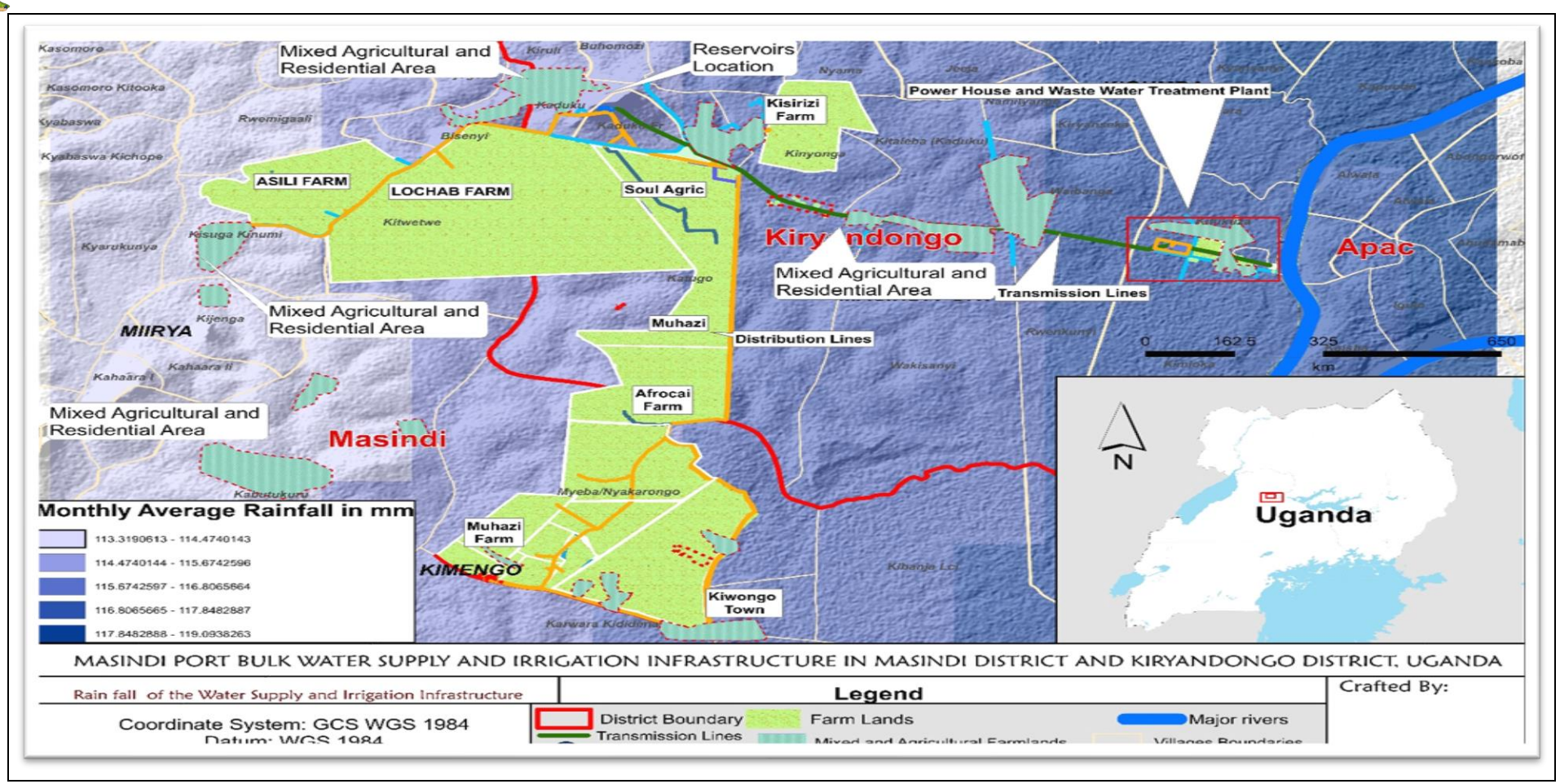
- **Medium rainfall zones** (800-1000 mm annually), such as Kigumba Sub County.
- **Low rainfall zones** (less than 800 mm annually), such as Masindi Port Sub County.

In Masindi District, climatic zones also vary:

- **High rainfall zones** (more than 1000 mm), such as Budongo and Pakanyi Sub Counties.
- **Medium rainfall zones** (800-1000 mm), like Bigando and Isimba Parishes in Miirya Sub County.
- **Low rainfall zones** (less than 800 mm), such as Kimengo Sub County.

All four sub-counties within the project area (Kigumba, Miirya, Masindi Port, and Kimengo) fall under medium or low rainfall zones, where agricultural production can be limited by insufficient and unreliable rainfall. In these medium and low rainfall zones, agricultural productivity is highly dependent on rainfall, which is often unpredictable. The Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation

(MWACRID) Project will provide a reliable water source from the Nile River to support irrigation, ensuring stable agricultural output in both districts. By supplying water to these drier areas, the project will enhance food security, promote agricultural development, and enable farmers to cultivate high-value crops throughout the year, even in periods of drought or inadequate rainfall.



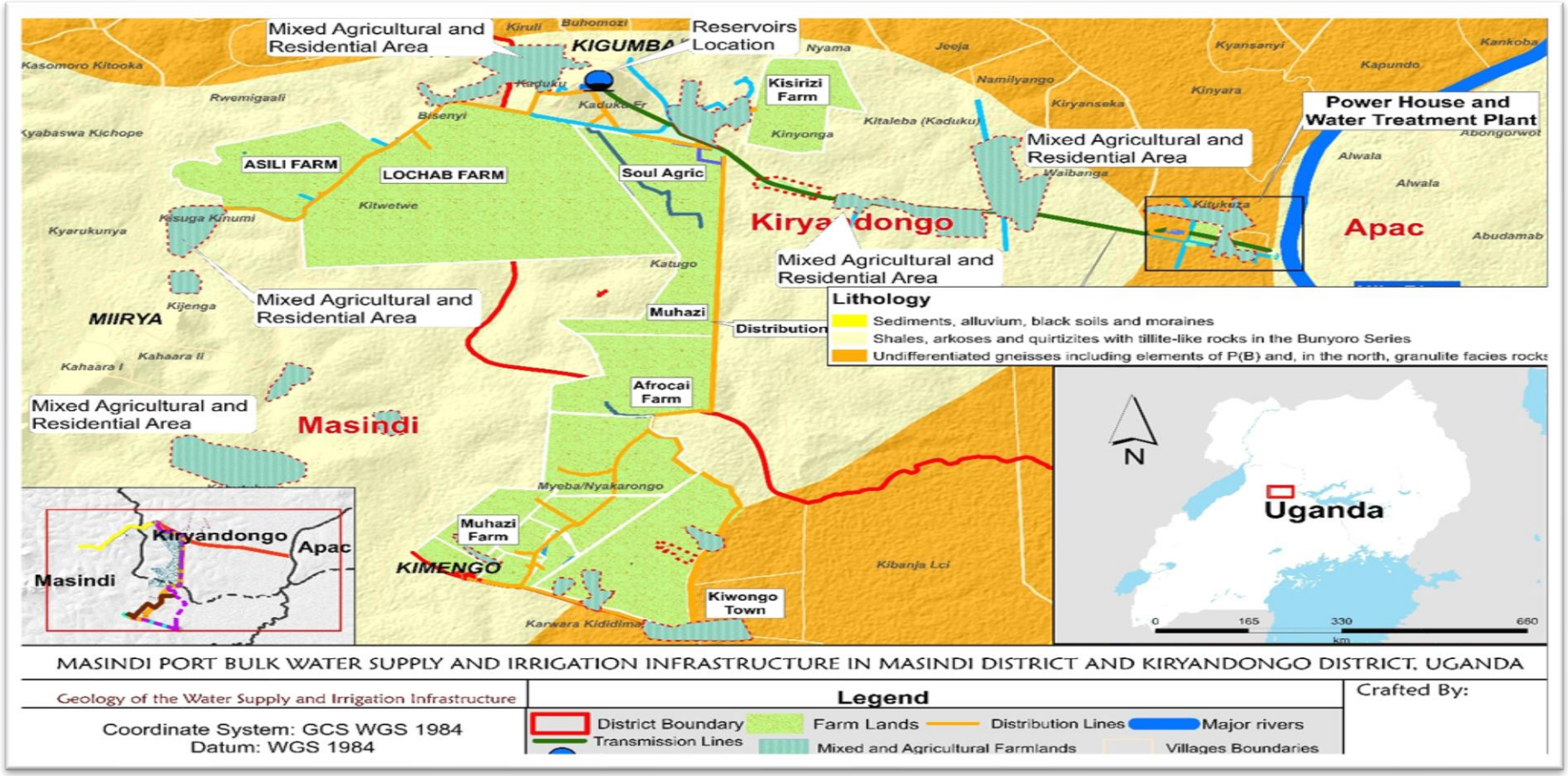
(Source: Study Team)

Figure 5-1: Rainfall distribution in the project area

5.2.2 Geology

In Masindi District, the plateau land with an altitude of 1,295 meters above sea level is a defining feature of the region. The geology is dominated by Precambrian rocks, mainly granite and gneiss, with quartzite and sandstones along the valleys. The undulating hills and high points like Kigulya, Fumbya, and Kaduku are prominent features that contribute to the topography of the area. The district also exhibits characteristics associated with Rift Valley formation, with sudden slopes and flat areas of the Murchison Falls conservation area to the west. Kiryandongo district has predominantly sedimentary and metamorphic rocks, such as quartzite and schist, which influence soil formation.

Overall, the geology of the project area in Masindi and Kiryandongo Districts shapes the landscape, soil composition, and water resources that contribute to the economic activities and growth potential of the region.



(Source: Study Team)

Figure 5-2: The geology of the project area

Masindi Port Site

The geology of Gulu banded tonalite-trondhjemite-granodiorite (TTG) gneiss is dominated by alluvium, swamp, lacustrine deposits, felsic granulite and, well granodiorite gneiss, banded iron formation and; a Paleoproterozoic metamorphic plutonic rock complex characterised by variable granitic gneisses, which underlies the residual soils. The proposed treatment site is almost surrounded by alluvium swamp deposits.

Kaduku Hill

The geology of the proposed Kaduku water reservoir site is underlain by an isolated phyllite formation. This formation is made up of mudstone, shale, and slates, which are sedimentary rocks. These rocks are generally fine-grained and are subject to weathering, often forming residual soils at the surface. The formation typically has a relatively shallow thickness, and its weathered nature may vary across the site.

The phyllite formation is also prone to foliation, which could impact the stability of excavations and construction. The underlying mudstone, shale, and slates are softer compared to the hard quartzite and granodiorite gneiss, making this site more suitable for certain types of infrastructure.

Transmission Mains Route

The transmission main traverses several different Proterozoic geological formations:(i) Masindi Port to Kaduku hill;

- Alluvium, swamp, lacustrine deposits.
- Alluvium,sand,silt,gravel
- Alvela granodionte gneiss (2649± ma)
- Banded iron formation
- Felsic granulite (2991 ±9 ma)
- Granite gneiss
- Gulu banded TTG gneiss (265 ±8 ma)
- Hornblende granite and granoorite

  Kyanite-quartz schist

  Laterite
- Mafic granulite
- Matagaborn
- Mica schist

- Mudstone, shale ,slate,phylite
- Porphyribic granite gneiss
- Quartz-field spar gneiss
- Quartzite
- Sand, silt, grilty, Sand stone.

5.2.3 Soils

The soils in Masindi and Kiryandongo Districts, consisting predominantly of sandy loam and clay loam, are highly suitable for the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project. These soil types, found in subcounties of Miirya, Kimengo, Budongo, and Masindi Port Sub-County, are conducive for agriculture, which is a significant economic driver in the region. The presence of sandy loam soils in Kigumba and sandy soils in Masindi Port Sub-County support the cultivation of crops like maize, cassava, sunflower, cotton, and tobacco, contributing to improved household incomes.

The availability of these fertile soils, combined with access to a reliable water source from the Nile River, enhances the feasibility of the project. The diverse soil types will facilitate various forms of agriculture under irrigation, ensuring that even areas with lower rainfall, such as Masindi Port, can produce high-value crops year-round. This strategic combination of soil suitability and water access will drive agricultural productivity, economic growth, and sustainable development in the project area.









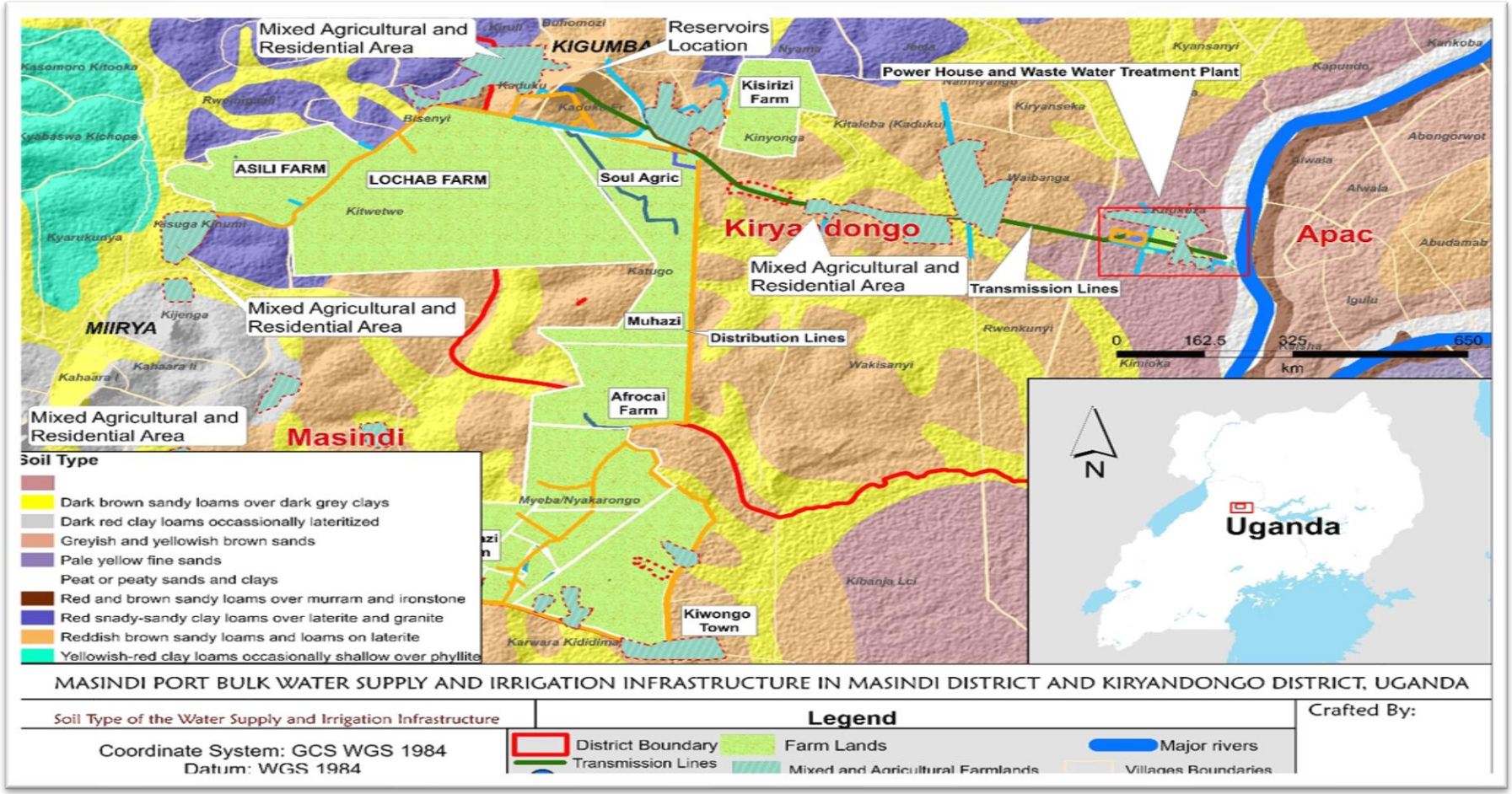
Soils encountered in the MWACRID Project area

The table 5-1 summarizes characteristics of soils encountered in the MWACRID project area, focusing on soil types, bearing capacity, California Bearing Ratio (CBR), moisture content, pH, sulphate content, and recommended foundation types. Soils identified include stiff clay, firm clay, and dense clayey gravel, with depths primarily at 1.5 meters, except for a deeper firm clay layer at 7.5 meters. Stiff clay generally exhibits moderate allowable bearing capacities ranging from 158 to 205 kPa, CBR values between 16–20%, and slightly acidic pH around 5, supporting the use of shallow footings or slab foundations. Firm clay at 7.5 meters shows the highest strength, with a bearing capacity of 475 kPa and a CBR of 48%, indicating suitability for either shallow or piled foundations at depth. Dense clayey gravel layers display varying strength, with bearing capacities ranging from 32 to 205 kPa and CBR values from 3% to 20%, supporting mostly shallow footings, although the lowest strength values may require careful consideration or reinforcement. Moisture content is consistent across samples (~24.4%), and sulphate levels are low (1.02–1.25%), posing minimal risk to concrete durability. Overall, the subsoils are generally suitable for shallow foundations, with site-specific adaptations based on bearing capacity.

Table 5-1: Characteristics of soils encountered in the MWACRID project area

Depth (m)	Soil Type	Allowable Bearing Capacity (kPa)	CBR (%)	Moisture Content (%)	pH	Sulphates (SO4)	Recommended Foundation Type
1.5	Stiff Clay	158	16	24.4	5	1.25	Shallow footing, slab foundations
7.5	Firm Clay	475	48	24.4	5	1.25	Shallow foundation or piled foundation for deeper depths
1.5	Stiff Clay	173	17	23.6	5.1	1.02	Shallow footing
1.5	Stiff Clay	158	16	24.4	5	1.25	Shallow footing
1.5	Stiff Clay	205	20	24.4	5	1.25	Shallow footing
1.5	Dense Clayey Gravel	205	20	24.4	5	1.25	Shallow footing or compacted gravel base for footing

Depth (m)	Soil Type	Allowable Bearing Capacity (kPa)	CBR (%)	Moisture Content (%)	pH	Sulphates (SO4)	Recommended Foundation Type
1.5	Dense Clayey Gravel	102	10	24.4	5	1.25	Shallow footing
1.5	Dense Clayey Gravel	118	12	24.4	5	1.25	Shallow footing
1.5	Dense Clayey Gravel	126	13	24.4	5	1.25	Shallow footing
1.5	Dense Clayey Gravel	142	14	24.4	5	1.25	Shallow footing
1.5	Dense Clayey Gravel	102	10	24.4	5	1.25	Shallow footing
1.5	Dense Clayey Gravel	95	9	24.4	5	1.25	Shallow footing
1.5	Dense Clayey Gravel	32	3	24.4	5	1.25	Shallow footing

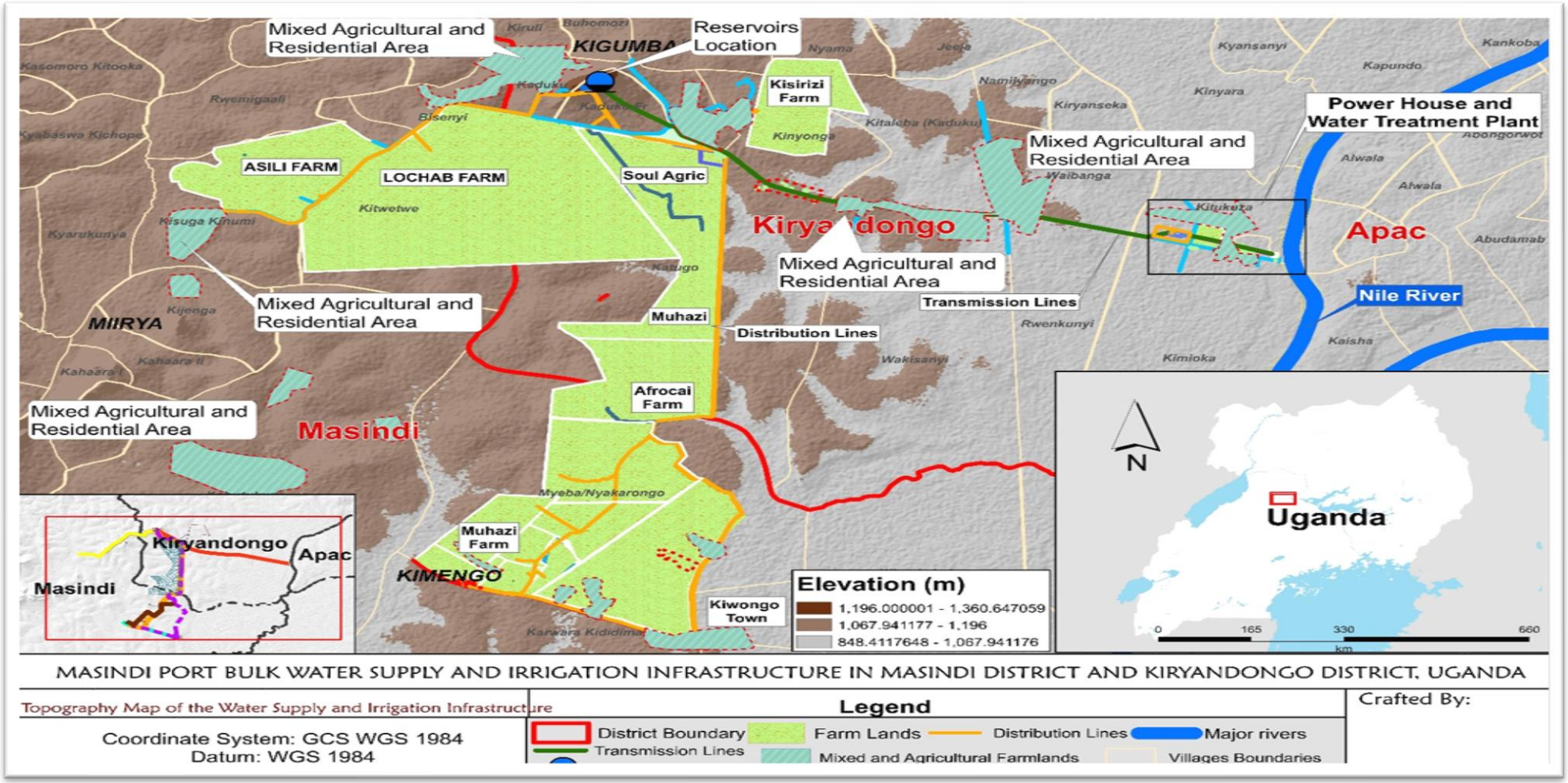


(Source: Study Team)

Figure 5-3: Map showing the nature of soils in the project are

5.2.4 Topography

Masindi District is located on a plateau, the topography is generally undulating, with altitudes ranging between 1,100 and 1,450 meters above sea level. The western part has rolling hills and valleys, while the area near the Nile River has flatter landscapes. Similar to Masindi, Kiryandongo's topography is characterized by gently rolling plains and highlands. The slopes become steeper near the Nile River in areas such as Masindi Port. Undulating hills with some pronounced high points are located in some localities in the District. One of these high points is Kaduku in Kigumba Sub County. The topography provides favorable conditions for water transfer and irrigation infrastructure development. The gentle slopes make it feasible for gravity-fed systems, reducing the need for extensive pumping infrastructure. However, the steeper areas near the Nile may require additional engineering measures for stabilization and proper water transfer systems.



(Source: Study Team)

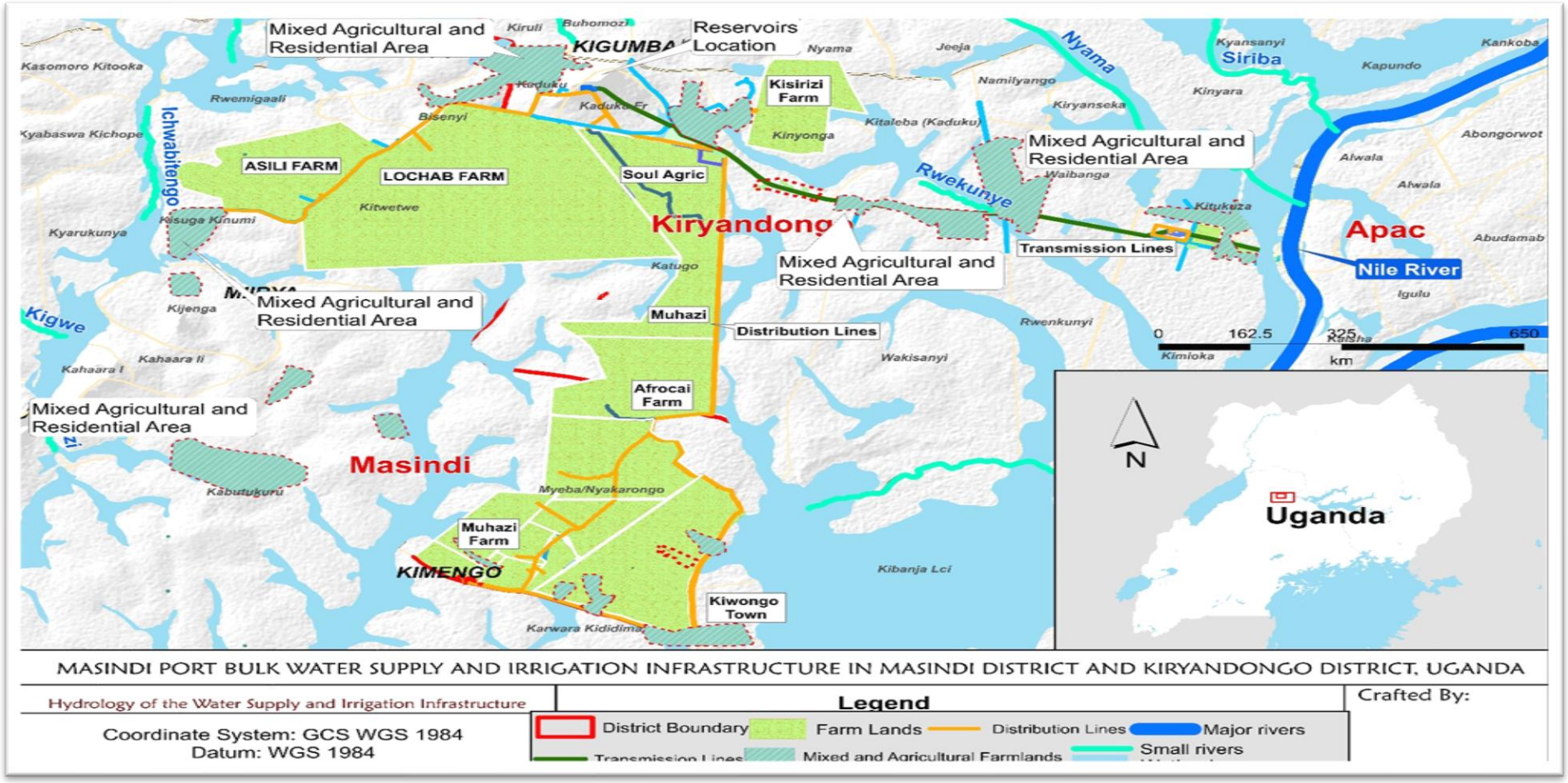
Figure 5-4: Map showing the topography of the project area

5.2.5 Water resources and Hydrology

The Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project is essential in addressing the water resource challenges in Masindi and Kiryandongo Districts, particularly in areas prone to water scarcity during the dry season. While both districts are rich in water resources, including rivers, small lakes, wetlands, and springs, the availability of surface water is inconsistent, especially in regions like Masindi Port and parts of Mutunda Sub-County, which suffer from severe water shortages during dry periods.

The project area is home to several rivers and wetlands, such as the Nile, Kafu, Waki, and Waiga Rivers, along with Lakes Kiyanja and Maiha. Masindi District, which lies in the Lake Kyoga basin and the River Kafu catchment, has numerous tributaries draining into the Kafu River. However, many areas along these rivers and wetlands are poorly drained and flood-prone, and human activities like farming, brickmaking, and waste disposal have led to the degradation and pollution of these water bodies.

In Kiryandongo District, the Victoria Nile is a significant water source, but parts of the district still experience seasonal water shortages. The Nile River, as the proposed abstraction point for the Masindi Port Bulk Water Transfer project, offers a reliable and abundant water source that can be harnessed to mitigate these shortages and ensure a consistent water supply for production and irrigation.



(Source: Study Team)

Figure 5-5: Hydrology of the project area



Figure 5-6: The Nile River Intake



Figure 5-7: Kiyanja wetland in Miirya Subcounty



Figure 5-8: Seasonally flooded grassland in Wakisanyi Village

5.2.5.1 Drainage patterns and watershed boundaries

The project area is characterised by an undulating morphology, with the presence of wetlands in the lower parts. No criticalities are expected in terms of drainage with regard to the main works (plants, adduction and distribution network). The various farms will have to distribute water for irrigation and create an internal drainage system in order to manage water during both the irrigation and rainy seasons.

The following figure shows the subcatchments' delineation and the main runoff directions based on morphology.

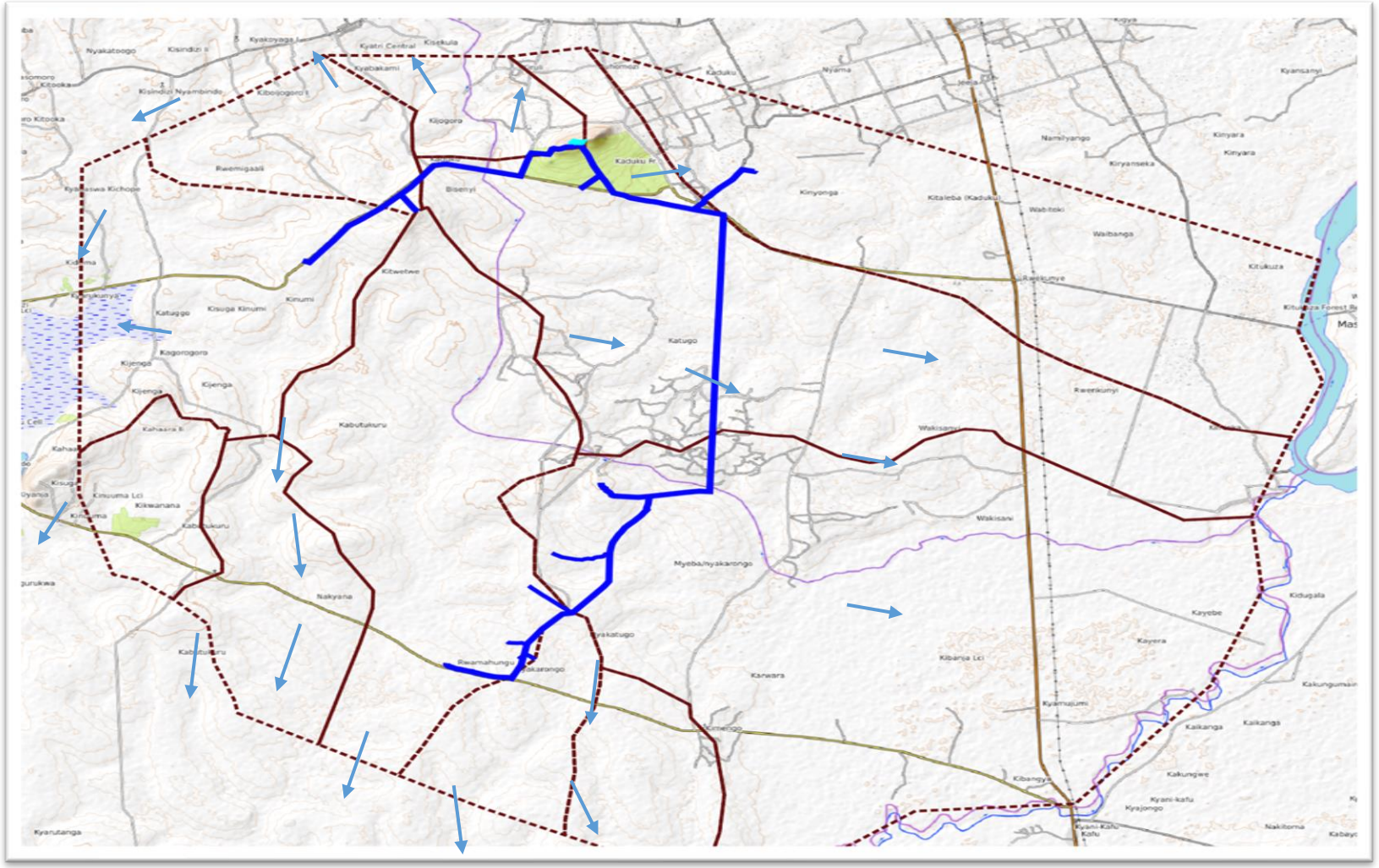


Figure 5-9: Subcatchments' delineation (brown lines) and the main runoff directions (blue arrows) based on morphology

5.2.5.2 Flow rates and seasonal variations of the Nile at Masindi Port

The abstraction point of the water supply project is located along the Kyoga Nile in Masindi Port, 18 km downstream the outlet of Lake Kyoga (Kimyoga Village, Waibanga Parish, Masindi Port Sub County, Kibanda County, Kiryandongo District). The distribution of main rivers in Uganda is shown in figure 19.

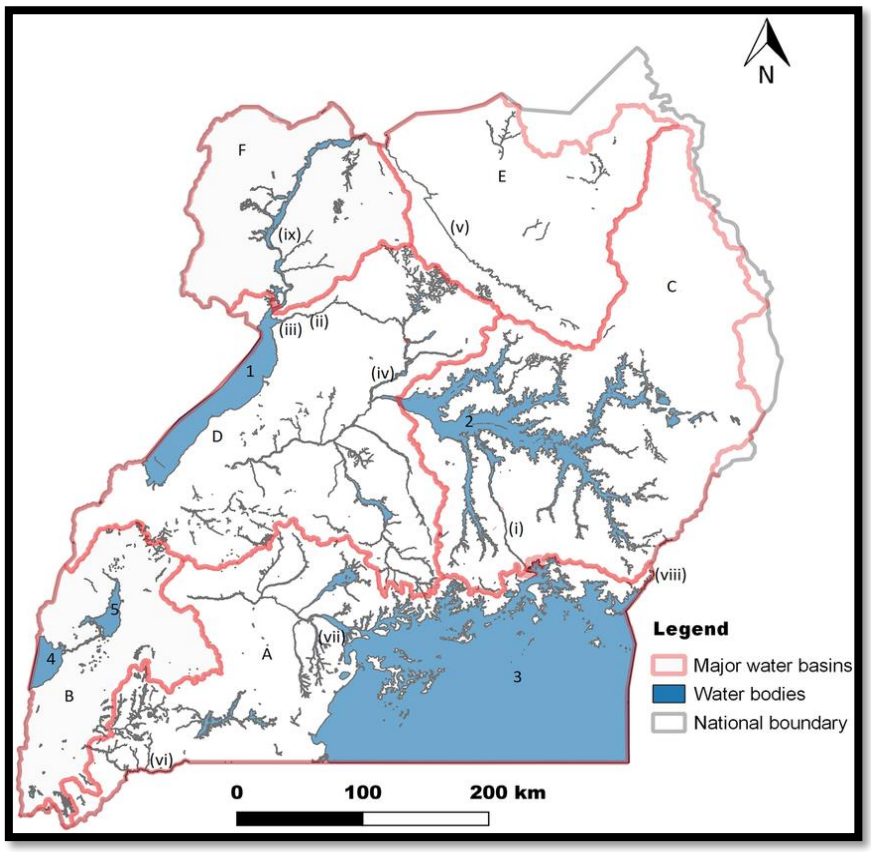


Figure 5-10: Location of major drainage basins in Uganda, & major lakes and rivers

Letters denote major basins: (A) Victoria, (B) Edward, (C) Kyoga, (D) Albert, (E) Aswa River, (F) Albert Nile. Numbers denote major lakes: (1) Albert, (2) Kyoga, (3) Victoria, (4) Edward, (5) George. Roman numerals denote major rivers: (i) Upper Victoria Nile, (ii) Murchison Nile, (iii) Murchison Nile Delta, (iv) Lower Victoria Nile, (v) Aswa, (vi) Kagera, (vii) Katonga, (viii) Sio, (ix) Albert Nile

The Nile has two major tributaries: the White Nile and the Blue Nile. The White Nile originates from the Kagera River, which drains the mountains of Burundi and Rwanda. It flows into Lake Victoria and then exits through a single channel heading north towards Lake Kyoga. The outflow from Lake Victoria was controlled naturally by the geometry of the Ripon Falls. The Victoria Nile reaches Lake Kyoga and then continues westward as the Kyoga Nile. The distance between the entrance where Victoria Nile flows into Kyoga Lake and the outlet (Lwampanga Lake) where Kyoga Nile River leaves Lake Kyoga is about 80km.

Kyoga Lake is a large-size shallow lake (surface 1720km^2, mean annual water depth of 3m~4m and max. water depth of 5.7m) and is located at about 120km downstream Jinja in the centre

of Uganda. In addition to Victoria Nile, the water of the lake is also from Okot River, which originates from Elgon Mountain at the boundary between Uganda and Kenya. Lake Kyoga system includes Kyoga Lake (lake area about 1720km^2), Lake Kwania (lake area about 780km^2), Lake Basina (lake area about 130km^2) and other 30 small lakes.

The Nile River runs westwards for 25km before reaching Masindi Port. 5km upstream Masindi Port, Kyoga Nile receives the water of River Kafu whose basin has an area of about 13000km^2, and during the flood period, it increases the flow of Kyoga Nile. Kyoga Nile reaches Karuma Fall before flowing into Lake Albert. From Lake Albert, the river becomes the Albert Nile or Bahr el Jebel, which eventually becomes the White Nile.

The hydrology of the Nile is mainly characterized and influenced by climate variations and catchment morphology. The catchment area at Masindi Port is 338 300km^2. The discharge of the Nile River at Masindi Port is highly dependent on the inflow patterns at Lake Kyoga, where the outflow indicates that the lake has minimal effect on inflow from the Victoria Nile (i.e., the major patterns are maintained both in the inflow and outflow).

The runoff of Kyoga Nile and Victoria Nile River Basin is mainly formed by precipitation, and the basin is abundant in annual rainfall. Within the basin range, the mean annual rainfall is 900mm~2000mm. Each year may be divided into two rainy seasons and two dry seasons. The rainy seasons are from March to May and August to November, and the dry seasons are from December to February and from June to July.

The quantity of water released from Lake Victoria through the Nalubale/Kiira power plants is constrained by an international treaty which stipulates that the outflow should simulate the natural flow of the Victoria Nile, based on a ten-day average flow, as a function of lake level (the so-called “agreed curve”). Over time, hydrological changes in the upstream catchments due to different factors, such as poor rains or excessive releases of water at Owen Falls, have been absorbed by Lake Victoria and the other lakes and swamps that have functioned as a buffer, so that the hydrological changes upstream the lakes have less impact downstream.

Since the available measures present some gaps, other sources, including literature, recent studies, satellite data, have been consulted to fill the gaps. Some sources of interest are represented by GLOFLAS (Copernicus) and the Nile Basin Initiative website (https://nilebasin.org/nile-basin-flow-forecast-system) that provide also forecast flows and the seasonal trend. As outlined below, from the analysis of various documents, it is confirmed that the river flow measures' gaps are not significantly impacting the estimates of water balance (availability versus demand) for the project, given the magnitude of the river flows compared to the abstractions.

The Nile Basin Water resources Atlas (2016) provides flow data at Masindi Port (Kyoga Outlet). As shown in the following figures:

- The mean annual flow is around 1100 m^3/s;

- The outflow from lake Kyoga seems to indicate that the lake has minimal effect on inflow from the Victoria Nile, since the major patterns are maintained both in the inflow and outflow;
- The annual inflow and outflow are similar with a small increment of 0.98 BCM which could be due to the contributing catchments of Lake Kyoga;
- The monthly runoff distribution in Masindi Port on Kyoga Nile River is affected by storage effects of Lake Victoria and Lake Kyoga, with a very small ratio of high flow to low flow within a year: given the morphology of the catchment and the presence of the lakes, the minimal seasonal flow variations don't affect water the availability for the project;
- The Flow Duration Curve at the Kyoga outlet shows that the 80% dependable flow is 2.25BCM/month that translates to 868.1 m^3/s. Taking into consideration environmental flow estimated at 20% of the dependable flow the available discharge for abstraction is 694.5 m^3/s.

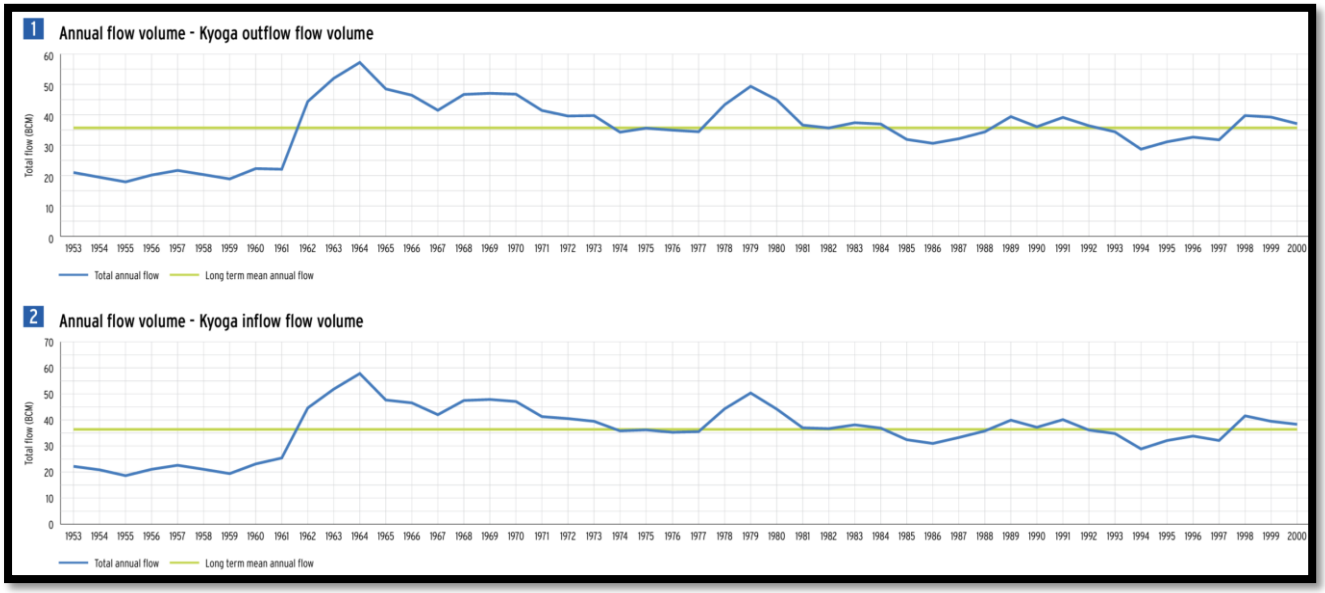


Figure 5-11. Annual Flow Volume at Kyoga outlet (Source: Nile Basin Water resources Atlas, 2016)

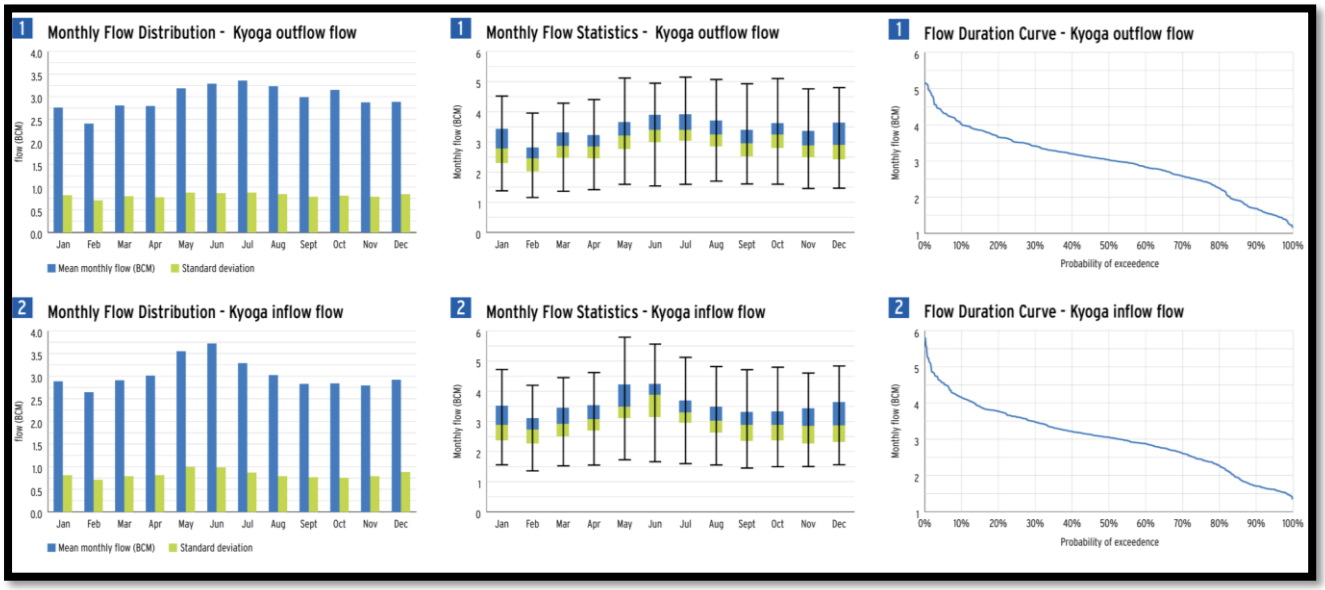


Figure 5-12. Monthly Flow Distribution, statistics and flow duration curve at Kyoga outlet and inlet (Source: Nile Basin Water resources Atlas, 2016)

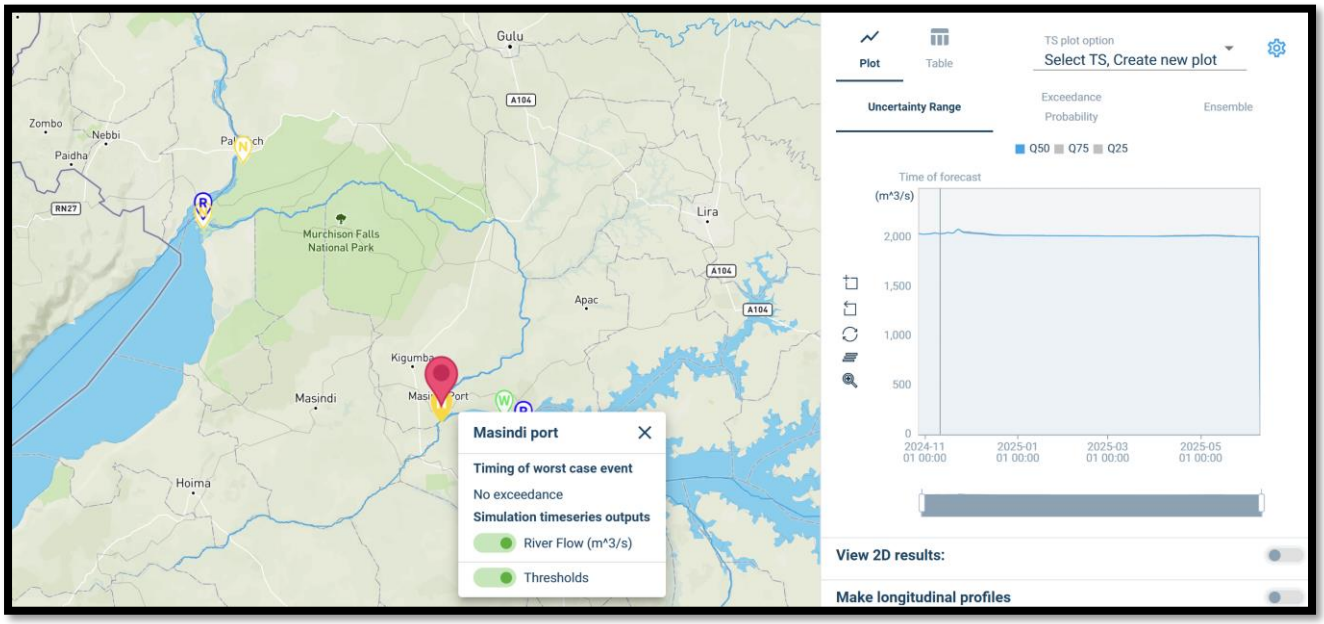


Figure 5-13.Seasonal trend at Masindi Port
(Source: https://nilebasin.org/nile-basin-flow-forecast-system)

5.2.5.3 Water Quality

Water samples were collected from the Nile River at Masindi Port to assess quality for domestic and irrigation use. Parameters such as pH, electrical conductivity, turbidity, dissolved oxygen, nitrate, phosphate were analyzed in accordance with WHO and Uganda National Water Quality Standards. The results appended in appendix D will serve as a baseline for ongoing monitoring of water safety and suitability.

The baseline water quality results from the Nile River at Masindi Port indicate that the water is generally suitable for irrigation purposes, with acceptable levels of electrical conductivity (272–280 µS/cm), total dissolved solids (136–140 mg/l), and total hardness (82–84 mg/l), all of which are within safe limits for most crops. Nutrients such as nitrates, phosphates, and potassium are also present in moderate quantities, which may benefit plant growth without posing a salinity or nutrient imbalance risk. For domestic (potable) use, the water appears microbiologically safe, as fecal coliforms, E. coli, and other pathogenic indicators are absent, and the pH (7.0–7.2) and dissolved oxygen levels (6.6–6.9 mg/l) are within WHO guideline values. However, turbidity (35–41 NTU) exceeds the WHO recommended limit of 5 NTU for drinking water, which could affect aesthetics and signal the presence of suspended matter that may harbor pathogens. Additionally, the presence of total organic carbon (0.6–0.9 mg/l) and biochemical oxygen demand (4–5 mg/l) suggests the need for treatment prior to domestic use to ensure full compliance with drinking water standards. Overall, while the baseline results support both irrigation and domestic water use, treatment—especially filtration and disinfection—is essential before human consumption.

5.2.6 Noise Levels

The project area where the project components are located is categorized as a mixed commercial and residential area and it was noted that the average noise levels at the project site were within the maximum permissible limits for daytime i.e., 55 dB (A) as prescribed in the first schedule of the National Environment (Noise Standards and Control) Regulations, 2003. The generated noise is mainly due to noise sources such as motorcycle and vehicle movement, birds, public announcement system and people around the project components. There is always an increase in noise levels during the construction, operation and decommissioning phases. However, when the proposed corrective measures are implemented, the impact is minimal.

Noise measurements were taken at the proposed project site during day using a sound level meter model PCE-322A and the average noise levels were as shown in table 5-2 below.

Table 5-2: Noise levels measured at the proposed project component sites

Area Sampled	**Minimum (dBA)**	**Maximum (dBA)**	**Source of baseline noise conditions**	**Coordinates where noise measurements were taken from**	**NEMA Standards (dBA)**	**Comments**	**Overall** Rating
Intake at Masindi port	32.1	64.3	Conversations, Vehicle movement	399017E 187376N	55	High	High

Area Sampled	Minimum (dBA)	Maximum (dBA)	Source of baseline noise conditions	Coordinates where noise measurements were taken from	NEMA Standards (dBA)	Comments	Overall Rating
Proposed location for the water treatment plant	30.2	38.3	People talking, Cows grazing		55	Normal	Low
Kimengo church of Uganda at Kimengo village, Kimengo sub-county, Masindi district	30.3	56.3	Church worship and music from the congregation	384141E 173111N	55	Normal	Low
Kimengo trading Centre at Kimengo village, Kimengo sub-county, Masindi district	56.0	54.5	Music and interactions from retail shops.	384072E 173306N	55	Normal	Low
Ndaburye primary school, Kaduku village, Kiryandongo sub county , Kiryandongo district	32.1	32.4	Students playing around the compounds and teachers teaching in classes	388325E 189360N	55	Normal	Low
Kimengo Primary School at Kimengo village, Kimengo sub-county	41.7	53.4	Students playing around the compounds and teachers teaching in classes	384122E 173477N	55	Normal	Normal
Katugo village, Kaduku sub county, Masindi district	45.7	59.1	Commercial activities from retail shops, traffic and conversations.	387029E 189505N	55	Normal	Moderate
Myeba Community Primary School, Myeba village, Kimengo sub county, Masindi district	32,0	32.9	Students playing around the compounds and teachers teaching in classes	386380E 180863N	55	Normal	Low
Myeba-2 trading Centre, Myeba village, Kimengo sub-county, Masindi district	47.3	57.4	Commercial activities from retail shops, traffic and conversations	385306E 178314N	55	Normal	Moderate

Area Sampled	Minimum (dBA)	Maximum (dBA)	Source of baseline noise conditions	Coordinates where noise measurements were taken from	NEMA Standards (dBA)	Comments	Overall Rating
Masindi port health Centre 3at kimwoga village, Kifuluka parish, Masindi port sub-county, Masindi district	33.2	54.2	Patients, visitors and doctor conversations	397457E, 187739N	55	Normal	Low
Quantum foods Uganda limited at Rwenkunye village, Masindi port, parish, Masindi port sub-county, Kiryandongo district	32.2	32.8	Conversation from workers and noise generated from vehicles visiting the place	390543E 189072N	55	normal	Low

5.2.6.1 Interpretation of results and implications for receptors

The noise levels measured across project sites were mostly within the NEMA daytime permissible limit of 55 dB(A). However, the intake site at Masindi Port recorded a maximum of 64.3 dB(A), indicating a high baseline likely to be further elevated during construction, which could disturb nearby residents and site workers.

At educational institutions such as Kimengo Primary School (53.4 dB(A)), Ndaburye (32.4 dB(A)), and Myeba Community School (32.9 dB(A)), levels were within limits, but the presence of students and teaching activities makes them sensitive receptors. Any increase during construction could disrupt learning, necessitating noise control measures and careful activity scheduling.

In trading centres like Kimengo (54.5 dB(A)) and Myeba-2 (57.4 dB(A)), noise levels are already moderate to high due to commercial activities. While these areas are generally less sensitive, construction noise may still cause temporary nuisance to businesses and the public.

At Masindi Port Health Centre III (54.2 dB(A)), the environment is currently within acceptable levels, but even slight increases during construction could affect patients' comfort and healthcare delivery.

Finally, industrial/agricultural zones such as Quantum Foods exhibited low levels (32.8 dB(A)), meaning any construction noise will represent a noticeable change, though the sensitivity is relatively low.

In summary, while the baseline noise environment is largely compliant, specific locations—particularly health centres, schools, and the intake site—require targeted mitigation to avoid adverse impacts during construction.



Figure 5-14: Noise assessment at the proposed project site

5.2.7 Ambient air quality assessments

Baseline air quality was measured with Temtop M2000C air monitor. At all points where air quality measurements were undertaken, the concentration of Particles of 2.5µm diameter in ambient air were below the WHO guidelines of 25µg/m^3. The concentration of Particles of 10µm were also below WHO guidelines of 50µg/m^3. There is always a temporary increase in fugitive dust emissions particularly; PM_{10} and $PM_{2.5}$ from construction activities hence an increase in ambient air particulate matter concentrations in the site neighborhood. There is need to adopt all air pollution control measures to avoid inconveniencing immediate neighbors to the project site. Baseline air quality at measurement locations indicated no detectable levels of NH_3, NO, NO_2, CO, H_2S, Cl_2, ClO_2, SO_2 and combustible gases.

The results for air quality analysis at the proposed project site are presented in the table 5-3 below.

Table 5-3: Results for air quality measurement

Location	Total suspended Particles(TSP)	PM 10.0	PM 2.5	PM 0.3
IFC, 2007 Standard	*	**50 µg/m^3**	**25 µg/m^3**	*
WHO Air Quality Guidelines (AQG), 2005	**150-230 µg/m^3**	**50 µg/m^3**	**25 µg/m^3**	*
Kimego church of Uganda 384141E, 173111N Kimengo village, Kimengo sub-county, Masindi district	1324 (moderate)	34.4	11.9	51000
Kimengo foundation nursery school at Kimengo trading Centre, Kimengo village, Kimengo sub-county, Masindi district 384147E, 172872N	1024 (moderate)	25.6	7.20	66000
Rwenkunye church of Uganda at Masindi port sub county, Kiryandongo district 392363E, 188993N	1817	26.5	18.5	34000
Masindi port health Centre 3at kimwoga village, kifuluka parish, Masindi port sub-county, Masindi district 397457E, 187739N	1212	16.8	12.0	37000
Masindi port, kimwoga village, Wayibango parish, Masindi port sub-county, Kiryandongo district 398267E, 187566N	1314	36.9	22.0	86000
Mile 7 trading Centre, katareba village, Kaduku parish, Masindi port sub county, Kiryandongo district	1512	22.0	17.4	40000
Kimyuka village, Wayibango parish, Masindi port, Kiryandongo district 398267E 187566N	1314	36.9	18.9	86000
Masindi port health Centre 3 at kimyoga village, Masindi port , Kiryandongo district 397457E 187739N	1212	16.8	12.0	37000

Location	**Total suspended Particles(TSP)**	**PM 10.0**	**PM 2.5**	**PM 0.3**
IFC, 2007 Standard	*	**50 µg/m^3**	**25 µg/m^3**	*
WHO Air Quality Guidelines (AQG), 2005	**150-230 µg/m^3**	**50 µg/m^3**	**25 µg/m^3**	*
Namiryango primary school at Kitukuza village, Kitukuza parish, amsindi port sub-county, Kiryandongo district 398163E 187630N	2247	26.1	14.6	59000
Quantum fods Uganda limited at Rwenkunye village, Masindi port, parish, Masindi port sub-county, Kiryandongo district 390543E 189072N	755	11.4	6.6	36000
Mile 7 trading Centre, katareeba village, Kaduku parish, Masindi port sub-county, Kiryandongo district 388697E 189363N	1512	22.0	17.3	40000
Bishenyi village, kigulya parish, miirya sub-county, Masindi district 377165E 193170N	1991	33.7	22.3	85000
Kaduku 2 village, Masindi port sub-county, Kiryandongo district 383876E 192818N	2448	39.1	27.5	94000
Kaduku health Centre 2 at Kaduku 2 village, Masindi port sub-county, Kiryandongo district 383833E 192959N	2472	44.0	28.7	10300
Kaduku church of Uganda at Kaduku 2 village, Masindi port sub-county, Kiryandongo district 383898E	1695	26.8	17.8	10200

Location	Total suspended Particles(TSP)	PM 10.0	PM 2.5	PM 0.3
IFC, 2007 Standard	*	**50 µg/m³**	**25 µg/m³**	*
WHO Air Quality Guidelines (AQG), 2005	**150-230 µg/m³**	**50 µg/m³**	**25 µg/m³**	*
193620N				
Kaduku 1 trading Centre, Kaduku 1 village, Masindi port sub county, Kiryandongo district 379802E 194126N	2146	32.0	22.0	71000
Mile 10 trading Centre, Kaduku 1 village, Masindi port sub-county, Kiryandongo district 381308E 192207E	2115	30.4	19.4	70000
Masindi port police station at Kitukuza village, Kitukuza parish, Masindi port sub-county Kiryandongo district	2249	28.8	17.4	48000
Intake at Masindi port	12000	25.0	40.5	2678
Proposed location for the water treatment plant	55000	9.7	13.7	2678

5.2.7.1 Interpretation of Ambient Air Quality Results

The baseline ambient air quality across all monitoring sites was generally within the WHO and IFC guideline limits for $PM_{2.5}$ (25 µg/m³) and PM_{10} (50 µg/m³). However, a few locations particularly Kaduku Health Centre II ($PM_{2.5}$ = 28.7 µg/m³) and Kaduku 2 Village ($PM_{2.5}$ = 27.5 µg/m³) recorded slightly elevated $PM_{2.5}$ concentrations, exceeding the WHO guideline. These areas may already be exposed to moderate particulate pollution and are thus more vulnerable to additional dust emissions during construction.

Sensitive receptors such as schools (e.g., Namiryango Primary School, $PM_{2.5}$ = 14.6 µg/m³) and health centres (e.g., Masindi Port Health Centre III, $PM_{2.5}$ = 12.0 µg/m³) showed low to moderate levels of $PM_{2.5}$ and PM_{10}, indicating a relatively clean baseline environment. However, any increases during the construction phase especially from excavation, vehicle movement, and material stockpiling could temporarily affect air quality and pose a risk to children, patients, and staff.

Commercial zones like Kaduku 1 Trading Centre and Mile 10 Trading Centre reported $PM_{2.5}$ values close to the upper threshold (19.4–22.0 µg/m³), implying that construction-related dust may cause temporary nuisance and reduce air quality further during peak activity.

The intake site at Masindi Port and the proposed water treatment plant location had low $PM_{2.5}$ values (13.7–25.0 µg/m³), suggesting good baseline air quality, though the intake site did report a high TSP value (12,000 µg/m³), likely influenced by its exposed, dry surroundings and vehicular activity.

In addition to $PM_{2.5}$ and PM_{10}, concentrations of $PM_{0.3}$ (ultrafine particles) were also recorded across sites, with notably high values at locations such as Kimengo Foundation Nursery School (66,000 particles/L) and Kimego Church of Uganda (51,000 particles/L). Although $PM_{0.3}$ is not currently regulated under WHO guidelines, its presence is a concern due to its ability to penetrate deep into the respiratory tract. Elevated $PM_{0.3}$ levels at these sensitive receptors underscore the need for additional dust control precautions during construction to protect vulnerable populations, especially children and the elderly.

Overall, while current air quality conditions are generally acceptable, construction activities may significantly increase local concentrations of $PM_{2.5}$, PM_{10}, and $PM_{0.3}$, particularly in areas already near threshold levels. Therefore, strict dust control measures (e.g., water spraying, covering of stockpiles, and vehicle speed limits) will be essential, especially near schools, health centres, and residential communities.



Figure 5-15: Air quality measurement at different project site locations

5.3 Biological Environment

5.3.1 Biodiversity

The proposed Masindi Port Bulk Water Supply project area features riverine and wetland ecosystems, including swampy areas at the water abstraction point. Key natural habitats include papyrus swamps and the Kaduku Central Forest Reserve (CFR). However, these habitats are significantly degraded by human activities such as resource over-extraction, encroachment, and conversion into agricultural land. According to the FSC National Forest Stewardship Standard of the Republic of Uganda (2018), Kaduku CFR is dedicated to industrial timber production

through private sector investment and consists of 582 hectares of artificial plantation cover on Kaduku Hills. This reserve is home to a variety of primates, including monkeys and baboons, as well as small mammals, numerous bird species, reptiles, amphibians, and invertebrates. The project area is rich in flora, supporting diverse vegetation communities ranging from farmlands, grasslands, and seasonal and permanent wetlands to thickets, bushlands, wooded grasslands, woodlands, secondary forests, and primary forests. These habitats contain a wide range of plant species, including lichens, algae, mosses, ferns, herbaceous flowering plants, and woody flowering plants with various growth habits.

5.3.1.1 Vegetation

The landscape of the proposed MWACRID project area is characterized by diverse vegetation types, including bushland with scattered trees, bushed grassland, bushland, wooded grassland, open grassland, and Cyperus papyrus swamps, notably Kiyanja Swamp, which is part of the Kafu wetland system. The area also features moist or swamp forests, moist forest and woodland mosaics, moist bushland, dense and open woodlands, agricultural parks, settlement areas mixed with bushland and agro-farm mosaics, built-up areas, and agro-economic gardens and plantations. Additionally, the Kaduku Central Forest Reserve forms a significant part of the landscape.



Figure 5-16: The swamp are that is part of the Nile River wetland system



Figure 5-17: The swamp area that is part of the Nile River wetland system



Figure 5-18: The swamp area that is part of the Nile River wetland system



Figure 5-19: Pine woodlot within the proposed project area



Figure 5-20: Farm trees at Kiiza farm in Wakisanyi Village



Figure 5-21: Panicum-Pennisetum grassland fallow at Ebenezer farm



Figure 5-22: Livestock farms-Ebenezer farm



Figure 5-23: Bushed grassland with scattered trees



Figure 5-24: Kaduku Central Forest Reserve



Figure 5-25: Sugar cane plantations that are project beneficiaries



Figure 5-26: Wooded grassland Within scattered fallow land



Figure 5-27: Maize gardens in Miirya subcounty



Figure 5-28: Cassava plantations for Soul Agric Farm in Kaduku

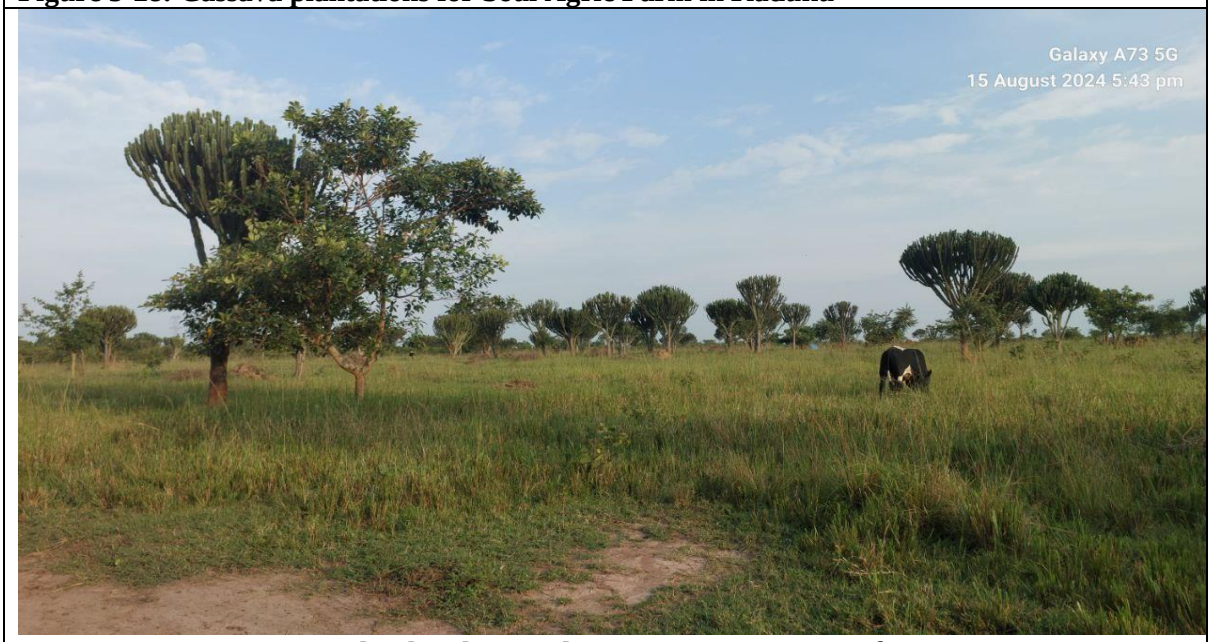


Figure 5-29: Savanna grassland with spread out cactus trees at Kesi farm

The agro-landscape along the proposed transmission water supply line is diverse, comprising woodlots of Eucalyptus and Pinus species, coffee gardens, cassava plantations, mixed agricultural areas for both crop production and livestock rearing, recently cultivated or cleared land, and animal farms. There is also a variety of cereal crops and perennial crops, particularly Zea mays (maize), Phaseolus vulgaris (common beans), Ipomoea batatas (Sweet Potatoes), Manihot esculenta (Cassava), Arachis hypogaea (Groundnuts).

Over time, significant portions of the greenbelt along this route have been degraded due to the conversion of natural vegetation—such as forests, woodlands, bushlands, grasslands, and wetlands—into agricultural fields, animal farms, and residential areas. The emergence of trading centers along the transmission water supply line has further exacerbated the loss of

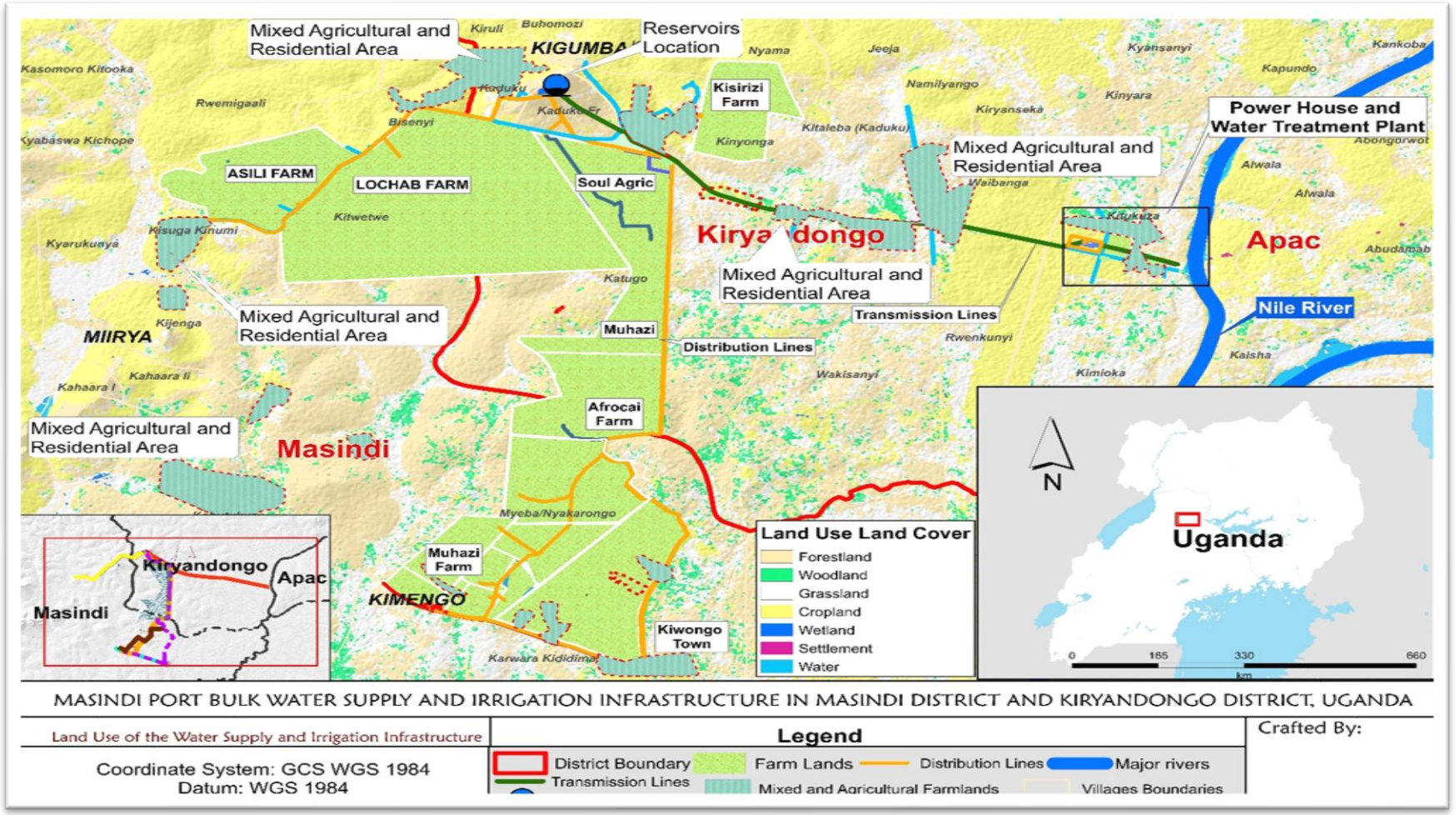
natural vegetation, hindering its survival and regeneration. Remnants of the original vegetation were mainly found in livestock farming areas, Kaduku Central Forest Reserve (CFR), and wetlands. On dry land, most of the natural vegetation has been replaced by farmlands, settlements, and trading centers.

The transmission water supply line cuts across ecologically sensitive areas, including fragile watersheds and riparian zones. Notable examples are the wetlands and moist vegetation associated with the Nile River and Kiyanja swamp. Other areas of high conservation significance include gently sloping landscapes with remnant vegetation, hilly regions in Kaduku featuring savanna woodlands and bushlands, and the Kaduku Central Forest Reserve. The vegetation assemblages along the proposed transmission water supply line have the potential to support threatened plant species and high-value timber species.

However, the surveys did not record any plant species currently listed as threatened at national or global levels (according to the International Union for Conservation of Nature (IUCN) 2015 and the Uganda List of Threatened Species compiled by the Wildlife Conservation Society (WCS) 2016).

The Kaduku CFR contains tree species protected under Schedule VI of the National Forestry and Tree Planting Act (2003). These include five economically important species—*Milicia excelsa, Markhamia lutea, Maesopsis eminii, Cannarium schweinfurthii*, and *Mitragyna spp*.—which are increasingly threatened by human activities.

In addition to native species, invasive plant species have been observed at various points along the proposed transmission water supply line. These invasive species, such as Lantana camara, Mimosa pigra, Senna siamea, Senna spectabilis, and Ricinus communis, have the potential to outcompete and suppress the regeneration of herbaceous plants. These invasive species will be mapped for effective management and control during the project implementation.



(Source: Study Team)

Figure 5-30: Land Use Land Cover map

The baseline assessment identified three primary vegetation/land cover types across the project area: (i) farmlands dominated by commercial crops (e.g., maize, sugarcane, cashew, avocado); (ii) shrublands and bush thickets with scattered emergents such as *Erythrina abyssinica* and *Mangifera indica*; and (iii) wetland zones, especially at the water intake near the Victoria Nile, dominated by *Cyperus papyrus*, *Typha capensis*, and other hydrophytes.

A total of 82 plant species from 40 families were recorded, with most being common or weedy species. However, some reserved and protected tree species, including *Mangifera indica*, *Albizia coriaria*, and *Lovoa swynnertonii* (Near Threatened), were documented along the project's right of way. Their protection will require adherence to the National Forestry and Tree Planting Regulations (2016), and necessary permits will be sought where disturbance is unavoidable. Notably, ten invasive species were recorded across the project area, including *Chromolaena odorata*, *Lantana camara*, and *Senna spectabilis*. These species are known to outcompete native vegetation and require targeted control measures during site clearance and construction activities.

Vegetation structure across surveyed zones reveals significant habitat modification, with dominant bushland compositions and minimal intact natural forest. However, important vegetative zones remain around Kaduku Forest Reserve, which hosts a variety of native shrubs, trees, and serves as a refuge for diverse fauna. Further detail on vegetation types, species lists, and ecological value assessments are provided in the Biodiversity Report in Appendix C.

5.3.1.2 Fauna

During the surveys for this report, no wild animals were directly encountered, except for the livestock reared by the local communities. The animal species mentioned were based on information provided by a few interviewees from the project area. The habitats along the stretch of the river at Masindi are heavily impacted by human activities, making them unsuitable for larger mammal species. According to the ferry captain at Masindi Port, crocodiles have never been observed in the area, nor have any migratory bird species. However, he did note that when water levels rise, floating islands occasionally drift into this section of the river, often carrying snakes. Interviews with local fishermen revealed that the primary fish species caught in this part of the river are Nile perch (*Lates niloticus*), Tilapia (*Oreochromis spp.*), and Catfish (*Clarias spp.*). These fish are more abundant in the middle of the lake, especially during the rainy season.

Human activities have had a significant negative impact on the vegetation along the proposed water supply line. This, in turn, affects the local fauna that depend on the flora for food, cover, and shelter. At the intake point at Masindi Port, the area remains underdeveloped, with only temporary structures made of wood or mud and wattle. Consequently, many local residents reported that mammal species once common in the area are now rarely seen or have disappeared altogether.

In Kaduku Central Forest Reserve (CFR), species such as monkeys, antelopes, wild pigs, and snakes are reported to still reside within the forest. These animals are typically seen during the early morning and late evening hours, according to local interviews. However, the encroachment of wildlife into nearby farmlands has led to increased incidents of crop raiding, which has intensified human-wildlife conflicts.

In terms of mammals, 16 species were documented, primarily small rodents and insectivores tolerant to disturbed environments. However, sightings of antelopes (e.g., bushbuck, common duiker, oribi) in Kaduku CFR highlight its ecological value as a medium mammal refuge. No mammal species of conservation concern were recorded, although measures must be taken to minimize habitat fragmentation in forested areas.

The herpetofauna includes 5 amphibian and 17 reptile species, with the transmission and reservoir areas showing the highest diversity. Most amphibians were associated with riparian vegetation, particularly at the Victoria Nile intake, while reptiles like skinks and agamas were common in bushland and rocky outcrops. All recorded species are categorized as Least Concern by IUCN, though the African Rock Python (*Python sebae*), while not currently endangered, is protected under Ugandan legislation and requires monitoring due to past hunting and habitat loss.

Additionally, aquatic biodiversity assessments found healthy populations of phytoplankton, zooplankton, macroinvertebrates, and fish in the Victoria Nile. Thirteen fish species were recorded, none of which are critically endangered, though the area is known to be a nursery and spawning ground for Nile-based fish species, requiring precautionary protection of aquatic habitats during intake construction and operation. For detailed species lists, refer to the Biodiversity Report in Appendix C of this ESIA



Figure 5-31: Cat Fish obtained from the Nile at Masindi Port



Figure 5-32: Livestock reared by the communities

5.4 Socio-Economic Environment

5.4.1 Population Demographics

5.4.1.1 Population size

Population size trends and growth rates in the Masindi and Kiryandongo districts between 2014 and 2024 reveal distinct patterns. In Masindi District, the total population increased from 291,113 in 2014 to 342,496 in 2024. This represents a growth rate of 1.7% over the decade, indicating a moderate but steady increase in population. The population is relatively balanced between males and females, with both groups experiencing similar growth rates. The male population grew from 148,121 to 170,972, while the female population increased from 142,992 to 171,524. The balanced growth pattern suggests stable demographic dynamics, which could be influenced by natural growth and possibly limited migration.

Kiryandongo District, on the other hand, indicates a much higher growth rate of 3.3%, with the total population increasing from 266,197 in 2014 to 364,878 in 2024. Throughout the decade, this significant population rise indicates a rapidly growing community. Both male and female populations have risen sharply, with males increasing from 132,822 to 180,868 and females from 133,375 to 184,010. The faster growth in Kiryandongo is majorly attributed to the influx of refugees. This rapid growth presents unique challenges and opportunities, necessitating more immediate and extensive planning and investment in infrastructure, such as schools, healthcare facilities, water supply systems, and other social services, to cater to the burgeoning population.

The project area supports a range of fauna, largely influenced by the presence of the Victoria Nile, Kaduku Central Forest Reserve, and surrounding bushlands and farmlands. While the landscape is generally modified due to agriculture and settlement, pockets of natural habitat

particularly along the riverbanks and within the forest reserve still support significant biodiversity. A total of 161 bird species from various habitat types were recorded, including forest visitors, open woodland species, water specialists, and migratory birds. The highest bird diversity was observed along the transmission and distribution corridors and at the intake site near the Victoria Nile, which provides ideal wetland habitat. Though no species of critical conservation status were found, the ecological roles of these birds in pollination, seed dispersal, and pest control underscore the need for habitat preservation during construction.

5.4.1.2 Population Growth Rate

According to the UBOS 2024 results, the population growth rate dropped slightly from 3.0 per cent in 2014 to 2.8 per cent in 2024.

5.4.1.3 Population density

The population density of Kiryandongo District is 74 persons per square kilometre, according to the Masindi DDP 2020/2021 - 2024/2025 source. However, the recent UBOS census results show that Masindi District covers an area of 3,691 square kilometres with a population of 342,496, resulting in a population density of 93 persons per square kilometre. This low density suggests a primarily rural environment with widely dispersed settlements. It also indicates that large portions of the district are likely dedicated to agriculture or remain underdeveloped. The infrastructure must cover extensive areas for a bulk water supply project to serve scattered communities.

The land area in Kiryandongo District is slightly smaller at 3,582 square kilometres, but it has a higher population of 364,878 people, leading to a density of 102 persons per square kilometre. Although still relatively low, this density is marginally higher than in Masindi, reflecting a similar rural characteristic but with a slightly more concentrated population. The demand for water for domestic and agricultural use may be higher due to the larger population. In summary, the low population densities of Masindi and Kiryandongo districts clearly show the rural context in which the proposed bulk water supply project would operate.

5.4.1.4 Household size

In Masindi District, there are 84,714 households with an average of 4.0 persons per household. On the other hand, Kiryandongo District has 80,789 households with a larger average household size of 4.5 persons, indicating the presence of extended families and a refugee influx. It's worth noting that the average household size in Masindi is slightly lower, and in Kiryandongo, it is marginally higher than the national average household rate, which is 4.4 (source: UBOS 2024).

5.4.1.5 Refugee population

The District hosts refugees from Sudan, South Sudan, the Democratic Republic of Congo, Ethiopia, Rwanda, Burundi, and Kenya. It also hosts internally displaced persons from Bududa District who were displaced by mudslides. The total number of refugees in the district is currently estimated at 71,865 (Source Kiryandongo DDP). According to the result (UBOS

2024), the refugee population in Kiryandongo stands at 32,081, while in Masindi it stands at 1,016.

Although the UBOS census data currently doesn't include the lower local government data, the UBOS projections for 2023 indicated that the population projection for Masindi district in 2023 was estimated at 177,000 males and 170,800 females, totalling 347,800. In the Kigumab sub-county, there were 19,900 males and 18,200 females, totalling 38,100. Masindi port's estimated population was 2,600 males and 2,300 females, totalling 4,900. In the refugee camp, the population was estimated at 9,100 males and 9,300 females, totalling 18,400. (Kiryandongo DLG, 2015).

5.4.2 Household Demographic Characteristics

5.4.2.1 Gender distribution of respondents

The gender distribution of respondents in the proposed geographic scope of the project across Masindi and Kiryandongo districts revealed a nearly equal representation of male and female participants. Overall, 195 respondents (49.24%) were male, while 201 respondents (50.76%) were female. This indicates that both men and women were well-represented in the study, ensuring a balanced perspective on water supply and irrigation needs.

At the sub-county level, there were notable variations in gender representation. Kigumba had a higher proportion of male respondents (66.67%), with female respondents accounting for 33.33%. In contrast, Kimengo had more female respondents (55.07%) than male respondents (44.93%). A similar trend was observed in Masindi Port, where 54.42% of respondents were female, while 45.58% were male. On the other hand, Miirya had a higher proportion of male respondents (56.79%) compared to female respondents (43.21%).

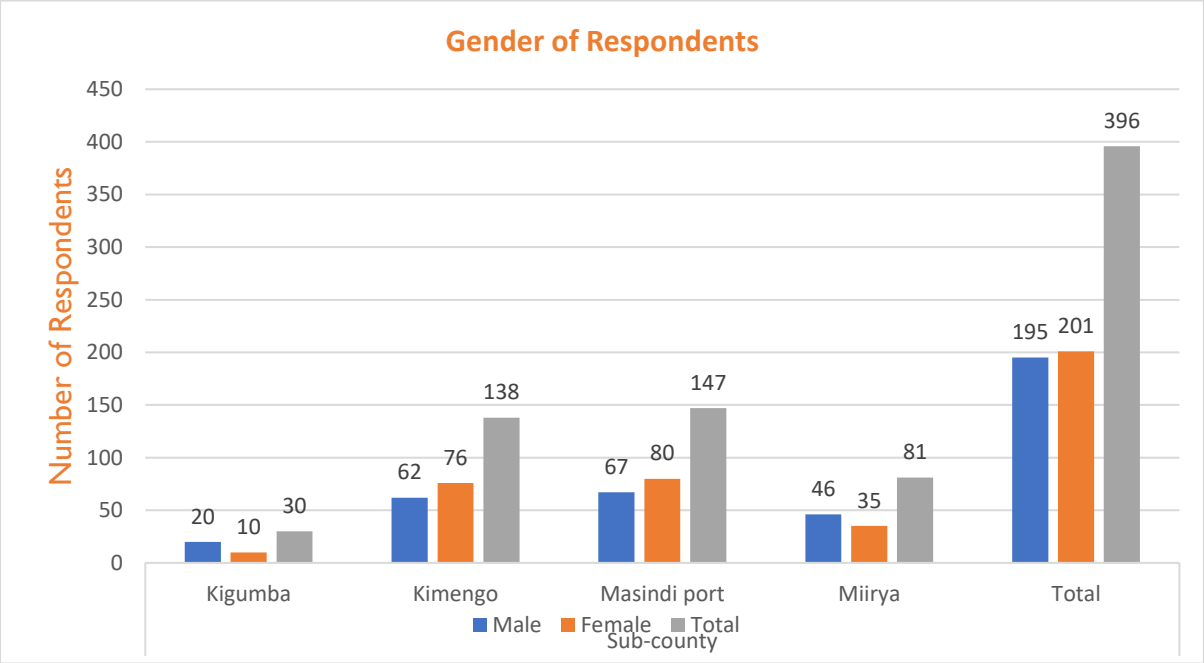


Figure 5-33: Gender of Respondents

5.4.2.2 Position of Respondents in the Household

Regarding the respondents' positions within the household, the gender distribution of household heads and spouses in the study provided a clear understanding of the leadership structures across the four Sub-Counties: Kigumba, Kimengo, Masindi Port, and Miirya.

Overall, 275 respondents (69.44%) were identified as spouses, while 121 respondents (30.56%) were household heads. This indicates that the majority of respondents were spouses rather than primary decision-makers in their households. The distribution varies across sub-counties, with Masindi Port having the highest proportion of spouses (74.83%), followed by Kigumba (73.33%), Miirya (65.43%), and Kimengo (65.22%). The higher percentage of spouses in these areas suggests that the study largely captured responses from individuals who may not be the principal decision-makers but still play a role in household affairs.

Equally, household heads made up 30.56% of the respondents, with Kimengo (34.78%) and Miirya (34.57%) having the highest proportions, followed by Kigumba (26.67%) and Masindi Port (25.17%).

When asked about the whereabouts of household heads who were absent during the data collection, 107 out of 121 respondents (88.43%) indicated that their spouses had travelled. This finding highlighted a significant level of mobility among primary decision-makers, particularly in Masindi Port (94.59%) and Miirya (96.43%). A smaller proportion of respondents, specifically 9.09% (or 11 spouses), reported that their spouses were living elsewhere in Uganda, with Kimengo having the highest share at 18.75%. Additionally, a few spouses (2.48% or 3 individuals) were reported to be abroad, with cases noted in Kimengo (4.17%) and Masindi Port (2.7%).

The high percentage of spouses as respondents suggests that many household heads may not have been available during the data collection, which could influence the type of responses obtained. However, spouses play a significant role in managing household affairs, especially in the absence of household heads.

The findings highlighted the need for inclusive decision-making strategies in water access and irrigation planning, ensuring that spouses and household heads are both engaged in key discussions.

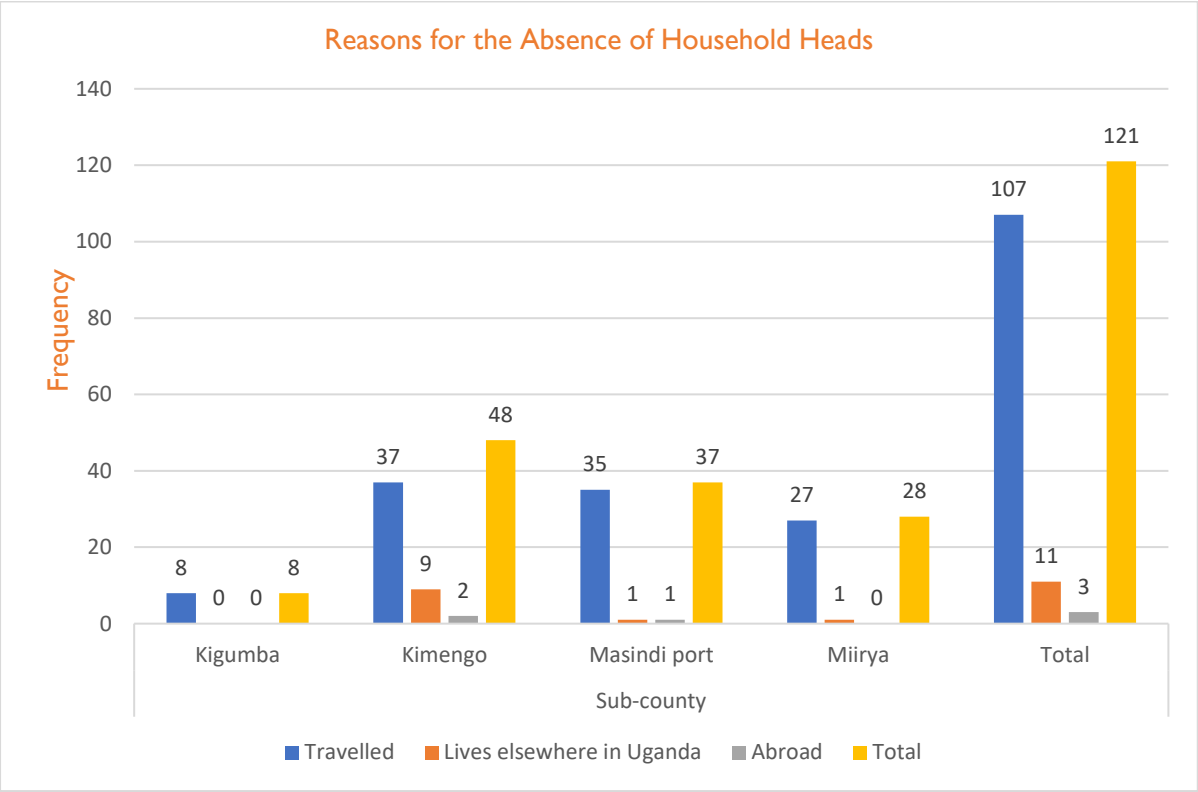


Figure 5-34: Reasons for the Absence of Household Heads

5.4.2.3 Age distribution

The age distribution of respondents in the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project area provides the demographic composition of the population. The findings revealed varying representation across different age groups in the sub-counties of Kigumba, Kimengo, Masindi Port, and Miirya. Understanding the distribution of these age groups is important planning project interventions that cater to the needs of different age groups of the population.

The majority of respondents (47.73%) were within the 18–39 age bracket, which consists of youth and young adults. Specifically, 21.72% of the respondents were between 18–28 years, while 26.01% were between 29–39 age category. Miirya recorded the highest proportion of respondents in these two age groups (64.2%), followed by Kimengo (52.17%). The prevalence of a younger population in these areas suggests a potential for active labor participation, training in modern irrigation techniques, and economic empowerment programs tailored toward youth engagement in agriculture and business.

A significant portion of respondents (25.25%) was within the 40–50 age category, representing individuals who are likely to be actively engaged in household decision-making, land ownership, and economic activities such as commercial farming and business operations. Kigumba recorded the highest proportion of respondents in this age bracket (36.67%), followed by Masindi Port (27.89%). This group is critical in ensuring the sustainability of irrigation activities, as they possess both experience and economic influence within their communities.

The 51–61 age category represents 14.9% of respondents, with Masindi Port (19.05%) and Kimengo (15.22%) having the highest shares. 8.59% of respondents were within the 62–72 age

range, with the highest representation in Masindi Port (14.29%). Only 3.54% of respondents were aged above 72, mainly concentrated in Masindi Port (4.76%) and Kimengo (4.35%). The presence of an older population highlights the need for inclusive project planning that considers their experience, traditional knowledge, and role in influencing community decisions related to water resource management and agricultural practices.

The data indicated that that the project area is predominantly occupied by a young and middle-aged population, with a decreasing proportion of older respondents. This demographic trend suggests that project interventions should prioritize labour-intensive agricultural activities, skill development programs, and youth engagement strategies.

Complete age	Sub-county				
	Kigumba	Kimengo	Masindi port	Miirya	Total
18 - 28	7	31	24	24	86
Percentage (%)	23.33	22.46	16.33	29.63	21.72
29 - 39	8	41	26	28	103
Percentage (%)	26.67	29.71	17.69	34.57	26.01
40 - 50	11	32	41	16	100
Percentage (%)	36.67	23.19	27.89	19.75	25.25
51 - 61	2	21	28	8	59
Percentage (%)	6.67	15.22	19.05	9.88	14.9
62 - 72	1	7	21	5	34
Percentage (%)	3.33	5.07	14.29	6.17	8.59
Above 72	1	6	7	0	14
Percentage (%)	3.33	4.35	4.76	0	3.54
Total	30	138	147	81	396
Percentage (%)	100	100	100	100	100

5.4.2.4 Religious Affiliation of the Population in the Geographic Area

The data revealed that the majority of respondents were Catholic (36.87%), making it the most dominant religious affiliation among the surveyed population. This suggested that Catholicism was the leading faith across the sub-counties, with the highest proportion recorded in Miirya (51.85%), followed by Kigumba (43.33%) and Masindi Port (36.05%). The lowest representation was in Kimengo (27.54%), where other religious groups had relatively higher numbers.

The second most common religious group was Pentecostal/ Saved Christians (27.02%). This denomination had the highest proportion of followers in Kimengo (30.43%), followed by Kigumba (36.67%) and Masindi Port (25.85%). Miirya had the lowest representation of Pentecostal respondents at 19.75%.

Protestant/Anglican Christians constituted 22.98% of the respondents, making it the third most prevalent religious group. The highest proportion of Protestants was recorded in Kimengo (28.99%), followed by Masindi Port (23.13%), while Miirya and Kigumba had lower percentages at 19.75% and 3.33%, respectively.

Muslims accounted for 8.33% of the respondents. The highest proportion was found in Kimengo (7.97%) and Masindi Port (8.84%), while Kigumba (13.33%) and Miirya (6.17%) had relatively smaller representations.

Adventists represented a smaller fraction of the population (3.79%), with the highest numbers in Kimengo (4.35%) and Masindi Port (4.08%). Kigumba and Miirya had very few Adventists, at 3.33% and 2.47%, respectively.

The Orthodox denomination and other unspecified religions each accounted for only 0.51% of the total respondents, with Masindi Port recording the only Orthodox followers (1.36%). The "Other" category was almost negligible, appearing only in Kimengo (0.72%) and Masindi Port (0.68%).

The findings indicate that Christianity is the dominant religion in the surveyed sub-counties, with Catholicism in the lead, followed by Pentecostal and Anglican denominations. The lower representation of Muslims, Adventists, Orthodox Christians, and other religious groups suggests they hold a minority status in the study area. This religious distribution is important for social engagement and community activities that should take into account the religious diversity across different sub-counties.

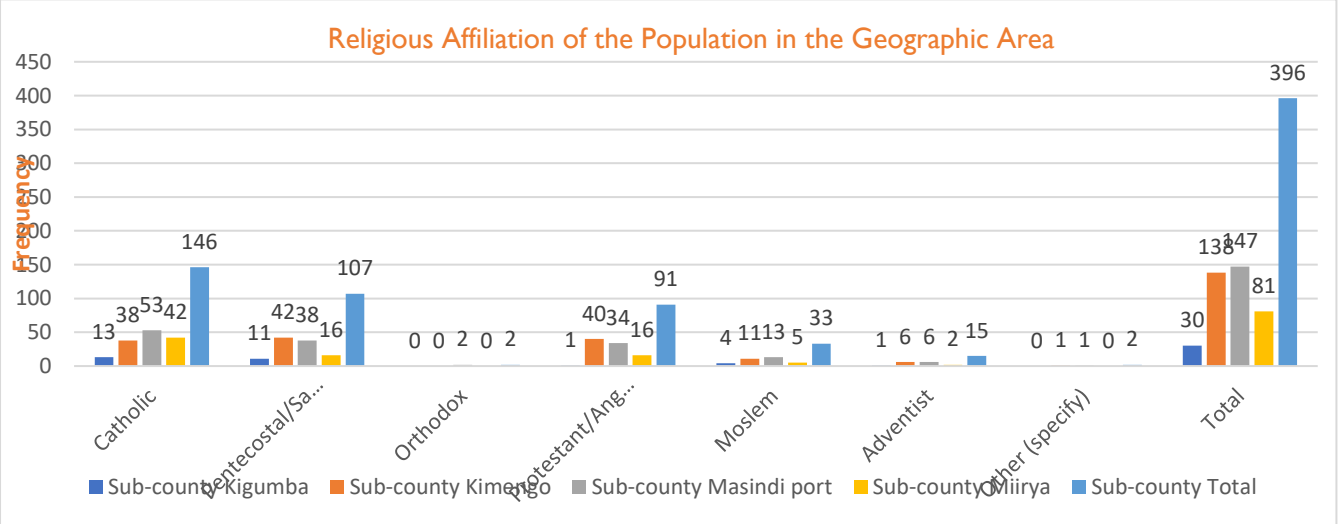


Figure 5-35: Religious Affiliation of the Population in the Geographic Area

5.4.2.5 Level of education

The educational distribution levels across the Kigumba, Kimengo, Masindi Port, and Miirya sub-counties revealed significant disparities in education attainment among the population. A notable total of 64 respondents reported having no formal education, representing approximately 16.16% of the sampled study population. Kimengo had the highest number of individuals lacking any educational background at 26, followed closely by Masindi Port with 25. This indicates a pressing issue concerning access to education in these areas.

Functional adult literacy was particularly low, with only 8 individuals (2.02% of the total) being classified at this level. Kigumba and Kimengo reported zero individuals in this category, while Masindi Port and Miirya had 4.

The data highlighted a troubling trend in the subset of individuals who had not completed primary school: 131 individuals (33.08%) fall into this category. Kimengo had the highest figure, with 47 individuals not completing their primary education. This high rate of incomplete primary education indicates that many individuals are entering the education system but are unable to finish it.

On a positive note, 74 individuals (18.69%) had completed primary education, but the overall completion rates remain low. Kimengo had the highest in this area as well. The number of individuals attaining 'O' Level qualifications is more promising, with 97 individuals (24.49%) reported, particularly in Masindi Port, which had the highest count at 45.

However, the progression to higher education appeared to be quite limited, as only 10 individuals (2.53%) hold an advanced level of education, with very few moving on to diploma programs, just eight (8) individuals (2.02%). Masindi Port Sub County reported a slightly higher number at 4. There is a low representation of individuals with university degrees, with only two (2) people (0.51%) holding a university qualification, both from Kimengo. Additionally, the data reveals that two (2) individuals (0.51%) have post-graduate qualifications, again from Kimengo.

Table 5-4: Level of Educational distribution

Level of Educational Distribution	Sub-county									
	Kigumba		Kimengo		Masindi port		Miirya		Total	
	Freq and %		Freq and %		Freq and %		Freq and %		Freq and %	
None	2	6.67	26	18.84	25	17.01	11	13.58	64	16.16
Adult literacy	0	0	0	0	4	2.72	4	4.94	8	2.02
Pri. Level Incomplete	11	36.67	47	34.06	42	28.57	31	38.27	131	33.08
Pri. Level Complete	6	20	33	23.91	21	14.29	14	17.28	74	18.69
O. Level	9	30	25	18.12	45	30.61	18	22.22	97	24.49
Advance level	2	6.67	1	0.72	6	4.08	1	1.23	10	2.53
Diploma	0	0	2	1.45	4	2.72	2	2.47	8	2.02
Uni Degree	0	0	2	1.45	0	0	0	0	2	0.51
Postgrad Level	0	0	2	1.45	0	0	0	0	2	0.51
Total	30	100	138	100	147	100	81	100	396	100

5.4.2.6 Marital status

The marital status of respondents revealed that the majority of participants were married or cohabiting (monogamous), making up 73.99% (293 respondents) of the total sample size of 396. This indicates that most respondents were in stable marital unions, and they are likely to have positive household decision-making on water and irrigation needs.

A small proportion of respondents (2.78% or 11 individuals) were in polygamous marriages, with the highest percentage recorded in Miirya Sub-County (7.41%), followed by Masindi Port (2.04%) and Kimengo (1.45%), while Kigumba had no respondents in polygamous marriages.

Those who were never married accounted for 5.81% (23 respondents), with Masindi Port having the highest proportion (7.48%), followed by Kigumba (6.67%), Kimengo (5.07%), and Miirya (3.7%). This suggests that a small percentage of respondents were young, single individuals who might not yet be heads of households.

Overall, the findings indicated that most of the respondents were in married or cohabiting unions (both monogamous and polygamous), meaning that household-level decisions on water and irrigation infrastructure will likely involve spouses.

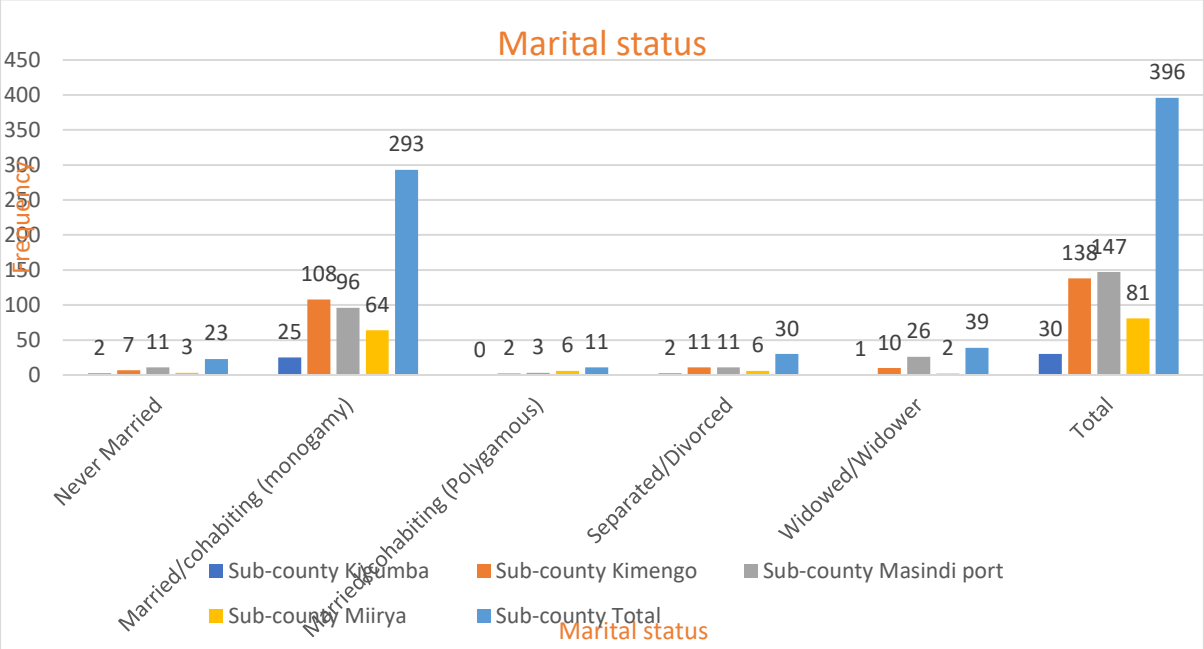


Figure 5-36:Marital Status

5.4.2.7 Ethnicity of the of people in the geographical project scope

The ethnicity distribution of respondents in the feasibility study for the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project reflects significant diversity, despite the area being traditionally inhabited by the Banyoro. Overall, 28.03% (111) of respondents identified were Banyoro, with the highest concentration in Miirya (44.44%), followed by Kimengo (30.43%), Masindi Port (19.73%), and Kigumba (13.33%). Other prominent ethnic groups included the Banyankole (9.6%), Langi (6.57%), Bagisu (5.3%), Iteso (4.04%), and Lugbara (6.57%), reflecting migration patterns from different regions of Uganda.

Ethnic diversity varied across sub-counties, with Kimengo being the most ethnically mixed, comprising Banyoro, Banyankole, Banyaruanda, and Langi, among others. Masindi Port, being a key economic hub, also had a notable mix, including Banyoro, Banyankole, Langi, and Lugbara, likely due to trade and agricultural activities. In contrast, Miirya remained largely Banyoro (44.44%). Kigumba had a high presence of Iteso (43.33%) and Bagisu (23.33%),

suggesting economic migration and interdistrict movement as key factors shaping settlement patterns.

The large proportion of Banyoro in Miirya and Kimengo means that traditional Bunyoro governance structures should be considered in decision-making and sensitization efforts. The presence of settler communities like the Banyankole, Langi, and Bagisu highlights the need for multilingual communication strategies to ensure inclusive participation. Additionally, the significant "Other" category (20.71%) suggests that further engagement is necessary to understand and address the specific concerns of smaller ethnic groups.

Table 5-5: Ethnicity of the of people in the geographical project scope

Ethnicity	Sub-County									
	Kigumba		Kimengo		Masindi Port		Miirya		Total	
Banyoro	4	13.33	42	30.43	29	19.73	36	44.44	111	28.03
Batoro	0	0	4	2.9	1	0.68	1	1.23	6	1.52
Banyankole	0	0	15	10.87	20	13.61	3	3.7	38	9.6
Baganda	0	0	7	5.07	5	3.4	1	1.23	13	3.28
Iteso	13	43.3	1	0.72	2	1.36	0	0	16	4.04
Basoga	0	0	7	5.07	3	2.04	3	3.7	13	3.28
Banyarwanda	0	0	12	8.7	6	4.08	1	1.23	19	4.8
Bakiga	1	3.33	6	4.35	1	0.68	0	0	8	2.02
Lango	0	0	10	7.25	16	10.88	0	0	26	6.57
Bagisu	7	23.33	4	2.9	9	6.12	1	1.23	21	5.3
Acholi	0	0	0	0	10	6.8	6	7.41	16	4.04
Lugbara	1	3.33	3	2.17	17	11.56	5	6.17	26	6.57
Karamojong	0	0	0	0	1	0.68	0	0	1	0.25
Other (Specify)	4	13.33	27	19.57	27	18.37	24	29.63	82	20.71
Total	30		138		147		81		396	
	100		100		100		100		100	

5.4.2.8 Age distribution

The longevity of respondents in the villages within the project scope provides an understanding of the settlement patterns, community stability, and potential stakeholder engagement in project implementation. The data indicated the largest group of respondents (37.63%) has lived in their respective villages for 1–10 years, indicating a relatively recent influx of settlers. Kigumba has the highest proportion (50%) in this category, suggesting that it may be experiencing higher mobility or recent settlement patterns. Kimengo (34.78%), Masindi Port (36.05%), and Miirya

(40.74%) also have significant numbers of respondents who have lived in their locations for a decade or less. This trend suggests a growing population that may be influenced by factors such as land availability, agricultural opportunities, and infrastructure developments.

Respondents who have lived in their respective locations for 11–20 years account for 17.68% of the total sample, with Masindi Port and Kimengo each having 17.69% and 18.84%, respectively. Meanwhile, 11.62% of respondents have lived in the area for 21–30 years, with Miirya having the highest proportion (17.28%), indicating a slightly stable settlement pattern in this sub-county.

Longer-term residents who have stayed for 31–50 years make up 22.98% of respondents. Masindi Port has the highest percentage in this category, with 17.01% of its respondents having lived in the area for 31–40 years, followed by Kimengo (15.22%). Those who have stayed for 41–50 years are slightly fewer (8.33% overall), with Masindi Port again having the highest proportion (10.2%). These long-term residents are crucial stakeholders for the project, as they possess extensive knowledge of local water use, agricultural practices, and environmental changes.

A small but notable proportion (3.54%) has lived in the area for over 70 years, with Kigumba and Kimengo each reporting 6.67% and 3.62%, respectively. These long-established residents may have historical knowledge into water resource availability and land use changes that could inform project planning and sustainability strategies.

Overall, the presence of recent settlers implies that the area is experiencing population growth, possibly driven by economic and agricultural prospects. At the same time, the presence of long-term residents ensures continuity in community traditions and knowledge, which can be used for effective water management and irrigation planning.

Table 5-6: Age distribution

Number of lived in this village/location (longevity)	Sub-county				
	Kigumba	Kimengo	Masindi port	Miirya	Total
1-10	15	48	53	33	149
Percentage (%)	50	34.78	36.05	40.74	37.63
11-20	6	26	26	12	70
Percentage (%)	20	18.84	17.69	14.81	17.68
21-30	3	15	14	14	46
Percentage (%)	10	10.87	9.52	17.28	11.62
31-40	2	21	25	10	58

Number of lived in this village/location (longevity)	Sub-county				
	Kigumba	Kimengo	Masindi port	Miirya	Total
Percentage (%)	6.67	15.22	17.01	12.35	14.65
41-50	1	10	15	7	33
Percentage (%)	3.33	7.25	10.2	8.64	8.33
51-60	1	8	7	2	18
Percentage (%)	3.33	5.8	4.76	2.47	4.55
61-70	0	5	2	1	8
Percentage (%)	0	3.62	1.36	1.23	2.02
Above 70	2	5	5	2	14
Percentage (%)	6.67	3.62	3.4	2.47	3.54
Total	30	138	147	81	396
Percentage (%)	100	100	100	100	100

5.4.2.9 Household size

The household size distribution across the sub-counties of Kigumba, Kimengo, Masindi Port, and Miirya provides family structures, resource demands, and social dynamics that could influence the implementation of the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project. The data indicated that most households have between 4 and 6 members, while a smaller proportion has more than 9 or more members.

The majority of households (47.22%) fall within the 4–6-member range, with Kimengo (48.55%), Masindi Port (44.9%), and Miirya (46.91%) reflecting this trend. Kigumba has the highest percentage (53.33%) in this category, suggesting a predominance of medium-sized households. This range is significant because it represents the standard household size in rural Uganda, where extended family living is common, and resource-sharing plays an important role in livelihoods.

Households with 1–3 members constitute 27.27% of the total sample, with Miirya having the highest proportion (37.04%), followed by Kimengo (28.99%). Masindi Port (19.05%) has the lowest percentage in this category, which could indicate a lower number of small nuclear households in this area. The presence of a significant number of smaller households suggests variations in family composition, potentially influenced by factors such as migration, economic activities, and social structures.

Larger households, those with 7–9 members, constituted up to 19.19% of the total. Masindi Port has the highest proportion in this category (26.53%), suggesting a trend of extended families or polygamous households. Kimengo follows with 15.94%, while Kigumba (10%) and

Miirya (14.81%) have lower percentages, indicating that extended family structures might be less common in these areas.

Households with more than 9 members account for 6.31% of the sample, with Masindi Port having the highest proportion (9.52%), followed by Kimengo (6.52%). Kigumba and Miirya each have very few households in this category (3.33% and 1.23%, respectively), reflecting differences in family expansion and household structures across the sub-counties.

Overall, the data shows that most households have between 4 and 6 members, indicating a balance between nuclear and extended family settings suggesting the potential need for more substantial resource allocations, including water access for domestic and agricultural use.

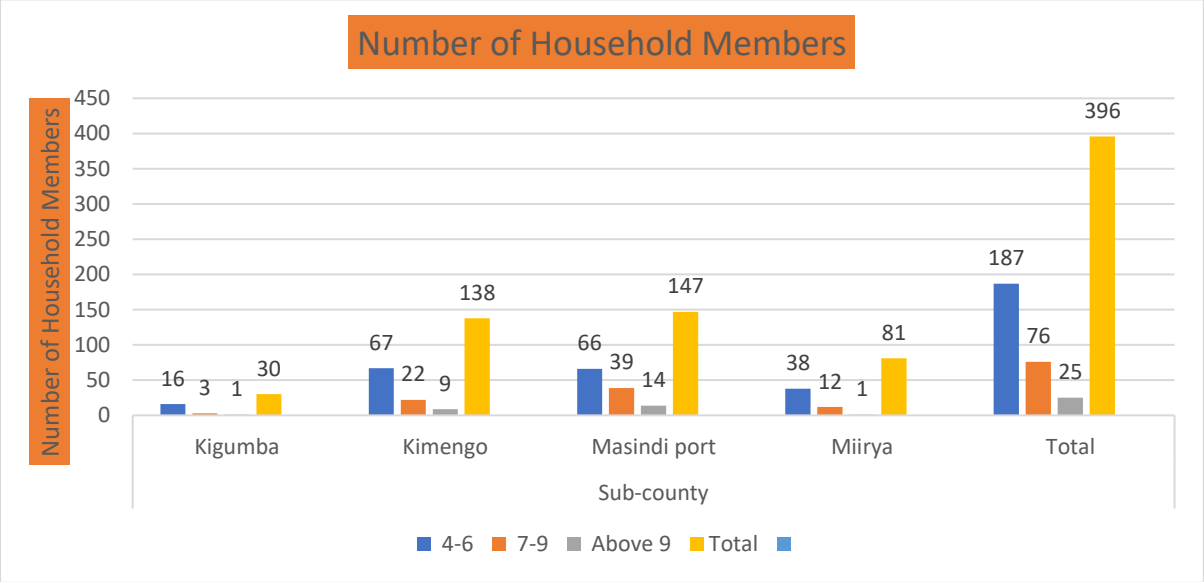


Figure 5-37: Household size

5.4.3 Household Conditions

5.4.3.1 Housing Conditions Analysis

The housing conditions in the project area, provides an understanding of the home/house ownership, rental status, and roofing materials. These factors are essential in evaluating the socioeconomic conditions of the households and determining their potential resilience in utilizing the proposed project (services)

Majority of households in the owned their houses, accounting for 344 (86.87%) of all respondents. The highest proportion of home/house ownership was recorded in Kigumba 29 (96.67%), followed by Masindi Port 140 (95.24%), Kimengo 113 (81.88%), and Miirya 62 (76.54%). The high rate of home/house ownership suggests that most households have a level

of stability in terms of shelter, which is a positive indicator for the feasibility of long-term development interventions in the area.

Rental housing constituted 46 (11.62%) of the total respondents, with Miirya having the highest proportion at 18 (22.22%), followed by Kimengo 22 (15.94%), Masindi Port 5 (3.4%), and Kigumba 1 (3.33%). The higher rental rates in Miirya and Kimengo may be attributed to population mobility, labor migration, or proximity to commercial centres where employment opportunities exist.

A small percentage of households 6 (1.52%) reported living in houses under a caretaking arrangement, where they neither own nor rent but reside with permission from the owner. This was observed in Kimengo 3 (2.17%), Masindi Port 2 (1.36%), and Miirya 1 (1.23%), with no such cases in Kigumba.

Concerning roofing conditions of the houses, among households that own their homes, the predominant roofing material was iron sheets, used in 238 (69.19%) of owned houses. This was highest in Kimengo 89 (78.76%), followed by Miirya 47 (75.81%), Masindi Port 85 (60.71%), and Kigumba 17 (58.62%). The widespread use of iron sheets indicated a shift towards more durable housing structures, which is a positive indicator for housing resilience against harsh weather conditions.

Despite this, grass-thatched roofs remain common, particularly in Masindi Port 55 (39.29%), followed by Kigumba 12 (41.38%), Kimengo 20 (17.7%), and Miirya 15 (24.19%), totalling 102 (29.65%) of all owned homes. A small number of households 4 (1.16%) in Kimengo reported using tin or scrap iron sheets as roofing material, reflecting possible financial constraints or resourcefulness in using available materials.

The high rate of home ownership across the sub-counties presents a favourable condition for implementing infrastructure and service-based interventions, as households have long-term residency in the area.

Table 5-7: Ownership status of the house (home)

Ownership status of the house (home)	Sub-county				
	Kigumba	Kimengo	Masindi port	Miirya	Total
Owned	29	113	140	62	344
	96.67	81.88	95.24	76.54	86.87
Rented	1	22	5	18	46
	3.33	15.94	3.4	22.22	11.62
Care taking	0	3	2	1	6

	0	2.17	1.36	1.23	1.52
Total	30	138	147	81	396
	100	100	100	100	100

Table 5-8: Type of roofing

Type of Roof	Sub-county									
	Kigumba		Kimengo		Masindi port		Miirya		Total	
Iron sheet	17	58.62	89	78.76	85	60.71	47	75.81	238	69.19
Grass thatched	12	41.38	20	17.7	55	39.29	15	24.19	102	29.65
Tin (scrap sheets of iron)	0	0	4	3.54	0	0	0	0	4	1.16
Total	29	100	113	100	140	100	62	100	344	100

Regarding the Wall Types majority of households (40.12%, 138 households) live in houses constructed with burnt bricks, with Miirya having the highest proportion (54.84%). Mud and wattle walls were reported in 28.78% (99 households), particularly in Masindi Port (34.29%) and Kimengo (24.78%), indicating a reliance on locally available materials. Cement-plastered houses, which signify improved construction quality, accounted for 15.41% (53 households), with Kimengo having the highest proportion (23.01%). The presence of mud blocks (8.14%) and poles and reeds (7.56%) in some areas suggests that a section of the population still resides in semi-permanent or less durable structures.

When analysed the flooring materials the most common flooring material was earth (52.62%, 181 households), highlighting the prevalence of unfinished housing floors. Masindi Port had the highest proportion of earth floors (57.14%), followed by Kigumba (58.62%). Cement screed floors were found in 36.05% (124 households), showing a significant share of households with improved flooring, particularly in Kimengo (38.05%) and Miirya (40.32%). Concrete slab flooring accounted for 9.88% (34 households), while floor tiles were the least common (1.45%, 5 households), primarily observed in Kimengo and Masindi Port. The dominance of earth floors indicates that many households still live in semi-permanent structures with limited access to improved housing amenities.

Overall, the housing conditions in the surveyed sub-counties reveal a mix of permanent and semi-permanent structures, with most households owning their homes. While iron sheets are the dominant roofing material, a significant proportion of houses still have grass-thatched

roofs, particularly in Masindi Port. Flooring conditions remain a key area for improvement, as more than half of the households still have earth floors.



Figure 5-38: The housing conditions in the project area

5.4.4 Form Of Vulnerability Distribution

Household vulnerabilities across proposed project area revealed various social and economic challenges that could impact household resilience and well-being.

One of the key findings is the prevalence of female-headed households, which make up 9 (23.68%) of the total households. These households are most common in Masindi Port 4 followed by Miirya 3 and Kimengo 2. Female-headed households often face economic hardships due to limited access to land, credit, and other productive resources, making them more vulnerable to poverty and food insecurity.

Another significant finding was the presence of child-headed households, which account for 5 (13.16%) of the total. These are most common in Kimengo 4 (30.77%) and Miirya 1 (16.67%), with none reported in Masindi Port. Child-headed households may arise due to parental mortality, family separation, or economic displacement, putting children at risk of exploitation, school dropout, and lack of basic needs. Such households require special interventions, including social protection and education support.

Elderly-headed households make up 4 (10.53%) of the total and are more prevalent in Kimengo 2 (15.38%) and Miirya 1 (16.67%), with a lower proportion in Masindi Port 1 (5.26%). These households may struggle with limited income, health issues, and reduced physical ability to engage in economic activities.

The data also highlighted the presence of household heads with chronic illnesses, 1 (2.63%) household this was reported in Masindi Port 1 (5.26%). Similarly, household heads with disabilities were recorded in 5 (13.16%) households, all in Kimengo 5 (38.46%), with none reported in Masindi Port and Miirya. Households with disabled members were noted in 4 (10.53%) households, mainly in Kimengo 3 (23.08%) and Masindi Port 1 (5.26%).

Another vulnerability observed was low education levels among household heads, with 2 (5.26%) households having education below the primary level. This is more common in Miirya 1 (16.67%) and Kimengo 1 (7.69%). The data also showed that widows and widowers make up 8 (21.05%) of the households. Widows were recorded in 5 (13.16%) households, particularly in Masindi Port 3 (15.79%), Miirya 1 (16.67%), and Kimengo 1 (7.69%). Widowers were found in 3 (7.89%) households, with cases in Kimengo 1 (7.69%) and Masindi Port 2 (10.53%). The loss of a spouse can lead to financial instability, particularly for widows who may face challenges accessing land and inheritance rights.

Other vulnerabilities identified include households with physical disabilities (2 (5.26%)), recorded in Kimengo 1 (7.69%) and Masindi Port 1 (5.26%). Households with visual impairments were 1 (2.63%), noted in Masindi Port 1 (5.26%). Households with hearing impairments were 1 (2.63%), recorded in Miirya 1 (16.67%). These conditions highlight the need for disability-inclusive services and support programs. Additionally, 1 (2.63%) household in Miirya 1 (16.67%) reported experiencing absolute poverty, indicating severe financial struggles and lack of access to basic needs such as food, healthcare, and education.

Overall, the findings indicated that female-headed households, elderly persons, child-headed households, and households with disabled or chronically ill members were among the most vulnerable groups in the project area. Addressing these challenges will require targeted interventions, including social protection programs, improved access to water services.

5.4.5 Physical Cultural Resources (PCRs)

As part of the ESIA for the MWACRID project, a detailed physical cultural resources (PCR) assessment was conducted through field surveys, consultations, and stakeholder meetings across Masindi and Kiryandongo Districts. The objective was to identify and document

archaeological, historical, ethnographic, and spiritual sites that may be directly or indirectly affected by the proposed bulk water supply and irrigation infrastructure.

A total of 30 cultural heritage sites were identified, comprising 15 churches, 4 mosques, 1 burial site, 3 archaeological sites, and 7 medicinal plant sites. These sites are of varying historical and spiritual significance and are dispersed across sub-counties such as Masindi Port, Kimengo, and Kaduku. Some sites, including mosques and churches, are still actively used, while others like burial sites and Iron Age archaeological remains reflect historical community practices and settlement.

Of the 30 identified PCRs, 10 are expected to be directly affected by the construction activities particularly along pipeline alignments while the remaining 20 may experience indirect impacts due to their proximity to the project footprint. Specific sites within or near the intake, treatment plant, and distribution lines such as the Kitukuza Burial Site, Kaduku II Iron Age Site, and Myeba Iron Age Site are of archaeological significance and require preservation attention. Several medicinal plant sites, including those in Ndabulya, Kaduku, and Myeba villages, are culturally important due to their traditional health applications.

The consultative process confirmed that both tangible and intangible cultural resources were considered, although formal district heritage registers were lacking. Local leaders and community members contributed significantly to the identification and contextual understanding of the sites. The potential for accidental discovery of PCRs during construction was also highlighted, necessitating the development of a PCR Chance Finds Procedure, to be implemented alongside stakeholder engagement throughout the project lifecycle. For detailed site descriptions, GPS coordinates, condition assessments, and photographic documentation, refer to the PCR Study Report in Appendix 3 of this ESIA.

5.4.6 Economic activities

Agriculture is the main economic activity in the districts of Masindi and Kiryandongo, involving both smallholder and commercial farming. The main crops grown are maize, beans, cassava, and coffee, significantly affected by unreliable rainfall. Livestock farming, particularly cattle, is mainly practised in the Kimengo sub-county in the Masindi district and Masindi port in the Kiryandongo district.

Kiryandongo District: Kiryandongo District has great potential for agriculture and livestock production. The region mainly focuses on growing staple crops like maize, beans, and cassava. The Agricultural Cluster Development Project (ACDP) and the District Rural Development Investment Programme (DRDIP) are important initiatives that aim to improve the processing of these crops. The district benefits from diverse Agroecological conditions, which support various agricultural activities, including dairy, beef, and honey production.

Effective water management is crucial for optimizing agricultural productivity in Kiryandongo. The construction of communal valley tanks and irrigation systems is essential for addressing

water challenges and ensuring a reliable water supply for agricultural activities. The National Agricultural Advisory Services (NAADS) has a significant role in supporting dairy farming by providing resources and infrastructure to facilitate dairy value addition.

The district's surplus cassava production provides opportunities for developing ethanol and starch production facilities. Support from DRDIP, NAADS, and ACDP can significantly boost these sectors. Furthermore, the ample rangelands in Mutunda, Kiryandongo, and Masindi Port Sub-Counties offer the potential for expanding beef production. The honey market, both locally and internationally, is also growing, supporting the expansion of honey value addition in the region.

5.4.7 Livestock Sector

Kiryandongo is a prominent cattle corridor district with a large number of pastoralists. The district's cattle population is substantial, totaling 72,586, including 40% crosses, and the average daily milk production is 7,300 litres. Specific figures for key sub-counties highlight the importance of livestock in the district's economy: Masindi Port Sub-County has 21,200 cattle, while Kigumba Sub-County has 8,452 cattle.

In addition to cattle, poultry production is rapidly expanding in Kiryandongo. Major commercial farms, such as Quantum Foods, produce eggs for local and neighboring markets. Goat production is also rising, adding to the district's diverse livestock offerings. Although commercial piggery is still developing, it holds great promise for future growth.

Masindi District: Masindi is an agricultural district that relies heavily on food and livestock production as its main economic activities. The district produces food crops such as cassava, bananas, sweet potatoes, beans, and maize, and also grows cash crops like coffee, cocoa, and sugar cane, which significantly impacts food production due to the large land area dedicated to sugar cane cultivation.

Cattle rearing is primarily practiced in the sub-counties of Kimengo and some parts of Bwijanga, while beekeeping is another key economic activity in the sub-county. Miirya, on the other hand, focuses on crop production, mainly producing maize, sunflower, vegetables, and fruits.

Masindi District benefits from well-trained and experienced staff, including extension workers and active farmer groups like the Masindi Agricultural Demonstration and Extension Centre (MADEC). The presence of demonstration sites and the availability of new technologies provide valuable platforms for innovation and skill-building in farming practices. Additionally, there is strong interest among local farmers in livestock farming, supported by government programs such as the National Agricultural Advisory Services (NAADS) and partnerships with external development organizations. Local farmers in the district have shown a willingness to

adopt new technologies, offering an excellent opportunity to integrate improved water management systems, such as irrigation, into agricultural practices.

5.4.8 Commercial farmer's contribution to economic activities

Concerning the commercial farmers in the area of interest, the farmers are involved in various agricultural activities. Soul Agric-business is engaged in diverse agricultural activities such as crop production (cassava, maize, matooke, beekeeping, coffee cultivation, and maintaining orchards). Keith Farm focuses on livestock farming, raising around 500 cattle, 400 goats, 20 sheep, and 300 poultry. Kiiza Farm specializes in dairy farming with approximately 180 Friesian cows. Additionally, Ebenezer Farm combines livestock farming with grass farming, maintaining about 74 cattle and 29 goats, and selling grass to other livestock farmers. These various farming practices showcase the specialization and diversification among commercial farmers in the area.

5.4.9 Gender aspects

Gender and economic activities in the area of interest cater to both males and females. Commercial farms play a significant role in the local economy in terms of employment and gender inclusion. Soul Agric-business is a major employer with over 50 permanent workers and around 500 casual or seasonal workers, 60% of whom are female. This indicates a significant contribution to gender-inclusive employment. In contrast, Keith Farm employs around 20 workers, including 5 females, while Kiiza Farm has about 12 workers, with only 2 being female. Ebenezer Farm employs 6 workers, with just 1 female. The data suggests a need for more balanced gender representation in the workforce across these farms.

5.4.10 Land Tenure and Use

Land tenure regimes and transfer of land: Article 237 of the Constitution (1995) vests land in citizens of Uganda and identifies four land tenure systems: customary, freehold, Mailo, and leasehold. These systems are detailed under Section 4 of the Land Act (Cap 227) as outlined below:

a. **Customary Tenure:** Land is owned in perpetuity and is governed by rules generally accepted as binding and authoritative by the relevant community. Customary occupants have a proprietary interest in the land. They are entitled to certificates of customary ownership acquired through application to the Parish Land Committee and eventual issuance by the District Land Board.
b. **Freehold Tenure:** This tenure enables the holder to exercise full powers of ownership subject to the law, either in perpetuity or for a fixed period.

c. **Leasehold Tenure**: This system is created either by contract or by operation of the law, granting the tenant or lessee exclusive possession of the land for a defined period in return for rent.

d. **Mailo Tenure:** The British introduced this feudal ownership system in 1900 under the Buganda Agreement, with "Mailo" meaning “mile” in Luganda. Mailo land parcels have title deeds. Persons who buy portions (kibanja) on Mailo land are protected by Ugandan law to live on and use the land and are obligated to pay certain annual royalties to the Mailo owner. In cases of compensation, land value is apportioned to the Kibanja and land owners.

In Masindi and Kiryandongo Districts, there was a significant variation in the availability of land for commercial farming among commercial farmers. Soul Agric-business, for example, operates on a large scale with 4,250 acres of leased land from the Uganda Investment Authority. Similarly, most of the commercial farmers in the area have acquired land through the lease system from the Uganda Investment Authority, while some own land on a freehold basis.

5.4.11 Water Supply and Access

Access to water is a significant issue in all four sub-counties, but the extent of the problem varies. Kimengo Sub-County has 18 boreholes but faces severe water stress during droughts, often resulting in humans sharing water sources with animals. Miirya Sub-County has about 20 boreholes distributed across its three parishes, which provides slightly better water access, although the situation remains challenging. In Masindi Port Sub-County, the water issue is more acute, particularly for businesses along the ferry point, due to the lack of safe drinking water sources despite some boreholes. Kigumba Sub-County has both protected and unprotected water sources, and efforts to improve water access include the recent construction of eight boreholes and the rehabilitation of an additional one. While some progress has been made, there remains a need for reliable and safe water sources across all sub-counties to address water scarcity, especially in dry seasons.

According to the NWSC Customer Satisfaction Survey FY2023/24 report, Masindi district had a Customer Satisfaction Index (CSI) of 91% while Kiryandongo recorded the lowest at 54%. Although Masindi recorded a higher percentage on the CSI, poor water quality was mentioned in Masindi.

Masindi NWSC reported that only 50% of customers are willing to pay their water bills. Additionally, Kimengo sub-county faces the biggest challenge in terms of water levels.

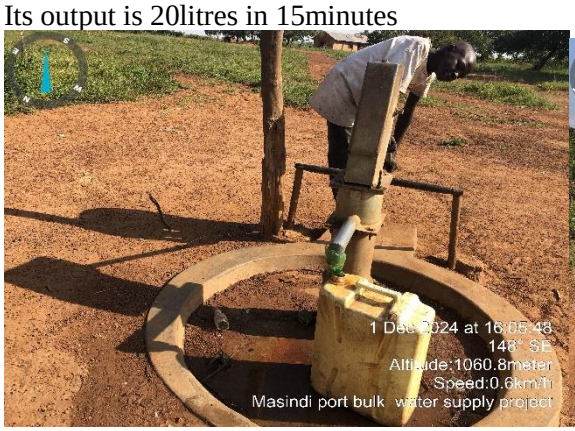
Kimengo Primary School Borehole
Kimengo Primary School Located At Kimengo Sub-County in Masindi District
Coordinates; 384193E, 173487N
Constructed 28/01/2024 by the ministry of water through a charity program funded by THE WATER TRUST
Its output is “10 litres jerry can take up to 15minutes to full”

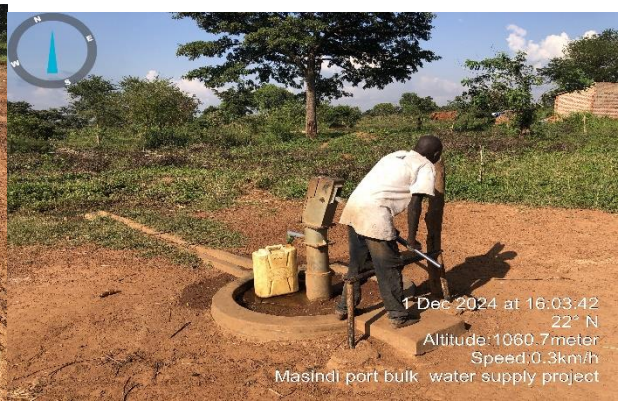




Myeba Community School Borehole

Located at Myeba Community Primary School at Myeba Village
Kimengo Sub-County in Masindi District
Coordinates; 386339E, 180881N
Its output is 20litres in 15minutes





Myeba community school borehole

Kabagambe James's dam

Located at Myeba-2 village, Kimengo sub-county, Masindi district
Coordinates; 386032E, 17921N
Was purposely established to provide water for cattle on individual basis but due to increased scarcity. This dam turned out to be the community's secondary source of water for domestic use.





Kabagambe's dam at Myeba village

Yohana Byaruhanga's dam at Myeba-1 village, Kimengo sub-county in Masindi district

Coordinates; 384921E, 177934N
This dam was purposely established to reserve water for cattle and other farm activities and is restricted for community use.



Yohana‘s dam at Myeba-1 village

Masindi health Centre 3 bore hole

Coordinates; 397448E, 187752N

Constructed 12/04/2024

Output is 20litres per 20minutes

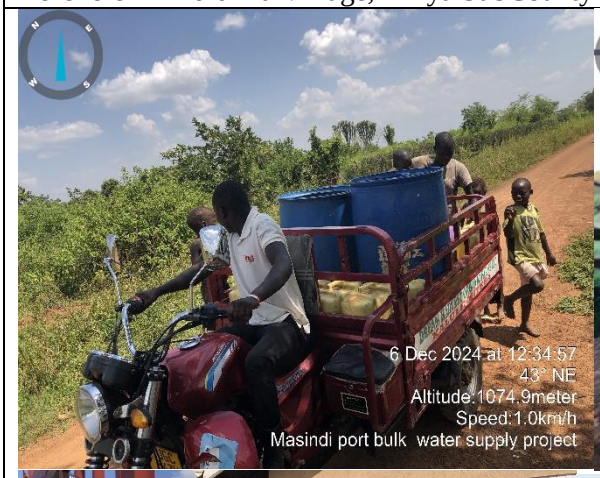








Borehole in Kididima Village, Mirya SubCounty









The storage facilities in these areas consisted of:Water tanks, drums and jerry cans

5.4.12 Source of Energy

In the four sub-counties, the energy infrastructure is characterized by limited grid electricity coverage, with a heavy reliance on solar energy. For example, in Kimengo Sub-County, grid

electricity supply is scarce, and most households as well as the Health Centre III depend on solar power. Similarly, in Miirya Sub-County, there is limited grid electricity, with most households and health centers using solar systems, except for a few facilities connected to the grid along the main roads.

In Masindi Port Sub-County, grid electricity is mainly limited to Kitukuza and Waibango parishes, while the rest of the community relies on solar energy. In Kigumba Sub-County, there is better grid coverage in extensive trading centers; however, many households still use solar systems for lighting.

Across these sub-counties, the lack of extensive grid coverage poses challenges for development, requiring an energy infrastructure to support local growth and livelihoods.

5.4.13 Works and Transport

The infrastructure for works and transport varies across the sub-counties. In Kimengo Sub-County, the roads are well-developed, with the sub-county being served by the tarmac Masindi–Kampala Road and several motorable roads, providing good connectivity. The Masindi–Kampala Road partially serves Miirya Sub-County; however, some roads are affected by poor drainage and swampy areas, making them impassable during the rainy seasons. In Masindi Port Sub-County, transport infrastructure is under development, with ongoing construction to upgrade Masindi Port Road from gravel to tarmac. The sub-county also benefits from its location along the Gulu highway. Kigumba Sub-County enjoys relatively better transport infrastructure, with the Kampala-Gulu highway and Kigumba-Masindi Road, both tarmacked, providing good accessibility alongside several motorable feeder roads. While some sub-counties have benefited from infrastructure development, others require significant improvements to enhance connectivity and support local economic activities.

6 STAKEHOLDER CONSULTATIONS AND DISCLOSURE

Stakeholder consultation is an integral part of the environmental and social assessment. The consultant conducted stakeholder engagement with the overall objective of documenting the concerns of the stakeholders with specific reference to the project planned interventions. The consultation meetings were organized basically for two important purposes, i.e., to introduce the consultant to the stakeholder groups and to consult with the stakeholders and document their concern, with particular reference to environmental and social impacts of the proposed project interventions.

6.1 Stakeholder analysis

The stakeholder analysis showed in the table below indicates the key stakeholders in this project.

Table 6-1: Stakeholder analysis

Category	Stakeholder	Primary	Secondary	Interests
Regional Organisation	Nile Basin Commission (NBC)	Yes		• NBC has the responsibility to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile basin water resources. • It will provide a platform for prior notification, information exchange and further discussion between countries.
Government of Uganda	Ministry of Water and Environment (MWE)	Yes		• MWE is the Project proponent, beneficiary of financing for the proposed project and ESIA during implementation. • It has the overall responsibility of the development, managing, and regulating water and Environment resources in Uganda.
	Department of Water Development (DWD)-MWE	Yes		• DWD is responsible for providing overall technical oversight for the planning, implementation and supervision of the delivery of urban, rural water and sanitation services, and water for production across the country. DWD is

Category	Stakeholder	Primary	Secondary	Interests
				responsible for regulation of provision of water supply and sanitation and the provision of capacity development and other support services to Local Governments, Private Operators and other service providers.
	Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	Yes		• Established by MWE in collaboration with its development partners as a funding mechanism to focus on provision of water supply and sanitation in Small Towns in the Northern region of Uganda. • It is the project implementing agency which makes it a primary stakeholder.
	Ministry of Gender Labour and Social Development (MGLSD)		Yes	• MGSLD is a secondary stakeholder and will be interested primarily in labour conditions during construction and the entire project development: ✓ Community Rehabilitation Programme for the Disabled (CBR), ✓ Occupational Health and Safety ✓ Functional Adult Literacy Programme (FAL), ✓ Support to AIDS Orphans and Other Vulnerable Children (PCY), ✓ Elimination of Child Labour.
	National Environmental Management Authority		Yes	• NEMA spearheads the development of environmental policies, laws, regulations, standards and guidelines; and

Category	Stakeholder	Primary	Secondary	Interests
	(NEMA)			guides Government on sound environment management in Uganda. • It approves ESIA reports and issues the ESIA certificates to developers.
	National Forestry Authority (NFA)		Yes	The National Forestry Authority (NFA) is a key institutional stakeholder in this project because the reservoir tanks for the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure will be located on Kaduku Hill, which is part of the Kaduku Central Forest Reserve.
	Uganda Investment Authority (UIA)		Yes	As an Investment Promotion Agency, UIA mainly: markets investment opportunities; promotes packaged investment projects; ensures local and foreign investors have access to information, especially about the business environment so as to make more informed business decisions; and offers business support, advisory and advocacy services. The majority of the project area encompasses two agricultural parks, one in Kiryandongo (6 square miles) and another in Masindi (20 square miles), both managed by the Uganda Investment Authority (UIA). UIA formally requested the Ministry of Water and Environment (MWE) to provide water for production and irrigation to support the farmers in these areas.
	National Water and Sewerage Cooperation (NWSC)			NWSC is a parastatal that operates and provides water and sewerage services for 111 urban centres across the country. Sector reforms in the period

Category	Stakeholder	Primary	Secondary	Interests
				1998-2003 included commercialization and modernization of the NWSC operating in cities and larger towns as well as decentralization and private sector participation in small towns. NWSC also operates small conventional sewage treatment plants in a series of towns. National Water and Sewerage Corporation (NWSC) is working on a project aimed at improving sanitation and water delivery in Lira, Hoima, and Fort Portal and this project is considering the Nile River at Masindi Port as the intake
Local Governments	Districts of Kiryandongo and Masindi	Yes		The project is situated in two districts. Stakeholder consultations have been made in three of the four districts to inform the inception and ESIA reports. These are also key in mobilizing communities, managing water resources, and ensuring local policies align with project activities. Details consultation shall also be undertaken during the detailed ESIA studies.
Communities	Masindi Port Subcounty; Kigumba Subcounty; Mirya Subcounty;Kimengo Subcounty	Yes		• Communities will derive direct benefit from project development in form of construction jobs and reliable supply of safe water supply.
NGO/Private Sector	NGO/Private Sector		Yes	• NGOs and private sectors support community development work promote water for production
Farmers' Organizations which include	Farmers' Organizations		Yes	• Operate and Maintain irrigation facilities sustainably;

Category	Stakeholder	Primary	Secondary	Interests
community groups, associations and cooperatives among others				• Make and implement Bye-laws; • Participate in capacity building programs; • Participate in site identification for irrigation facilities; • Participate in monitoring and evaluation; • Participate in sustainable natural resource management in water for production development.

6.2 Approach for Consultation

The following methods were used to conduct consultations during the ESIA exercise:

i. Meeting with relevant stake holders
ii. Key informant interviews
iii. Observation tool

List of stakeholder consulted and minutes for the ESIA exercise is presented in the Appendix B.

6.3 Findings from Stakeholders Consultations

In the process, stakeholder consultations were carried out in the two (2) project districts and in all four (4) sub-counties for two days that is December 17-18/2024 and March 15th-18th 2025 covering particularly district level line departments including; District Water Officer, who led the team to the offices of the Chief Administrative Officer (CAO), the Resident District Commissioner (RDC), and the District Chairperson, Natural Resources and Environment. Additional stakeholder consultations were conducted at the community level across all four sub-counties—Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District—from November 28 to December 14, 2024. A summary of the key findings from the consultation process are presented in Table 6-2; 6-3 and 6-4 while a detailed transcription of the meetings is provided in Appendix B.

6.4 The Consultation Process

The MWACRID Project enhances water availability for irrigation, drinking, and livestock farming in Kiryandongo and Masindi districts. Various stakeholders, including commercial farmers, were consulted to ensure that the project is aligned with practical needs on the ground and can address the specific requirements of different agricultural businesses. Understanding

the needs and limitations of these stakeholders is a crucial aspect of ensuring the successful implementation of the project.

6.5 District leadership

a. Need for Water:

In both Kiryandongo and Masindi districts, stakeholders have consistently emphasized the critical need for water. The Water Engineer in Kiryandongo District highlighted the region's prolonged water stress and emphasized that the Bulk Water Supply and Irrigation Infrastructure project would significantly benefit both domestic use and agricultural production. The Chief Administrative Officer (CAO) of Kiryandongo district also stressed that water scarcity affects both small-scale and commercial farmers, particularly maize growers and livestock farmers. Past interventions, such as borehole drilling and valley tank construction, have been insufficient. In Masindi District, the sub-county chairperson for Kimengo and other officials reiterated the severe water scarcity, pointing out that the entire sub-county lacks adequate water for consumption and livestock. Efforts to drill boreholes have failed. The Regional District Commissioner (RDC) and other leaders across both districts stressed that the need for water is urgent and requested the inclusion of additional areas in the feasibility studies to extend the project's impact.

a) Willingness:

The stakeholders shown strong support and willingness to participate in the Bulk Water Supply and Irrigation Infrastructure project. In Masindi District, the CAO acknowledged that the project is demand-driven, indicating that communities are likely to use and even pay for the water services provided. The district chairpersons and sub-county chairpersons also expressed their willingness to see the project succeed. Additionally, the RDC of Kiryandongo committed to facilitating community engagement and preventing any potential misunderstandings during the feasibility study. The commitment from local leaders to engage their technical and political teams to support community mobilization further demonstrates the districts' willingness to embrace and facilitate the project.

b) Support for the Project:

The stakeholders in both Kiryandongo and Masindi districts strongly supports the Bulk Water Supply and Irrigation Infrastructure project. In Kiryandongo District, the Vice Chairperson, RDC, and other officials welcomed the Ministry of Water and Environment (MWE) and the consortium of consultants. They emphasized the district's inability to manage water issues without external support. They assured the project team of their commitment to assisting with community mobilization and addressing logistical challenges. In Masindi District, the Chief Administrative Officer (CAO) and district chairperson expressed their readiness to collaborate, offering support in mobilizing technical teams and engaging communities. The RDC in Masindi also pledged to support the team in addressing potential land disputes and providing security when necessary. This indicates the level of commitment from the local leadership to ensure the project's successful implementation.

c) Grievance Management:

Effective management of grievances is a major concern highlighted by stakeholders in both districts. The Resident District Commissioner (RDC) of Kiryandongo District assured the project team of his willingness to address any social or cultural issues, such as misunderstandings among local communities. He stressed the importance of engaging reliable contractors to prevent problems related to poor performance and contract terminations. In Masindi District, the RDC mentioned potential environmental concerns and the need to collaborate with the National Environment Management Authority (NEMA) to address such issues proactively. The officials also emphasized the importance of clear communication and ongoing community sensitization to minimize potential grievances related to land acquisition or project activities. This focus on addressing community concerns and grievances demonstrates the commitment of the local leadership to create a supportive environment for the project and ensure its smooth implementation.

- **Commercial farmers**

Among the commercial farmers consulted, key information was noted:

a) Availability of land for agriculture

The availability of land for commercial farming varied significantly among the farmers we spoke with. Soul Agric-business operates on a large scale with 4,250 acres of leased land from the Uganda Investment Authority, allowing for diverse crop production and other agricultural activities. In contrast, Keith Farm has approximately 100 acres of freehold land, while Kiiza Farm owns 250 acres under freehold tenure. With over 100 acres, Ebenezer Farm utilises its land for crop and livestock farming. The size of the landholding plays a crucial role in determining the scale and type of farming enterprises these stakeholders undertake.

b) Duration in the sector of agriculture

The consulted farms have varying durations of operation. Keith Farm and Kiiza Farm have existed for over 20 years, showing a long-term commitment to farming and likely possessing more established practices and market connections. Ebenezer Farm has been operating for over 10 years, and Soul Agric-business has existed for over 5 years. These farms' longevity suggests resilience and a depth of knowledge in managing agricultural enterprises.

c) Type of farming

In terms of the types of farming, the farmers practice crop production and livestock farming. Soul Agric-business engages in diverse agricultural activities, including crop production such as cassava, maize, matooke, beekeeping, coffee cultivation, and maintaining orchards. On the other hand, Keith Farm focuses on livestock farming, raising approximately 500 cattle, 400 goats, 20 sheep, and 300 poultry. Similarly, Kiiza Farm specializes in dairy farming with around 180 Friesian cows. At the same time, Ebenezer Farm combines livestock farming with grass farming, maintaining approximately 74 cattle and 29 goats and selling grass to other livestock farmers. These diverse farming types show a range of specialization and diversification among commercial farmers.

d) Annual yields

The annual yields and income from farming activities vary across the farms. Keith Farm generates approximately 60 million Ugandan shillings annually, reflecting high productivity, likely due to its livestock operations. Kiiza Farm, on the other hand, earns around 30 million Ugandan shillings per year from its dairy farming activities. Ebenezer Farm reports an annual yield of over 20 million Ugandan shillings. These figures highlight the varying scales of operation and productivity levels among commercial farmers, influenced by factors such as farm size, type of farming, and access to resources.

e) Technical and Extension Services

Access to technical and extension services is crucial for enhancing productivity and addressing farming challenges. Soul Agric-business employs technical workers and consults with district extension officers for additional advice. Similarly, Keith Farm and Kiiza Farm receive timely technical services to support their farming operations. Ebenezer Farm benefits from regular extension services, enabling effective maintenance of their agricultural activities. Access to these services allows farmers to adopt improved farming practices and respond better to their challenges.

f) Irrigation systems

The irrigation systems used by the farmers we consulted vary, reflecting different levels of investment and access to water resources. Soul Agric-business primarily uses manual watering, which may limit the scale and efficiency of its farming operations. Keith Farm and Kiiza Farm rely on unprotected dams for livestock watering, which may pose water quality risks. In contrast, Ebenezer Farm uses a solar-powered borehole to supply water to the farm and about 20 households, in addition to having an unprotected dam for livestock. The variety in irrigation methods highlights the diverse approaches to water management and the need for more sustainable water solutions.

g) Employment and gender inclusion

In terms of employment and gender inclusion, these farms play a significant role in the local economy. Soul Agric-business is a major employer, with over 50 permanent workers and around 500 casual or seasonal workers, 60% of whom are female. This indicates a considerable contribution to gender-inclusive employment. In contrast, Keith Farm employs around 20 workers, including 5 females, while Kiiza Farm has about 12 workers, with only 2 being female. Ebenezer Farm employs 6 workers, with just 1 female. The data suggests a need for more balanced gender representation in the workforce across these farms.

h) Challenges faced by the farmers

Commercial farmers face various challenges, with water scarcity being the most significant. Soul Agric-business, Keith Farm, and Kiiza Farm all experience water stress, impacting their livestock and crop farming activities. Ebenezer Farm relies on an unprotected dam, posing water quality and availability risks. These challenges underscore the critical need for improved water management solutions, such as the proposed Masindi Bulk Water Transfer Project. This project aims to support sustainable agricultural practices and enhance regional commercial farmers' productivity.

6.6 Findings from Stakeholders Consultations

The agenda of the consultations was structured as follows;

- Opening prayer
- Self-introduction
- Communication from the chairman
- Communication from the MWE representative
- Communication from consultant
- Reactions from district and subcounty representatives
- Closing remarks.

Table 6-2: Matrix table summary of consultations

Category	Designation	Concerns Raised
National Forestry Authority (NFA)	NFA Head Office, Kampala	• NFA was not engaged in initial ESIA stages. • Requested coordinates (KML) of Kaduku and Kitukuza CFR. • Sought joint inspection at hotspots (Kaduku & Kitukuza). • Clarified land ownership of Kaduku CFR belongs to NFA. • Emphasized need for biodiversity assessments, RAP considerations, offset planning, and valuation of affected forest resources. • Consultant to share KML coordinates of project sites. • Joint site inspection to be arranged with NFA. • Comprehensive ecological, RAP, and valuation assessments to be conducted. • Timeline for assessments to be shared with NFA
Wetlands Management Department-MWE	Assistant Commissioner's Office	• Ensure farming activities remain outside wetland buffer zones. • Chemical use by farmers must be managed to prevent wetland pollution. • Need for estimated daily water abstraction volumes. • Project infrastructure must not encroach on wetland ecosystems. • Requested details on crops to be grown. • Consultant to submit information on crops and agro-chemicals to be used. • Provide estimated water abstraction volumes.

Category	Designation	Concerns Raised
		• Apply for water abstraction permits. • Ensure all infrastructure is sited outside wetland buffer zones. • Plan for a field visit to wetlands with Wetlands Department.
Bunyoro Kitara Kingdom	Bunyoro Kitara Kingdom Secretary's Office	• Kaduku Hill CFR is Kingdom land, managed by NFA under MoU. • Kingdom plans to build a palace on Kaduku Hill. • Kingdom open to offering alternative land if compensated. • Squatter issues on proposed treatment plant site. • Requested formal communication from MWE about project intentions. • Boundary opening and valuation of Kaduku CFR requested. • MWE to formally write to the Kingdom expressing project intentions. • Initiate boundary opening and land valuation assessments for Kaduku Hill. • Assess and resolve squatter issues. • Discuss potential compensation mechanisms with Kingdom.
Nile Basin Commission (NBC)	Virtual	• Environmental and Social Safeguard studies are pre-requisite for water resources development. • The country interested in withdrawing water must notify the downstream countries along with the necessary documentation such as a project brief. • Given the small percentage of abstraction and minimal impact on water levels, the impact on downstream impacts and the overall river regime is considered not significant.
Ministry of Works and Transport (MoWT)		• No objection to project, provided road crossings are coordinated with Road Engineering Department. • Caution against duplicate compensation along Rwenkunye–Masindi Port road corridor. • Noted flooding issues at Gulu-Kampala Highway crossing.

Category	Designation	Concerns Raised
		• Raised concerns over HIV/AIDS risk during construction phase. • Emphasized thorough community sensitisation for RAP implementation. • Consultant to coordinate with MoWT for road crossing procedures. • Design to consider flooding-prone areas. • RAP to include robust community sensitisation. • MoWT to communicate with the Commissioner for National Roads and schedule a follow-up meeting for further guidance.
Kiryandongo District Local Government	Water Office-Water Engineer	▪ The Water Engineer expressed appreciation for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted the district's long-standing water stress issues and noted that the project's implementation would significantly support domestic use and production. ▪ The Water Engineer committed to providing necessary documentation, such as water coverage data and relevant statistics, to support the feasibility study report.
	Chief Administrative Officer (CAO)	▪ The CAO thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted that the proposed area indeed lacks water for their animals. ▪ The CAO mentioned that the district has made several interventions like drilling boreholes, but these were insufficient. Even the valley tanks they constructed could not meet the needs. ▪ He noted that the number of animal farms is significant, and he believes the proposed

Category	Designation	Concerns Raised
		project will support these farms and improve domestic water use. ▪ The CAO emphasized the need to consider small and subsistence farmers to benefit from the project. He asked the team to explain how this would be achieved and sought details on how the consortium of consultants would work and implement the assignment. ▪ He stressed the community's urgent need for water, particularly for modern farming practices, as the area is mainly occupied by maize growers.
	District Vice Chairperson	▪ The District Vice Chairperson thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted that the proposed area indeed lacks water for their animals. ▪ The District Vice Chairperson acknowledged that Kiryandongo District cannot stand alone and manage without the support from the ministries, and therefore welcomed the team to Kiryandongo District. He committed to providing support to the team while executing the assignment. He added that when the right time comes, the district will support in mobilization and engagements. ▪ He noted that the project areas have some refugees who have bought land and settled in the areas where the project has been proposed.
	Resident District Commissioner (RDC)	▪ The RDC welcomed and thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted that the proposed area indeed lacks water for their animals.

Category	Designation	Concerns Raised
		▪ The RDC emphasized the serious need for water in the area and requested that the feasibility study be extended to other areas not initially considered for the Masindi Port Bulk Water Supply and Irrigation Infrastructure project. ▪ The RDC committed to supporting the project, including addressing accessibility, social, and cultural issues. ▪ The RDC assured the team that he would communicate with the local communities to prevent misunderstandings, such as mistaking the feasibility team for land grabbers.
Masindi District Local Government	Chief Administrative Officer (CAO)	▪ The CAO thanked the MWE for proposing the Bulk Water Supply and Irrigation Infrastructure project. She noted that she was only two days into her role as CAO. ▪ The CAO acknowledged that since the project is demand-driven, people are likely to be willing to use and pay for the service. However, she sought clarity on whether the project would be free or if users would have to pay, how the management system would work, and whether the District Development Plan (DDP) captures these future plans.
	District Chairperson	▪ The district chairperson thanked the MWE for proposing the Bulk Water Supply and Irrigation Infrastructure project. ▪ The district chairperson noted that this project has come at a much-needed time for the people. He informed the team that, as a district, they have tried to drill boreholes in this area but have not succeeded. ▪ The district chairperson assured his full support. ▪ He committed to mobilizing his political team to assist with community engagement. The district chairperson looked forward to a

Category	Designation	Concerns Raised
		successful partnership, ensuring the project's objectives are met efficiently and effectively.
	Resident District Commissioner (RDC)	▪ The RDC welcomed and thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. ▪ The RDC noted that the project has environmental concerns and there is a need to consult and engage with NEMA. ▪ The RDC anticipated land wrangles and pledged to support the team, informing them to approach him at any time when encountering such land-related issues. He committed to providing security support whenever necessary. ▪ The RDC informed the team that the office of the president is committed to dealing with corruption. He committed to providing support in the sensitization process of the project.
	Kimengo Sub County	▪ The sub-county chairperson thanked the MWE for proposing the Bulk Water Supply and Irrigation Infrastructure project. ▪ The sub-county chairperson noted that this project has come at a much-needed time for the people. He informed the team that the entire sub-county does not have adequate water for consumption or livestock. Efforts to drill boreholes have failed, and the sub-county has never seen tapped water. ▪ He mentioned that an animal census survey indicated Kimengo Sub County had the highest number of livestock in the area, yet they lack water for their livestock. ▪ The sub-county chairperson shared pictures of water-stressed people and livestock, requesting an expedited project timeline and the inclusion of other areas in the sub-county during the feasibility studies.

Category	Designation	Concerns Raised
		▪ He assured his full support and commitment to mobilizing his political team for community engagement. The sub-county chairperson looked forward to a successful partnership, ensuring the project's objectives are met efficiently and effectively.
Commercial Famers	Soul Agric Business Company	▪ The commercial farm proprietor mentioned that the farm spans approximately 4,000 acres, growing crops like cassava, soya beans, maize, coffee, macadamia, paw paws, and matooke, among others. ▪ He highlighted the difficulties faced during drought seasons and requested the expeditious extension of water supply for production to their farm.

Table 6-3: Summary of key issues raised from consultations with communities

Key Issue	Community Concern	Response/Resolution
Access to Water for the Community	Concern about prioritization of big companies over community use.	The project will provide water for both commercial and domestic use.
Land Acquisition and Displacement	Fear of land loss and displacement due to project activities.	The project will minimize land take and compensate affected individuals per national guidelines.
Employment Opportunities	Community members, including women, inquired about job availability.	Both skilled and unskilled jobs will be available, with gender considerations in hiring.
Project Implementation Timeline	Community wanted to know when the project would start.	The project is in the feasibility stage; implementation depends on approvals and funding.
Water Pricing and Billing	Concern over water costs and payment procedures.	Water pricing will be determined by the service provider, based on consumption.
Water Quality	Concerns about the water being "hard water."	Water will be treated according to national and WHO standards for safety.

Table 6-4: Summary of key issues showing each entity's interests, potential concerns, and expectations during implementation and operation

Stakeholder	Primary	Secondary	Concerns / Interests
Ministry of Water and Environment (MWE)	Yes		• Effective implementation of the project to meet national water and irrigation targets. • Ensuring that all designs meet the technical and environmental standards. • Full compliance with ESIA requirements and integration of climate resilience measures. • Oversight of stakeholder coordination and institutional collaboration. • Ensuring sustainability mechanisms are embedded in operation and maintenance.
Department of Water Development (DWD) – MWE	Yes		• Quality assurance in water infrastructure design and delivery. • Proper integration of irrigation and domestic water supply systems. • Technical integrity of pipelines, reservoirs, and off-takes. • Coordinating capacity building for District Water Offices and Water User Committees. • Harmonization of implementation with Uganda's water for production strategy.
Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	Yes		• Ensuring irrigation infrastructure supports planned agricultural transformation. • Promotion of climate-smart agriculture alongside water infrastructure. • Linkage of irrigation services with extension services and agro-input support. • Avoidance of conflicts between livestock and crop farmers over shared water infrastructure.

Stakeholder	Primary	Secondary	Concerns / Interests
			• - Ensuring agricultural productivity from irrigated land to justify investment.
Office of the Prime Minister (OPM) – Bweyale Refugee Settlement		Yes	• Ensuring refugees in Bweyale Settlement are integrated in irrigation planning and benefit from water access • .Prevention of marginalization or exclusion of vulnerable refugee groups. • Coordination of land and water use between host and refugee communities. • Support for food self-sufficiency among refugees given WFP food aid reductions • Avoiding conflict between refugees and host communities over water access.
Ministry of Gender, Labour and Social Development (MGLSD)		Yes	• Ensuring fair labour practices, especially during construction (wages, working hours, safety). • Prevention of child labour and exploitation on project sites.- Inclusion of women, youth, and persons with disabilities in employment and training • .Integrating Gender-Based Violence (GBV) mitigation measures in labour camps. • Supporting functional adult literacy and empowerment programs where needed.
National Environmental Management Authority (NEMA)		Yes	• Reviewing and approving the ESIA and associated environmental management plans. • Monitoring compliance with the approved environmental permit conditions. • Ensuring biodiversity, water quality, and natural habitat protection (especially near Kaduku Forest).

Stakeholder	Primary	Secondary	Concerns / Interests
			• Assessment of cumulative impacts from similar projects in the region.
National Forestry Authority (NFA)		Yes	• Protection of Kaduku Central Forest Reserve, where reservoir tanks will be located. • Preventing encroachment, deforestation, or degradation due to project activities. • Ensuring restoration or compensation for disturbed forest areas. • Monitoring access and enforcing restricted use of forested zones by contractors or community.
Uganda Investment Authority (UIA)		Yes	• Ensuring reliable and timely water supply to the Masindi and Kiryandongo Agricultural Parks. • Enabling agribusiness investors in the parks to access irrigation support. • Linking water infrastructure to broader industrial and agro-processing strategies • Mitigating delays or disruptions that could affect investment confidence.
National Water and Sewerage Corporation (NWSC)		Yes	• Avoiding duplication or conflict in raw water intake at Masindi Port. • Coordinating the design of shared infrastructure where feasible. • Preventing over-abstraction of water from the Nile to safeguard downstream users. • Sharing hydrological and feasibility data for cross-sector planning.
Nile Basin Commission (NBC)	Yes		• Facilitate the country abstracting water from the R.Nile to notify downstream countries along with the necessary documentation such as a project briefs.



Figure 6-1: Consultations with the Water Office - Kiryandongo District



Figure 6-2: Consultations with the CAO's office - Kiryandongo District



Figure 6-3: Consultations with the District Chairperson's office represented by the District Vice Chairperson



Figure 6-4: Consultations with the RDC - Kiryandongo District

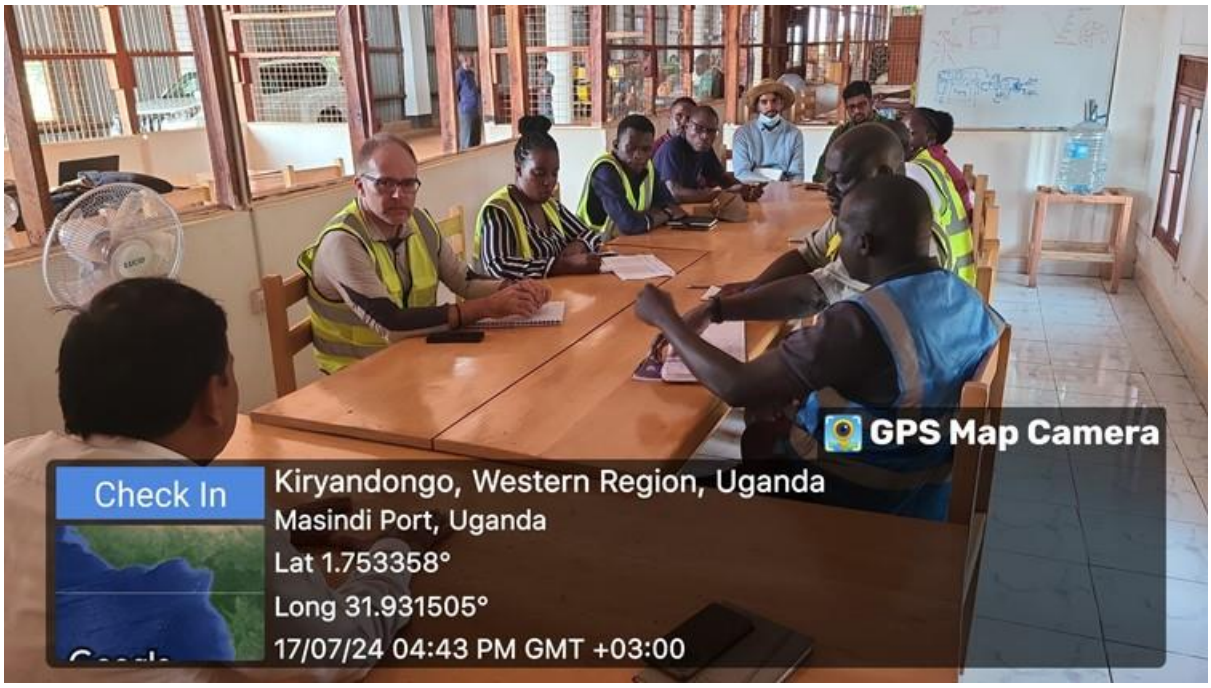


Figure 6-5: Team in a discussion with management team at Soul Agric Business Company (Beneficiary)



Figure 6-6: Consultations with the District Chairperson – Masindi District



Figure 6-7: Courtesy visit to RDC – Masindi District



Figure 6-8: Consultative and sensitization meetings with communities in the project area- Kididma and Karangwe Village Sensitisation in Kimengo Subcounty



Consultative and sensitization meetings with communities in the project area- Miyeba Village Consultation in Kimengo sub County





Consultative and sensitization meetings with communities in the project area- Bisenyi Village sensitisation in mirya subcounty



Consultative and sensitization meetings with communities in the project area- Kitwetwe Village sensitisation in Mirya subcounty





Consultative and sensitization meetings with communities in the project area- Waibango Village and Kitukuza village sensitisation in Masindi Port sub county




Consultative and sensitization meetings with communities in the project area- Kaduku 1 and Kaduku 2 Villages sensitisation in Masindi port subcounty




Consultative and sensitization meetings with communities in the project area- Kaduku 1 and Kaduku 2 Villages sensitisation in Masindi port subcounty

7 ANALYSIS OF ALTERNATIVES

Analysis of project alternatives as part of this study considers other practicable strategies that can be taken to promote the elimination of negative environmental and social impacts identified during implementation of the project which maximizes economic and social benefits but with minimal environmental damage. In considering the development options, analysis of the "No-Project" alternative will be conducted.

Analysis of the "no project option" as an alternative provides an environmental baseline against which impacts of the proposed action can be compared.

The 'No Project' scenario would lead to continued water scarcity, reduced agricultural productivity, economic stagnation, and increased vulnerability to climate change, making it neither a viable nor beneficial option for the communities in Masindi and Kiryandongo Districts.

Three project alternatives, have been analysed which are characterised by different characteristics of the distribution system that affect the storage tanks at Kaduku hill, reservoirs at farms and distribution pipelines diameter (Storage Tanks at Kaduku hill, Reservoirs at the farms; Main and Submain Distribution Lines covering the commercial farmers, Groundwater Intake with Minimal Treatment and River Water Intake with Comprehensive Treatment.

7.1 Storage Reservoirs and distribution network

Three options of the water scheme have been analysed. The alternatives mainly differ by operating time, storage capacity, pressure at the farms as follows:

7.1.1 Option n. 1:

i. The system operates 16/24 hr and daily supplies water to the farms; the 16-hour supply might cater for future expansion;
ii. An emergency storage volume is foreseen at NFA hill having a total capacity of 40,000 m³ (11% of maximum daily requirement);
iii. Additional storage volume is foreseen at the farms for a total of 188,000 m³, equal to 50% of the maximum daily water requirement; the on-farm storage tanks shall be excavated and will be of varying capacity depending on water volume required.

7.1.2 Option n. 2:

i. The system works 16/24 hr and supply water to each farms that can take it through a week, so supply is done once or twice a week deepening on the demand;
ii. An emergency storage volume is foreseen at NFA hill having a total capacity of 40,000 m³ (11% of maximum daily requirement);
iii. Additional storage volume is foreseen at the farms for a total of 821,000 m³, that is about 30% of the maximum weekly water requirement; the on-farm

storage tanks shall be excavated and will be of varying capacity depending on water volume required.

7.1.3 Option n.3:

i. The pumps operate 24/24 hr and the distribution 18/24 hr continuously every day:
ii. A storage volume is foreseen at Kaduku hill having a total capacity of 188,000 m³ (equal to 50% of maximum daily requirement);
iii. No additional storage volume is foreseen at the farms, but the water is provided with sufficient pressure for sprinkler and drip irrigation systems.

The following table summarizes the adopted design demands for the three options.

Table 7-1: Summary of the Design Demands for Options 1, 2, 3

Farm Name	Irrigated Area (ha)	Max Required Volume Per Week (m3)	Design Discharge (m3/h)		
			Opt 1	Opt 2	Opt 3
Soul Agric	1,640	297,562	2,657	17,276	2,362
Afro-Kai	1,220	231,898	2,071	14,673	1,840
Kazire	392	115,154	1,028	7,286	914
Zamburi Farm	130	23,587	211	1,492	187
Kisirizi Excellence	430	115,171	1,028	7,813	914
CMG	81	13,297	119	902	106
Muhazi Heritage	1,562	377,879	3,374	23,452	2,999
Norma Agric	130	21,341	191	1,315	169
Lochab	4,000	967,680	8,640	23,452 (2.58 times per week)	7,680
Asili	1,448	237,704	2,122	8,091	1,887
Medium Scale Farms	320	52,531	469	3,236	417
Kimengo area	1,000	172,800	1,543	10,646	1,371

(Source: Study Team)

The three options have been compared considering the following criteria:

i. Flexibility of the irrigation system at farm scale
ii. Pumping cost at farms
iii. Reservoir cost at Kaduku Forest Reserve hill / land use
iv. Reservoir cost at farms / land use

v. Pipe cost
vi. Ease of manage operation issues of the pumps
vii. Possibility to expand the network

An environmental analysis of each option based on ecological considerations, social considerations, and land use and landscape impacts:

Option 1: 16/24 Hour Operation with On-Farm Storage (188,000 m³)

This option involves daily water supply to farms supported by individual on-farm reservoirs with a total estimated storage capacity of approximately 188,000 m³, representing about 50% of daily irrigation demand across all farms.

As detailed in the feasibility assessment, farms would receive a daily water supply, requiring smaller, distributed storage tanks. The total weekly irrigation requirement across 12,673 hectares of farmland is estimated at 2,390,209 m³. Under Option 1, each farm stores about half of its daily need, with proposed storage capacities ranging from around 950 m³ (CMG) to 69,120 m³ (Lochab Farm).

Ecological Considerations:

- **Kaduku Forest Hill Reservoir**: The reservoir construction at Kaduku Forest Hill (40,000 m³) could affect the local biodiversity, especially if it disturbs natural habitats. It would be important to assess the forest's ecological sensitivity and potential loss of flora and fauna due to land clearance or alterations in water runoff.
- **On-Farm Reservoirs**: Excavation of reservoirs across farms (totaling 188,000 m³) may disrupt local ecosystems, especially if these farms are near sensitive environments. However, smaller on-farm reservoirs may have less impact on large-scale biodiversity loss.

Social Considerations:

- **Farmer Flexibility**: Farmers would have the advantage of daily access to water, allowing flexibility for irrigation management. However, this also places the burden of water storage and pumping on individual farmers, which may increase operational costs and labor.
- **Community Resilience**: Emergency storage at Kaduku Hill provides a buffer for water supply during system failures, which is crucial for maintaining agricultural productivity during crises.

Land Use and Landscape:

- **Kaduku Forest Hill Reservoir**: The construction of a 40,000 m³ reservoir will require substantial land and could alter the landscape of the Kaduku Forest Hill, potentially affecting the aesthetics and natural structure of the forest.
- **Farm-Level Reservoirs**: The excavation of multiple on-farm reservoirs would occupy valuable farmland and alter the natural topography of the region. The visual impact would be scattered but noticeable across the farming landscape, and productive land might be lost to storage facilities.

Option 2: 16/24 Hour Operation with Large On-Farm Storage (821,000 m³)

This alternative provides water to farms once or twice weekly, requiring larger on-farm reservoirs totaling approximately 821,000 m³ roughly 30% of the weekly irrigation requirement.

Compared to Option 1, this setup prioritizes water independence for farmers by storing larger volumes less frequently. For instance, Lochab Farm would need 308,200 m³, and Muhazi Heritage Farm would require 118,075 m³. This significantly increases excavation scope and land use demands

Ecological Considerations:

- **Kaduku Forest Hill Reservoir**: The 40,000 m³ reservoir at Kaduku Forest Hill remains the same, with similar impacts on biodiversity.
- **Larger On-Farm Reservoirs**: The much larger total on-farm storage (821,000 m³) would lead to greater ecological disruption on individual farms. Large reservoirs might interfere with surface water flow patterns, affecting downstream ecosystems and water availability for wildlife.

Social Considerations:

- **Increased Water Security**: Farmers can store water for up to a week, giving them flexibility to irrigate without daily dependence on the supply system. This increases operational independence and resilience.
- **High Farmer Costs**: While flexible, the need to build and maintain larger reservoirs increases costs for farmers, potentially affecting smaller or resource-constrained farmers.

Land Use and Landscape:

- **Kaduku Forest Hill Reservoir**: Same impact as Option 1.
- **Larger On-Farm Reservoirs**: The excavation of 821,000 m³ of storage capacity will require significant land use changes, with a considerable amount of farmland being converted to storage. This will have a large visual impact, with several farms potentially

having large reservoirs that alter the flat farming landscape. The loss of productive land may be significant.

Option 3: 24/24 Hour Operation with Centralized Reservoir (188,000 m^3)

Ecological Considerations:

- **Kaduku Forest Hill Reservoir**: The larger centralized reservoir at Kaduku Forest Hill (188,000 m^3) poses a more substantial ecological risk than the smaller reservoirs in other options. Clearing land for a large reservoir could lead to habitat loss, potential deforestation, and displacement of wildlife.
- **No On-Farm Reservoirs**: The lack of on-farm reservoirs reduces the disruption of individual farm ecosystems, leading to less localized ecological disturbance compared to Options 1 and 2.

Social Considerations:

- **Water Supply Reliability**: With 24/24 hour operation and 18/24 hour water distribution, farmers benefit from consistent and pressurized water delivery, which eliminates the need for individual storage and pumping systems. This reduces on-farm operation and maintenance costs.
- **Centralized Control**: While this option offers convenience, it limits the flexibility for farmers to manage their own water schedules, as they will depend on the centralized distribution system.

Land Use and Landscape:

- **Kaduku Forest Hill Reservoir**: The larger reservoir at Kaduku Forest Hill (188,000 m^3) will have a more significant impact on the forested landscape. This would involve clearing a larger area of the hill, which may degrade the visual appeal of the natural environment and disrupt its natural contours.
- **No On-Farm Reservoirs**: The absence of farm-level reservoirs preserves farmland and maintains the current agricultural landscape. The aesthetic of the farmland will remain largely unchanged, and more land can be dedicated to crop cultivation.

Table 7-2: Comparison of different options

Consideration	Option 1	Option 2	Option 3
Ecological	Moderate impact at Kaduku Forest Hill and localized farm ecosystems (188,000 m^3 on farms).	Higher impact due to large-scale on-farm reservoirs (821,000 m^3).	High impact at Kaduku Forest Hill (188,000 m^3); low farm-level disturbance.

Consideration	Option 1	Option 2	Option 3
Social	Flexible for farmers but costly due to individual reservoirs and pumping.	High flexibility for farmers but more expensive due to large farm reservoirs and infrastructure.	Centralized system reduces farm-level costs but limits flexibility.
Land Use	Moderate land use change at farms; visual impact scattered across the landscape.	Significant land use change due to large reservoirs; high visual impact.	Major land use change at Kaduku Forest Hill but minimal at farms.
Landscape	Noticeable impact on farm landscape due to reservoirs.	Large visual disruption due to extensive farm-level reservoirs.	Altered forested landscape at Kaduku Forest Hill, with minimal disruption to farmland aesthetics.

7.2 Intake Works and Raw Water Pumps

7.2.1 Option 1: Groundwater Intake with Minimal Treatment

This option proposes drilling 9 boreholes to extract groundwater, which will undergo minimal treatment before use.

Ecological Considerations

Groundwater Depletion: This option could potentially lower the water table, impacting local ecosystems dependent on groundwater, such as wetlands and plant species.

Minimal Chemical Use: Due to minimal treatment requirements, the ecological impact of chemical runoff is low. However, the need for chlorination and pH adjustment might still have localized effects on soil and water quality.

Biodiversity Impact: Drilling operations may disturb the habitats of subterranean fauna, but since treatment is minimal, overall impacts on surface biodiversity are likely to be low.

Social Considerations

Water Accessibility: This option ensures reliable access to potable water, benefiting communities with minimal infrastructural requirements.

Health Benefits: Due to reduced reliance on surface water, which may be contaminated, this option could improve public health outcomes by providing cleaner drinking water.

Job Creation: Less extensive infrastructure (boreholes and minimal treatment facilities) creates fewer jobs compared to more complex systems.

Land Use and Landscape

Limited Surface Disruption: Borehole drilling requires minimal land clearing, thus preserving existing land uses such as agriculture and forestry.

Aesthetic Impact: Since infrastructure is mostly underground, this option has a lower visual impact on the landscape compared to large water treatment plants.

7.2.2 Option 2: River Water Intake with Comprehensive Treatment

This option involves direct extraction of water from the Nile River with extensive treatment processes to meet the needs for irrigation and domestic consumption.

Ecological Considerations

River Ecosystem Disturbance: The intake from the river could disrupt aquatic life, particularly if large volumes are extracted. Screens and filters must be carefully designed to minimize the impact on fish and other species.

Water Quality and Sediment Management: Treating river water involves handling high sediment loads and possible contaminants, including pesticides and heavy metals from nearby agricultural activities. This could generate sludge that needs proper disposal to avoid downstream pollution.

Chemical Usage: Extensive chemical treatment (coagulation, flocculation, disinfection) introduces more chemicals into the environment, which could affect local ecosystems if not properly managed.

Social Considerations

Water Supply Security: Direct Nile water extraction ensures a more consistent supply for irrigation and domestic use, crucial for long-term water security in the region.

Health Improvements: Comprehensive treatment ensures safe drinking water, significantly reducing the risk of waterborne diseases.

Local Employment: Construction and operation of the treatment plant and intake structures provide more jobs and local economic benefits compared to groundwater systems.

Land Use and Landscape

Land Requirements: This option requires significant land for the intake structures, treatment plant, and associated infrastructure, potentially leading to displacement of current land uses (agriculture, housing).

Visual Impact: Large intake structures and treatment facilities may have a substantial visual impact, particularly near riverbanks and agricultural areas.

7.3 Conclusion on Alternatives

Based on technical, environmental, and socio-economic considerations, Option 1 was preferred due to its balance between storage flexibility and manageable environmental impact. River water intake was selected over groundwater due to higher yield reliability and lower ecological risk from abstraction. The final alternative ensures sustainable bulk water delivery with optimized infrastructure and minimal disruption.

8 EVALUATION OF ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION / ENHANCEMENT MEASURES

The proposed project will have impacts on the surrounding environment, both positive and negative. These impacts were analysed based on the criteria discussed in section 2.5 and the results are summarized in table 8-1. Whereas positive impacts should be enhanced, negative ones should be mitigated or eliminated. This section identifies the potential impacts that could arise because of implementing this project. Enhancement and mitigation measures have been proposed for positive and negative impacts respectively.

Table 8-1: Evaluation of Anticipated Impacts

Anticipated Impacts	Impact Nature	Extent	Duration	Magnitude	Probability	Overall Assessment before Mitigation & Enhancement	Overall Assessment After Mitigation& Enhancement
Pre-Construction / Mobilisation Phase							
Provision of Employment	Positive	Local	Short term	High	High	Negligible	Severe
Increased Trading and Services	Positive	Local	Short term	Moderate	High	Minor	Moderate
Multiplier Effect on Local Economy	Positive	Local	Short to Medium term	Moderate	Medium	Minor	Moderate
Community Anxiety and Speculation	Negative	Local	Short term	Moderate	High	Moderate	Minor
Setting Up Camps and Site Access	Negative	Site-specific	Short to Medium term	High	High	Moderate	Moderate
Initial Vegetation Clearance	Negative	Site-specific to Local	Short to Medium term	Moderate to High	Medium to High	Moderate	Minor to Moderate
Provision of Employment	Positive	Local	Short term	High	High	Negligible	Severe
CONSTRUCTION PHASE							
Socio-Economic Impacts							
Provision of Employment	Positive	Local	Short term	High	High	Negligible	Severe
Boost to Construction Sector	Positive	Local	Short term	High	High	Negligible	Severe

Anticipated Impacts	Impact Nature	Extent	Duration	Magnitude	Probability	Overall Assessment before Mitigation & Enhancement	Overall Assessment After Mitigation& Enhancement
Increased Revenue / Taxes	Positive	Local	Short term	High	High	Negligible	Severe
Capacity Building	Positive	Local	Temporary	High	High	Negligible	Severe
Traffic Disturbance	Negative	Local	Temporary	High	High	Moderate	Minor
Spread of HIV/AIDS and other sexually Transmitted Diseases	Negative	Local	Long term	High	High	Moderate	Minor
Prostitution, crime and drug abuse	Negative	Local	Temporary	High	High	Moderate	Minor
Child labor, potential of child abuse and school dropouts	Negative	Local	Temporary	High	High	Moderate	Minor
Disruption of families	Negative	Local	Temporary	High	High	Moderate	Minor
Gender concerns	Negative	Local	Temporary	High	High	Moderate	Minor
Impact on vulnerable groups	Negative	Local	Temporary	High	High	Moderate	Minor
Impacts on cultural property	Negative	Local	Temporary	High	High	Moderate	Minor
Labour influx and social disruption	Negative	Local	Temporary	High	High	Moderate	Minor
Loss of structures and assets	Negative	Local	Permanent	High	High	Severe	Moderate
Interference with water supply	Negative	Local	Temporary	Medium	Medium	Moderate	Minor
Physical displacement	Negative	Local	Long term	High	High	Severe	Moderate
Environmental Impacts							
Loss of vegetation cover and suitable habitat	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Likelihood of introduction and spread of invasive species	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impact from noise pollution	Negative	Site	Temporary	Medium	Medium	Moderate	Minor

Anticipated Impacts	Impact Nature	Extent	Duration	Magnitude	Probability	Overall Assessment before Mitigation & Enhancement	Overall Assessment After Mitigation& Enhancement
and vibration effects							
Soil erosion	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Pollution of soil, surface water and ground water	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impacts on and of Storm Water	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impacts of auxiliary facilities (quarries, borrow sites and campsites)	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impacts on landscape general aesthetics	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impacts from leakage of transmission pipes.	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impacts of transmission pipe bursts	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impact on faunal groups	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Impacts on wetlands	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Access road construction	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Pipe laying activities	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Hydrology and sedimentation	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Fish and fishing	Negative	Local	Temporary	Medium	Medium	Moderate	Minor
Health and Safety Impacts							
Dust and Air emissions	Negative	Local	Temporary	Medium	Medium	Moderate	Minor
Impacts of Noise	Negative	Site	Temporary	Medium	Medium	Moderate	Minor

Anticipated Impacts	Impact Nature	Extent	Duration	Magnitude	Probability	Overall Assessment before Mitigation & Enhancement	Overall Assessment After Mitigation& Enhancement
Increased spread of communicable diseases	Negative	Local	Temporary	Medium	Medium	Moderate	Minor
Human Waste Disposal Impacts	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Solid waste generation	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Fire risks	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Occupational health and safety incidents	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Pressure on public health and sanitation	Negative	Local	Temporary	Medium	Medium	Moderate	Minor
Insecurity risks	Negative	Local	Temporary	Medium	Medium	Moderate	Minor
OPERATION PHASE							
Socio-Economic Impacts							
Employment generation and poverty alleviation	Positive	Local	Permanent	High	High	Moderate	Severe
Improvement in transport and communication	Positive	Local	Permanent	High	High	Moderate	Severe
Transformation of agricultural practices	Positive	Regional	Long term	High	High	Moderate	Severe
Sustainable & optimal use of irrigation water	Positive	Regional	Long term	High	High	Moderate	Severe
Improved food security	Positive	Regional	Long term	High	High	Moderate	Severe
Improved access to social	Positive	Local	Long term	Medium	High	Moderate	Severe

Anticipated Impacts	Impact Nature	Extent	Duration	Magnitude	Probability	Overall Assessment before Mitigation & Enhancement	Overall Assessment After Mitigation& Enhancement
services							
Crop diversification and intensification	Positive	Regional	Long term	High	High	Moderate	Severe
Tourism potential and aesthetic value	Positive	Local	Long term	Medium	Medium	Minor	Moderate
Increased Traffic Flow	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Health Risks from Communicable Diseases	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Prostitution, Crime, and Substance Abuse	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Child Labor and Educational Disruption	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Family and Social Disruption	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Gender-Related and vulnerable groups issues	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Community health & safety	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Impacts on water supply & flood control	Negative	Regional	Long term	Medium	Medium	Moderate	Minor
Environmental Impacts							
Impact from noise pollution and vibration effects	Negative	Local	Long term	Medium	Medium	Severe	Moderate
Impact from poor waste management	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Downstream water withdrawal impacts	Negative	Regional	Long term	High	High	Severe	Moderate

Anticipated Impacts	Impact Nature	Extent	Duration	Magnitude	Probability	Overall Assessment before Mitigation & Enhancement	Overall Assessment After Mitigation& Enhancement
Sediment loading & wetland management	Negative	Site	Long term	Medium	Medium	Moderate	Minor
Water loss impacts	Negative	Site	Long term	Medium	Medium	Moderate	Minor
Introduction of invasive species	Negative	Site	Long term	Medium	Medium	Moderate	Minor
Impacts on fish & fishing	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Climate change impacts	Negative	Regional	Long term	High	High	Severe	Moderate
Health and Safety Impacts							
Impacts of human waste management	Negative	Site	Short term	Minor	Medium	Moderate	Negligible
Impacts of safety and Security	Negative	Site	Short term	High	High	Moderate	Minor
Dust and air emissions	Negative	Site	Short term	High	Medium	Moderate	Minor
Noise Emissions	Negative	Site	Temporary	High	Medium	Severe	Moderate
Poor Sanitation at the treatment plant	Negative	Site	Temporary	High	Medium	Moderate	Minor
Workplace accidents	Negative	Site	Temporary	Minor	Medium	Moderate	Minor
Water & vector-borne disease risks	Negative	Local	Long term	Medium	Medium	Moderate	Minor
Water system leaks and pressure loss	Negative	Site	Long term	Medium	Medium	Moderate	Minor
DECOMMISSIONING PHASE							
Employment opportunities for demolition workers		Site	Temporary	Minor	Medium	Moderate	Severe
Unemployment	Negative	Local	Temporary	High	High	Moderate	Minor
Decommissioning waste	Negative	Site	Temporary	Medium	Medium	Moderate	Minor

Anticipated Impacts	Impact Nature	Extent	Duration	Magnitude	Probability	Overall Assessment before Mitigation & Enhancement	Overall Assessment After Mitigation& Enhancement
Accidents to the demolition workers	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Noise due to demolition of structures and disassembling of machinery	Negative	Site	Temporary	Medium	Medium	Moderate	Minor
Dust impacts	Negative	Site	Temporary	Medium	Medium	Moderate	Minor

Note: Based on the above evaluation, the proposed project will have adverse impacts on the biophysical and social environment. Most of the identified adverse impacts especially during the construction phase are temporary and can be mitigated. Mitigation and enhancement measures for the predicted impacts during the operation phase have been provided.

8.1 Pre-Construction / Mobilisation Phase Impacts

8.1.1 Positive Impacts

8.1.1.1 Employment Opportunities

During the pre-construction or mobilisation phase, the project will create immediate short-term job opportunities for both skilled and unskilled labour. Local residents will be engaged in activities such as land demarcation, topographic and environmental surveys, bush clearing, and preliminary civil works including grading and opening of access roads. These activities will reduce unemployment and improve household incomes, particularly for youth and vulnerable groups in the project-affected areas of Masindi Port, Kigumba, Mirya, and Kimengo sub-counties.

Enhancement measures

a) Prioritise hiring from within the host communities.
b) Require contractors to advertise job openings locally.
c) Integrate gender-sensitive employment targets (e.g., 30% female participation).
d) Offer training and safety orientation before commencement of duties.

8.1.1.2 Increased trading and services

The arrival of project teams, contractors, and labourers will increase demand for food, accommodation, mobile money services, transport, and other goods. This presents an opportunity for local businesses to expand, including vendors, boda boda operators, and service providers in and around project areas such as Kimengo Trading Centre and Masindi Port.

Enhancement measures

a) Encourage contractors to procure non-specialised supplies locally.
b) Facilitate engagement of local suppliers and women-led enterprises.
c) Establish collaboration with local authorities to monitor fair pricing and service quality.

8.1.1.3 Multiplier effect on the local economy

The combination of local employment and increased demand for services is expected to generate a multiplier effect that stimulates broader economic activity in both rural and peri-urban settings. Indirect beneficiaries may include farmers supplying food, artisans hired for site facilities, and youth offering logistical services.

Enhancement measures

a) Support financial literacy training for locals to sustainably manage increased income.

b) Collaborate with local SACCOs to facilitate access to microcredit for small business expansion.
c) Ensure transparent and inclusive benefit-sharing mechanisms.

8.1.2 Negative Impacts

8.1.2.1 Community anxiety and speculation

In anticipation of project works, communities may experience anxiety about land acquisition, resettlement, or compensation. Rumours may spread regarding who is eligible for benefits, how land will be used, or whether property will be lost particularly in areas where detailed stakeholder consultation is still underway.

Mitigation measures

a) Conduct timely and transparent community sensitisation meetings led by the District and Parish-level committees.
b) Provide verified information on compensation, grievance redress, and project timelines.
c) Activate and publicise the Grievance Redress Mechanism (GRM), including clear contact points.

8.1.2.2 Setting up camps and site access

Establishing workers' camps, offices, and equipment storage areas may result in land clearance, dust, traffic congestion, noise, and community disruption, especially where space is limited or near trading centres and schools. If poorly managed, these facilities can become sources of pollution, health hazards, and social tension.

Mitigation measures

a) Locate camps and laydown areas away from sensitive receptors like schools, health centres, and wetlands.
b) Design and implement a Camp Management Plan aligned with NEMA guidelines.
c) Limit access to camps and maintain strict hygiene, security, and waste management standards.

8.1.2.3 Initial vegetation clearance

The opening of access roads, boundary marking, and camp setup may necessitate removal of trees, shrubs, and grassland, particularly around Kaduku Central Forest Reserve and community lands. Uncontrolled clearing may result in erosion, habitat loss, or disturbance of culturally significant trees.

Mitigation measures

a) Undertake site-specific environmental screening prior to vegetation clearance.
b) Demarcate No-Go areas, especially within or adjacent to Kaduku CFR and wetlands.
c) Implement selective clearing, retaining natural buffers where possible.

d) Replant disturbed areas with indigenous tree species after construction.

8.2 Construction Phase Impacts

8.2.1 Socio-Economic Impacts (Positive)

8.2.1.1 Employment opportunities (skilled and unskilled)

It is anticipated that the project will provide direct employment opportunities over the installation cycle to ensure its completion, with a sizable locally contracted workforce of between 80-100 persons at any one time. The project will require skilled labour as well as un-skilled labour and will offer many employment opportunities for persons from within local communities, including women. The impact is local, short-term, high in magnitude, and highly probable, with an overall assessment of negligible before enhancement and severe after enhancement.

Enhancement Measures

a) Carrying out prompt payment of project workers (employees) and terms and conditions should be well laid out in the workers' contracts.
b) A good working relationship should be established between the contractor and employees to avoid incidences of work abandonment which would delay the operation of the project.
c) The contractor or subcontractor should to the greatest extent possible, employ casual laborers from within the local community (approximately 30% locals and 70% be expatriates). This ensures security and sustainability of the project since it will be highly supportive.
d) Ensure that all workers are registered with LC1 chairperson to be easily traced.
e) The contractor should avoid child labor

8.2.1.2 Boost to Construction Sector

It is expected that construction of proposed bulk water supply and irrigation infrastructure facilities at the project site will provide a positive boost to the local and national economy through its multiplier effect, which the project intends to maximize. Most of the construction material such as structural steel, timber sheeting, etc., will be procured from within the country. The developer is, committed to ensuring that by using Ugandan companies, local raw materials and finished products will be utilized as much as possible for successful completion of these facilities. Manufacturers and suppliers of local materials will include manufacturers of protective ware as well as manufacturers of other local building materials will be sought for. The impact is local, short-term, high in magnitude, and highly probable, with an overall assessment of negligible before enhancement and severe after enhancement.

Enhancement Measures

a) Prioritize local suppliers and manufacturers for construction materials.
b) Provide training and support to local suppliers to meet project requirements.
c) Partner with associations to identify and support local suppliers.

d) Offer incentives like long-term contracts and advance payments.
e) Ensure open and fair procurement to encourage local participation.
f) Track local material usage and supplier participation, adjusting as needed.
g) Ensure materials meet standards through testing and certification.
h) Source materials from suppliers with strong environmental and labour practices.

8.2.1.3 Increased Public Revenue / Taxes

The implementation of the project will increase revenue and taxes for both the central and local authorities. This includes indirect taxes resulting from the construction project such as Value Added Tax (VAT) on materials and services, Pay As You Earn (PAYE) for workers and other formally employed persons. The impact is local, short-term, high in magnitude, and highly probable, with an overall assessment of negligible before enhancement and severe after enhancement.

a) Ensure most project spending is within the local economy to boost VAT collection.
b) Encourage formal employment to increase PAYE contributions.
c) Provide incentives for contractors and suppliers who comply with tax regulations.
d) Maintain transparency in financial transactions to ensure accurate tax reporting.
e) Collaborate with URA to streamline tax processes and ensure compliance.
f) Educate workers and suppliers about tax obligations and benefits to increase compliance.
g) Conduct regular financial audits to ensure all taxable activities are reported accurately.
h) Implement policies favouring local suppliers to keep more economic activities taxable locally.
i) Ensure timely payment of all applicable taxes to support local revenue streams.
j) Utilize local banks and financial institutions for project transactions to enhance local tax collections.

8.2.1.4 Capacity Building

The sheer scale of the Industrial technology project with the logistics involved and speed of construction that will be required while maintaining standards will involve considerable management and planning skills and will contribute to capacity building within the Ugandan construction sector. This will result in the transfer of skills and will also build additional local capacity. The impact is local, temporary, high in magnitude, and highly probable, with an overall assessment of negligible before enhancement and severe after enhancement.

Enhancement Measures

a) Implement comprehensive training programs for all workers in advanced construction techniques.
b) Provide on-the-job training opportunities during the project to enhance practical skills.
c) Offer certification courses in collaboration with local educational institutions.
d) Establish mentorship programs pairing experienced professionals with local workers.
e) Introduce and train locals on modern construction technology and equipment.
f) Assign local professionals to leadership roles to gain project management experience.

g) Encourage continuous learning through access to online courses and resources.
h) Regularly monitor and evaluate the performance of local workers to identify skill gaps and provide targeted training.

8.2.2 Socio-Economic Impacts (Negative)

8.2.2.1 Traffic Disturbance

Movement of trucks shifting raw materials to the work sites and those which will be transporting equipment will disrupt the traffic on site access roads. Considering that not many trucks will be involved during this period and also the fact that construction will only take a short time, the impact significance is expected to be negative. However, with the implementation of the suggested mitigation measures below, the significance of the impact can be reduced to minor.

Mitigation measures

a) Develop and implement a comprehensive traffic management plan to minimize disruptions.
b) Schedule deliveries during off-peak hours to reduce congestion on access roads.
c) Install clear and visible signage to guide drivers and manage traffic flow around construction sites.
d) Identify and promote alternate routes for trucks to reduce the impact on main access roads.
e) Inform the public about potential traffic disruptions and construction schedules.
f) Employ trained traffic control personnel to manage traffic flow during peak construction activities.
g) Regularly monitor traffic conditions and adjust traffic management strategies as needed.
h) Ensure that emergency access routes are always clear and unobstructed.

8.2.2.2 Labour influx and social disruption

The MWACRID Project is expected to attract a sizable number of workers contractors, technicians, and support personnel during dam, reservoir, treatment plant, and irrigation network construction. This influx, particularly into rural sub-counties like Kimengo, Masindi Port, and Kaduku, may result in social tensions, overburdened social amenities, gender-based violence, and increased cost of living for locals.

Mitigation measures

a) Prioritize local labour recruitment (at least 30–40%).
b) Develop a Labour Influx Management Plan, including worker codes of conduct and regular community dialogue.

c) Provide contractor-managed worker camps with sanitation, water supply, and recreation areas to avoid pressure on host communities.
d) Engage local leaders and District Community Development Officers to monitor social dynamics.

8.2.2.3 HIV/AIDS and other sexually Transmitted Diseases

The proposed project is expected to be generating an influx of migrant workers which will increase the risk of spread of HIV/AIDS and other STDs. The impact of increased risk of HIV includes pressure on local health systems, impact on community livelihood and social cohesion. Increased HIV prevalence would result into reversal of economic gains within the community and may reduce the ability of the community to benefit from the project. The impact is local, long-term, high in magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) As a contractual obligation, the Contractor should have an HIV/AIDS policy and a framework (responsible staff, action plan, etc.) which will be implemented during Project execution.
b) Conduct regular HIV/AIDS and STD awareness campaigns for workers and local communities.
c) Implement comprehensive health education programs focusing on prevention and safe practices.
d) Provide free condoms at the workplace and in the local community.
e) Ensure easy access to health services, including testing and counselling, for workers and the community.
f) Collaborate with local health organizations to support prevention and treatment efforts.
g) Engage with local leaders and communities to promote awareness and reduce stigma.
h) Provide safe and regulated accommodation for migrant workers to reduce risky behaviours
i) Continuously monitor and evaluate the effectiveness of the mitigation measures and adjust strategies as needed.

8.2.2.4 Prostitution, crime and drug abuse

A large influx of males for a construction project increases demand for sex in an area. Concerns have always been raised about increased prostitution, crime and drug abuse in areas as a result of new social activities specifically in night clubs. The impact is local, temporary, high in magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) The developer should implement the workers code of conduct.
b) The developer should implement mandatory leave schedules such that workers can travel back to their families.

c) Development and implementation of security plans should involve local council (LC) leaders and police.
d) All workers should be orientated and sensitized about responsible sexual behavior within the Project area communities
e) Create awareness and build capacity within communities, workers, security agencies on the dangers of prostitution, crime and drug abuse to resist the temptation.
f) Capacity of local authorities should be enhanced to handle challenges associated with migrant and immigrant workers.

8.2.2.5 Child labor, potential of child abuse and school dropouts

The proposed project area has schools and settlements. It is likely that workers associated with the project will engage in sexual relationships with school and under aged children. The young school boys may end up working at the project site in order to make money for survival hence dropping out of school. The community indicated that re-occurrence of such behaviors may reduce community support for the project. The impact is local, temporary, high in magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Cases of abuse should be reported to the police for investigation and prosecution.
b) Minimize the interaction of children with the workers, and closely monitor and report worker's behavior/conduct.
c) The contractor should conduct awareness campaigns about the social risks in the project area with the focus on schools and host communities.
d) The contractor should collaborate with communities to provide information where child abuse cases happen.
e) The contractor should develop a child protection plan which will be implemented in collaboration with community leaders, schools and districts.

8.2.2.6 Disruption of families

High disposable income especially for male workers increases predisposition to extra marital affairs. Cases have been reported where men with new disposable income completely abandon their families resulting into school dropouts, single mothers and increased risk of child labor. Social vices are likely to increase including family breakdowns and increase in the number of street children. This is due to workers exploiting the local communities taking advantage of high disposable income compared to community members and taking advantage of company resources. The impact is local, temporary, high in magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Administrative controls should be instituted to prevent unethical use of employers' resources.
b) Awareness creation for community members on the challenges of additional disposable income and how it can have a disruptive effect on the family.

c) Contractors should be obliged to have codes of conduct for employees and anti-retaliation policies.
d) Empower community leadership to be able to protect the rights of children, woman and family norms.
e) Enhanced the capacity of local authorities to handle challenges associated with migrant and immigrant workers.
f) Sensitization of community members on the challenges of additional disposable income of migrant workers how it can have a disruptive effect on the family and therefore be prepared
g) The contractors should have grievance redress mechanisms (GRMs).
h) The contractors should have regular community engagement meetings.

8.2.2.7 Gender concerns

Gender concerns for the project particularly relate to infringement on the rights of women in the workplace. The concerns include; sexual harassment, denial of employment opportunities, physical violence, and male partners forcefully taking away women's pay and lack of proper public facilities such as toilets and shelter for their children as they work.

Other potential negative impacts on women include; exposure to STIs such as HIV/AIDS, sexual exploitation of young girls and abandonment by partners in case of unwanted pregnancies.

Impacts related to gender are negative, highly sensitive with potential for high magnitude however they can be effectively alleviated against hence making the overall impact moderate. The significance of the social impacts is likely to be moderate but, with the implementation of the suggested mitigation measures, the impact may be reduced to minor.

Mitigation measures

a) All workers should receive adequate briefing and education on the laws against defilement and other sexual offences.
b) Display signs throughout the site making it clear that the work site is a violence free zone and violence against women and girls should not be tolerated.
c) The project should install gender sensitive facilities (toilets and bath shelters).
d) There should be a Specialist (Environmental/Social Specialist) to oversee implementation of the gender action plan.
e) To the extent possible, there should be gender sensitivity in task allocation to the women.
f) Workers should be sensitized on their gender rights and responsibilities.
g) The Contractor should conduct gender sensitization to the work force on matters such as gender sensitive communication and on the gender sensitive conduct of workers towards women amongst others.

8.2.2.8 Impact on vulnerable groups

Construction of proposed bulk water supply and irrigation infrastructure could have significant impacts on vulnerable groups within the local community. Vulnerable groups may include women, children, the elderly, persons with disabilities, and economically disadvantaged individuals. These groups may face increased risks of exploitation, displacement, and reduced access to resources due to the influx of workers and the pressures on local infrastructure and services. The construction activities could exacerbate existing inequalities, leading to social tension and undermining community cohesion. The impact is local, temporary, high in magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Actively engage with vulnerable groups to understand their specific needs and concerns. Conduct regular meetings and consultations to involve them in decision-making processes.
b) Ensure that project planning and implementation are inclusive and consider the needs of vulnerable groups. This includes designing infrastructure that is accessible to all, such as ramps and facilities for persons with disabilities.
c) Develop and implement programs aimed at protecting vulnerable groups from exploitation and abuse. This could include setting up hotlines, shelters, and support services for victims of abuse.
d) Provide employment opportunities for members of vulnerable groups. This can help improve their economic situation and empower them within the community.
e) Ensure that vulnerable groups have access to essential resources, such as water, healthcare, and education. This may involve setting up additional facilities or providing subsidies.
f) Establish mechanisms to monitor the impacts on vulnerable groups continuously. Regularly report on these impacts and adjust mitigation strategies accordingly.
g) Collaborate with local and international non-governmental organizations (NGOs) that specialize in supporting vulnerable populations. These partnerships can provide additional resources and expertise.
h) Conduct training sessions for workers and the local community on the rights and protection of vulnerable groups. Raise awareness about the potential risks and encourage respectful and inclusive behaviour.
i) Set up a grievance redress mechanism specifically for vulnerable groups to report issues and seek assistance. Ensure that this mechanism is easily accessible and responsive.
j) Provide social support services such as counselling, legal aid, and financial assistance to vulnerable groups affected by the project.
k) Work with local authorities to develop and enforce policies that protect vulnerable groups from exploitation and discrimination during the construction phase.

8.2.2.9 Impacts on cultural property

During the construction phase, activities could potentially impact cultural properties, including archaeological artifacts, religious sites, and other locations of cultural significance. These impacts may arise from direct physical damage during construction, changes in the landscape, increased human activity, and potential looting or vandalism. The loss or degradation of cultural property can lead to the erosion of cultural heritage, identity, and community cohesion. A systematic and unsystematic archaeological survey conducted within the project area, primarily focusing on the zone of direct project influence, identified a total of 30 archaeological and cultural heritage sites. These include 4 mosques, 15 churches, 1 burial site, 3 archaeological sites, and 7 medicinal plant sites. Of these, 10 sites are expected to be directly affected by the project, while 20 may experience indirect impacts (see appendix for detailed PCR report). The impact is local, temporary, high in magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Conduct thorough assessments to identify cultural properties in the project area before construction begins. This includes archaeological surveys, historical research, and consultations with local communities and cultural experts.
b) Engage with local communities, cultural leaders, and heritage organizations to understand the significance of cultural properties and to gain support for their protection.
c) Provide training for construction workers and project staff on the importance of cultural properties and how to avoid damaging them. Raise awareness about cultural heritage and its value.
d) Establish a grievance redress mechanism for local communities to report concerns about impacts on cultural properties. Ensure that this mechanism is accessible and responsive.
e) Collaborate with local and national cultural institutions, museums, and universities to provide expertise and support for the protection of cultural properties.
f) After construction, restore any disturbed areas near cultural properties to their original state as much as possible. This includes replanting vegetation and repairing any damage to the landscape.
g) Implement a Chance Finds Procedure in accordance with the Uganda Museums and Monuments Act, 2022.
h) Halt work immediately upon discovery of artefacts and notify the Department of Museums and Monuments.

8.2.2.10 Loss of structures and assets and physical displacement

The construction of water intakes, treatment plants, irrigation lines, service roads, and major infrastructure such as reservoirs and dam components may require land acquisition and lead to

the physical displacement of households. This could affect homesteads, kiosks, and semi-permanent structures located within the project's construction footprint.

Mitigation measures

a) Implement the RAP findings in accordance with the Land Act (1998) and AfDB's E&S OS 5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement.
b) Provide compensation at full replacement cost before displacement.
c) Restore livelihoods through skill training, land-for-land options, and transitional support.

8.2.2.11 Interference with existing water supply facilities

Existing shallow wells, springs, or community boreholes may be disrupted by excavation and pipeline installation, especially around Myeba, Kimengo TC, and Masindi Port.

Mitigation measures

a) Conduct a full inventory and mapping of all water points before work begins.
b) Relocate or protect affected facilities and ensure alternative access during construction.
c) Engage communities in planning alternative routes and compensation (if needed).

8.2.3 Environmental Impacts (Negative)

8.2.3.1 Loss of vegetation cover and suitable habitat

The proposed bulk water supply and irrigation infrastructure development work frequently entails clearing and cutting back of trees and other vegetation, changes to the topography of the area, and interference with watershed patterns. Thus, the proposed bulk water supply and irrigation infrastructure may destroy the natural habitat and may deplete certain flora that are vital to the ecological balance of the area.

While most habitats along the project route have been transformed, areas like the Victoria Nile and Kaduku Central Forest Reserve are critical ecosystems that require protection. Minimal disturbance is expected during pipeline construction due to most activities being confined to the road reserve. The medium impact intensity is linked to limited vegetation clearance, resulting in a moderate overall significance.

Mitigation Measures

a) Optimize the bulk water supply and irrigation infrastructure layout to minimize the need for vast space that may not be needed.
b) Collaborate with NFA for a Forest Restoration Plan (targeting 2:1 replanting ratio)

c) Carry out a preclearance survey before clearance and early civil works to identify species of conservation concern/reserved species and develop a tree avoidance plan for species of interest.
d) Minimize vegetation clearance only in the project footprint
e) Grub top soil and store it for use in layering other excavated sites.
f) Sensitive project workers to avoid unnecessary vegetation clearing
g) Reinstate with native trees especially areas away from the runway to create habitat for some small mammals within the project area
h) Project should develop a tree planting strategy in order to replace the tees cut by the project.

8.2.3.2 Impacts on faunal groups

The construction zone overlaps wildlife corridors and wetland bird habitats. Herpetofauna (frogs, snakes), ground mammals, and birds may be disturbed, especially during excavation, and vegetation clearance. Findings from the biodiversity study indicate that the project area supports moderate faunal diversity, with several species at risk due to anticipated construction activities. Notably, 161 bird species were recorded, many of which depend on the riparian zones and forest edges—habitats likely to be disturbed by vegetation clearance and dam construction. Mammalian fauna such as small rodents, antelopes, and primates were observed within and around the Kaduku Forest Reserve; these species are vulnerable to habitat fragmentation and disturbance, especially along the proposed transmission line corridor. Amphibians and reptiles, including the African Rock Python, may be affected by changes in moisture regimes and habitat structure. Aquatic macroinvertebrates, used as bioindicators, currently reflect good water quality; however, sedimentation and hydrological changes during construction could degrade these aquatic ecosystems. Although no IUCN-listed threatened species were found, the study emphasizes that faunal habitats in the area are already under pressure, and further disruption could have cumulative negative effects if not properly mitigated

Mitigation measures

a) Implement a Biodiversity Management Plan that includes pre-construction fauna assessments, avoids sensitive periods (e.g., breeding/migration), restores disturbed habitats with native species, and monitors wildlife impacts throughout the project.
b) Restrict night works and prohibit fishing, hunting or trapping by workers.
c) Install culverts or underpasses where migration routes cross access roads

8.2.3.3 Impacts on wetlands

The biodiversity report identified key wetlands as ecologically sensitive zones supporting diverse flora and fauna, including papyrus swamps that serve as breeding and foraging grounds for birds, amphibians, and aquatic invertebrates. The construction of irrigation canals,

reservoirs, and associated access roads may lead to partial filling or hydrological modification of these wetlands. Such alterations can disrupt the natural water retention and filtration capacity of the wetland system, leading to loss of habitat for wetland-dependent species and reduction in ecosystem services. Additionally, communities reliant on wetland products (e.g., reeds for crafts, water for livestock, seasonal grazing) could experience reduced availability and quality of resources.

Mitigation measures

a) Avoid wetland encroachment where possible; apply the Avoid-Reduce-Restore hierarchy.
b) Install culverts and flow regulation structures to maintain wetland hydrological connectivity.
c) Rehabilitate temporarily disturbed wetland sections with native sedges, grasses, and hydrophytes.

8.2.3.4 Access road construction

The development of new and upgraded access roads to Kaduku Hill and farm areas may result in the clearing of vegetation, soil compaction, and increased runoff, which in turn can lead to erosion, sedimentation, and fragmentation of habitats. Roads often act as barriers to wildlife movement, especially for smaller terrestrial species, and can promote edge effects that degrade adjacent natural habitats. If not properly designed, they may also interfere with local drainage patterns and community pathways.

Mitigation measures

a) Design access roads with proper drainage systems, erosion control structures, and culverts at natural flow points.
b) Stabilize road embankments with erosion-resistant vegetation and materials.
c) Restrict construction vehicles and machinery movement to designated corridors and times to minimize disturbance.

8.2.3.5 Impacts from camps, offices, and equipment yards

Temporary construction camps and staging areas, if sited in undisturbed areas, can lead to habitat loss, waste pollution, and social tension due to land encroachment or poor sanitation. Camps may generate solid and liquid waste that can pollute nearby soils and watercourses. Additionally, they can contribute to illegal hunting or vegetation harvesting by workers, putting additional pressure on local wildlife and forest resources.

Mitigation measures

a) Site camps in previously disturbed or low ecological value areas and ensure NEMA approval is obtained.
b) Equip camps with adequate sanitation (latrines, soak pits), solid waste segregation and disposal systems.
c) Fence off camp boundaries, control access, and enforce no-hunting/no-logging rules for workers.
d) Fully decommission camps after construction and restore land to its original or improved use.

8.2.3.6 Impacts from pipe laying

Trenching and installation of irrigation pipelines (DN 1600 and distribution lines) will involve stripping of topsoil, compaction of subsoil, and potential interference with agricultural lands and homesteads. The disruption of existing access paths, especially in dense rural settings, may hinder local mobility and access to farmlands. Improper reinstatement of excavated areas can also affect soil fertility and natural drainage, indirectly impacting biodiversity.

Mitigation measures

a) Engage and notify landowners ahead of construction and compensate for affected crops or structures.
b) Apply trenchless technologies (e.g., horizontal directional drilling) in sensitive areas (e.g., near wetlands, roads, settlements).
c) Compact backfilled trenches, level the surface, and replant disturbed land with local crops or native grasses.

8.2.3.7 Impacts on hydrology and sedimentation

Earthworks for dam and canal construction will modify the surface hydrology of the area, potentially increasing surface runoff and altering flow regimes into rivers and wetlands. These changes can lead to excessive sediment transport, smothering aquatic habitats, reducing water quality, and affecting species such as macroinvertebrates and fish that rely on clean substrate for breeding. Downstream ecosystems may be particularly vulnerable during the rainy season if sediment controls are not in place.

Mitigation measures

a) Construct sediment control structures (e.g., check dams, silt fences, sediment traps) at key discharge points.
b) Schedule high-impact works outside peak rainfall periods to reduce erosion and runoff.
c) Monitor sediment loads at upstream and downstream sites to assess construction impacts and adjust controls accordingly.

8.2.3.8 Impacts on fish and fishing

Abstraction of water from the Nile for irrigation, along with the creation of reservoirs, may change river flow regimes, disrupt fish migration routes, and reduce the availability of breeding habitats in shallow and vegetated river margins. Community fishing, particularly in downstream reaches and wetlands, may decline due to reduced fish stocks and altered access to traditional fishing grounds. Biodiversity studies have shown the presence of economically and ecologically important fish species that could be impacted by changes in flow and sedimentation.

Mitigation measures

a) Install fish screens at water intakes to prevent juvenile fish and eggs from being drawn into pipes.
b) Ensure minimum environmental flows are maintained during key reproductive periods for fish.
c) Engage local fishers in monitoring programs and provide training on aquaculture and alternative livelihoods.

8.2.3.9 Likelihood of introduction and spread of invasive species

As much as no invasive species were encountered on the project site, movement of people, equipment and materials is known to introduce invasive species on project sites. Invasive species are known to colonize an area causing disappearance of native species that are palatable to the native species. This reduces in species richness and ecological function of the affected habitats. Invasive species may be introduced through vehicle tires and imported materials like murram, potentially degrading local habitats and crops. This is particularly concerning in areas near the Victoria Nile ecosystem.

The presence of invasive species can diminish biodiversity, especially around the water treatment plant and intake site. The anticipated impact intensity is medium due to the high volume of vehicles transporting materials, leading to a moderate overall significance.

The probability of this impact happening is medium. However, if it happens this impact will be long term and if not checked could spread and affect a significant area of the park. Therefore, the impact has been categorized as moderate but could be reduced to minor with the following mitigation measures.

Mitigation measures

a) Preclearance survey should be undertaken before construction to identify the likely occurrence of invasive species and if found should be mechanically removed and burnt before early civil works.
b) Reinstatement should be done using native species
c) Develop an Invasive Species management plan to guide management of invasive species that could be introduced onsite

8.2.3.10 Impact from noise pollution and vibration effects

Noise impacts may occur in the vicinity of the construction sites. Earthwork and site preparation activities would result in elevated levels of noise generated by the types of equipment used on most construction sites. Noise from this equipment would vary from model to model and would change according to the works involved. Any noise and vibration generated is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Use low noise emitting and vibration equipment or equipment used should have noise silencers during clearing, early civil works and construction.
b) Limit working only during daytime
c) Where possible create a noise barrier during construction

8.2.3.11 Soil erosion

The site clearing and stabilization activities will expose soils in the affected areas, leaving them vulnerable to erosion by surface run-off during heavy rainfall. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Minimize soil disturbance and excavations to project site only
b) Loose soil should be compacted in order to make it stable hence reducing soil erosion.
c) Installation of adequate drainage facilities to direct water to the existing drainage system.
d) Installation of soil retention bungs to hold any eroded soils at different levels of the construction site.

8.2.3.12 Pollution of soil, surface water and ground water

Oil and chemical spillage and leakage at the site can result in pollution of the soil, surface water and ground water. Runoff that is polluted with used oils can easily infiltrate into the ground hence affecting both water and soil quality hence changing the chemical and physical properties of both soil and water. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Machinery in good working conditions should be utilized during land clearance and delivery of equipment and personnel.
b) Fuelling and servicing of vehicles should be undertaken from only designated and lined area.

c) Construction machineries and vehicles should undergo routine maintenance and inspections to maintain them in good working conditions.
d) A waste management plan should be put in place for management of different types of waste.
e) A spill contingency plan including spill cleanup equipment should be put in place and workers in sensitive areas be trained in their use.

8.2.3.13 Impacts on and of Storm Water

Storm water management is crucial due to potential impacts such as erosion, sedimentation, flooding, and contamination of water bodies. These impacts can result from changes in land use and alterations to natural drainage patterns. Poor storm water management can lead to environmental degradation, infrastructure damage, and risks to public health and safety. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Develop and implement a comprehensive storm water management plan that includes measures for erosion control, sedimentation prevention, and flood mitigation.
b) Establish vegetative buffers along water bodies and sensitive areas to filter storm water runoff and reduce pollutants entering waterways.
c) Implement construction best management practices (BMPs) to minimize soil disturbance and prevent sedimentation during earth-moving activities.
d) Regularly inspect storm water management measures and conduct maintenance to ensure they are functioning effectively.

8.2.3.14 Impacts of auxiliary facilities (quarries, borrow sites and campsites)

The sourcing of construction materials such as marram, clay, sand, and rock is necessary for dam embankments, road foundations, and canal lining. However, unregulated or poorly managed borrow pits can result in significant environmental degradation, including landscape scarring, soil erosion, loss of vegetation, and creation of hazardous depressions that pose safety risks to people and livestock. The loss of topsoil and alteration of landform can also reduce land productivity and disrupt faunal habitats, particularly where pits are located near woodlands or grasslands. It is expected that the project activities may lead to creation of stagnant water bodies in quarries and borrow pits. The resultant stagnant water bodies are likely to be suitable habitats for the breeding of mosquitoes and snails that are disease vectors for malaria and bilharzia respectively. The facilities may also cause noise pollution, and disturbance to local communities. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Conduct thorough environmental assessments and site evaluations before establishing auxiliary facilities. Select sites away from sensitive habitats, water bodies, and residential areas to minimize impacts.
b) The Project Contractor should develop and implement comprehensive environmental management plans specific to each facility (quarries, borrow sites, campsites). Include measures for habitat restoration, erosion control, and waste management.
c) Engage with local communities and stakeholders to address concerns and incorporate their feedback into facility management plans.
d) Establish monitoring programs to assess environmental impacts from auxiliary facilities. Regularly report findings to relevant authorities and stakeholders and adjust management practices as needed.
e) Source materials only from NEMA-permitted sites
f) Rehabilitate borrow pits through controlled backfilling, recontouring, and planting with native grasses.
g) Implement designated haulage routes that avoid sensitive areas (e.g., schools, health centres).
h) Water dust-prone roads twice daily to reduce particulate pollution.

8.2.3.15 Impacts on landscape general aesthetics

Significant alterations to the landscape can occur, affecting its general aesthetics. These impacts include the visual intrusion of construction equipment, temporary structures, stockpiles of materials, and land disturbance. The degradation of the visual quality of the area can affect local communities' sense of place and potentially impact tourism and recreational activities. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Carefully plan and design the construction layout to minimize visual impacts.
b) Preserve natural features such as trees and topography as much as possible.
c) Use native plants for screening to blend with the surrounding landscape.
d) Limit the area of land disturbance and keep construction activities confined to designated zones.
e) Implement phased construction to reduce the extent of exposed areas at any given time.
f) Ensure that construction sites are kept clean and orderly, with regular removal of waste and debris.
g) Organize materials and equipment storage to minimize visual clutter.
h) Begin revegetation and restoration efforts as soon as possible in completed areas. Use fast-growing, native vegetation to quickly restore disturbed areas.
i) Inform local communities about construction schedules and activities to manage expectations regarding temporary visual impacts.

8.2.4 Health and Safety Impacts (Negative)

8.2.4.1 Dust and Air emissions

The proposed construction would cause temporary localized increase in air emissions. Emissions would include fugitive dust from ground disturbance, combustion by-products from construction equipment to the immediate residential surroundings. These emissions from construction vehicles and equipment will include air contaminants such as nitrogen and sulphur oxides as well as particulates. Earth moving activities during construction and offloading granular construction materials will be the main source of dust. This could be worst if construction is done in the dry season. The impact is local, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Water sprinkling should be done to contain dust emission.
b) The speed of the trucks carrying raw materials should be controlled at 30km/hr.
c) The contractor should provide safety means for workers for example masks.
d) The developer should use well-conditioned and serviced equipment.
e) Monitoring of dust emissions, notably Particulate Matter (PM_{10}), should be carried out on a regular basis.

8.2.4.2 Impacts of Noise

Noise will be generated during the construction of the proposed bulk water supply and irrigation infrastructure. Sources for this pollution include operation of motored equipment onsite, noise generated by site employees and noise from trucks that ferry material. The project area has access to hydroelectric power, but generator use can be a source of unpleasant noise. If these sources are not carefully controlled, there is likely to be a slight increase in the background noise levels within a radius of 50metres of the site boundaries. Excessive noise levels would lead to interruption of night sleep, hearing impairments and increased stress levels to the nearest households. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Noise reduction mechanisms should be employed such as using well-conditioned equipment, switching off the ones that are not in use and silencer installation in some equipment like generators.
b) Construction activities that will generate disturbing sounds should be restricted to normal working hours'
c) Unless exceptional circumstances warrant, working at night should be prohibited to avoid causing any sort of inconveniences to the nearest residents.

d) Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs.

8.2.4.3 Increased spread of communicable diseases

The project is expected to attract a significant number of workers, including migrant labour. This influx can increase the risk of spreading communicable diseases such as tuberculosis, malaria, respiratory infections, and waterborne diseases. Factors contributing to this risk include overcrowded living conditions, inadequate sanitation facilities, and limited access to healthcare services. These impacts can strain local health systems and pose significant health risks to both workers and nearby communities. The impact is local, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Conduct health screenings for all workers before they join the construction site to identify and manage any existing communicable diseases. Periodically conduct health checks during the construction phase.
b) Establish on-site clinic with licensed and well-trained medical personnel to provide preventive care and treatment. Ensure easy access to local health services for workers.
c) Provide health education sessions to workers about the prevention and control of communicable diseases. Train workers on personal hygiene practices and disease prevention measures.
d) Ensure a steady supply of necessary medical supplies, including personal protective equipment (PPE), medications, and first aid kits.
e) Develop an emergency response plan for handling outbreaks of communicable diseases, including protocols for isolation, treatment, and communication with health authorities.

8.2.4.4 Pressure on public health and sanitation facilities

During peak construction, the influx of over 100 workers will place additional pressure on local health and sanitation services, particularly in nearby communities such as Kimengo and Masindi Port. This increased demand can overwhelm existing clinics and water supply points, potentially leading to shortages of medical supplies, overcrowding, and deteriorated hygiene conditions. Without proper management, this situation could increase the risk of communicable diseases, including waterborne illnesses and respiratory infections.

Mitigation measures

a) Contractors should provide on-site medical kits and retain a qualified health worker.
b) Support local health centres (e.g., Masindi Port HC III) with medical supplies.
c) Conduct health education on hygiene like malaria prevention.

8.2.4.5 Insecurity risks

The presence of construction workers, valuable equipment, and cash transactions raises the risk of theft, vandalism, and social conflicts between workers and local residents. The influx of "strangers" may cause tension in host communities, possibly leading to disputes or security breaches. Unregulated access to project sites can compromise worker safety and asset security, potentially delaying project timelines and increasing costs.

Mitigation measures

a) Register all workers and restrict site access.
b) Work with local police and LC1 leaders for community policing.
c) Provide adequate lighting and perimeter security at all project sites.

8.2.4.6 Human Waste Disposal Impacts

Inadequate provision of sanitary facilities for use by construction workers can lead to ad hoc defecation in secluded areas on the sites, thus creating of unsanitary conditions and sources of fly infestation. This can lead to disease outbreaks. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) The developer in collaboration with the contractor should ensure that sanitary facilities/mobile toilets are the first facilities to be installed on the site for use by the construction workers before the construction works begin.
b) Train workers on proper sanitation practices and disease prevention measures.

8.2.4.7 Solid waste generation

Different types of waste are likely to be generated during the construction phase, some waste from the packaging material, construction debris – off cuts, and domestic waste from the food remains brought to the site by the construction workers. Solid waste if not properly managed, can lead to visual intrusion, public health risks, soil and water pollution. Poor construction waste management constitutes a short term but reversible negative impact. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

The Contractor is required to comply with the following best practice requirements for managing waste resulting from their activities.

1. **Minimizing waste**

The following best practice should be incorporated into Contractor's procedures to reduce the amount of waste produced:

- ❖ Ensure construction materials ordered are the correct size.
- ❖ Order the appropriate volume of materials.
- ❖ Return excess materials to the supplier if possible or advertise them to other projects within the project area.
- ❖ Avoid ordering new materials if there are existing materials available or able to be adapted to the task within the project area.

2. Identifying waste

Waste in the National Environment (Waste Management) Regulations, 2020 includes any matter and any radioactive matter, whether liquid, solid, gaseous or radioactive which is discharged, emitted or deposited into the environment in such volume, composition or manner as to cause an alteration of the environment. Therefore, materials considered to be waste, whether being sent to landfill, recycling or being reused on site under an exemption, are subject to the waste management control regime and the regulation.

Table 8-2: Waste streams anticipated to be generated by the project

Waste stream	Composition	Classification	Proposed storage method	Waste treatment or disposal	recommendations
Construction wastes	Concrete, asphalt, gravel, stone, inert materials, wood, wires, plastic insulation, packaging materials	Recyclable/combustible	Waste skips; inert material stockpiled	Crush inert material and reuse on site; segregate wastes	Segregate wastes and dispose of appropriately or reuse.
Top soil	Turf, soil, gravel	inert	On-site storage areas to await reuse	Reuse on site, reuse off site, disposal on-site, and disposal off-site.	Reuse on-site
Waste from vegetation clearance	Wood, plant matter	Combustible	On-site storage areas	Composting of plant matter on-site, composting of plant matter on-site, recycle of wood and	Recycling of wood

Waste stream	Composition	Classification	Proposed storage method	Waste treatment or disposal	recommendations
				disposal to land.	
Domestic waste	Food waste, sanitary waste, card and paper, packaging, plastics, textiles	Recyclable combustible	On-site storage in labelled bin containers	Segregate recyclable materials, disposal to landfill, compositing food waste offsite. Sanitary waste to be treated at the local sewerage treatment works	Segregate recyclable materials, Land fill, Collection and management by registered waste handlers. Composting.
Waste engine oil	oil	Hazardous combustible	On-site storage in a bunded container	Off-site reprocessing	Off-site reprocessing Waste engine oil can easily be reprocessed off-site.
Solid hazardous wastes	Oily rags, empty containers	Hazardous combustible	On-site storage in a labelled wheeled bin container	Offsite reprocessing and reuse Disposal to a land fill	Offsite reprocessing and reuse

3. Waste segregation

Segregation of all waste streams by type or category with the help of colour coded bins will avoid potentially undesirable combined effects and will facilitate the reuse, recycling, recovery and/or disposal of the various wastes. All waste categories will be evaluated under the principle of the following four categories:

a. Re-use

If surplus materials can be used in future operations they are classified as materials which can be re-used, Materials that can be reused in their present form are surplus to requirements and need to be removed from site will be reused. The surplus products will be labelled, and storage area recorded for future reference.

b. Recycling

If surplus materials cannot be reused in their present form but could be used in a different form, they will be sent to recycling or labelled as future recycling i.e. damaged stock and biofouling may be composted as potential fertilizers.

c. Residual Waste

Residual waste can come in several forms including:

- ✓ Waste that cannot be disposed of due to its category, class or material (e.g. old tyres, metals and contaminated waste). Ways of reusing or disposing of the waste from the site needs to be found; and
- ✓ Unused machinery, spare parts or discarded parts. All items of this nature will be identified and dated. These items should be assessed quarterly to gauge their importance for potential future use. Once an item is deemed to have little or no future potential to be utilized, it should be either assessed for reuse in another form or disposed of from the site.

Residual waste can be an eyesore, fire hazard and has potential to impact on the environment through leachates. All residual wastes will be identified and new residual wastes will be added to the residual waste catalogue for quarterly auditing. Residual wastes that are deemed essential or have the potential for future use will be stored in a neat and tidy manner and where possible under cover to avoid or reduce the potential for further corrosion or damage to the product.

d. Landfill

If the above options cannot be satisfied then the only alternative left is to send the surplus materials to landfill. Under no circumstances will biological (except biofouling) or non-biological waste be dumped into water bodies.

4. Proper Waste storage

Waste should be stored at the place where it is generated or at designated central areas (for example at abstraction point sites) in a secure manner which prevents it escaping into the environment.

Waste storage will be governed by two standard practices -containment to prevent a pollution incident and segregation of different waste types to facilitate maximum recycling

In order to achieve this, the Contractor is required to ensure:

- All containers are in good condition, contain no holes and are covered to prevent material blowing away and to prevent water ingress. Any water entering a skip may require to be treated if is mixes with hazardous waste.
- All wastes that could leach or be entrained in water runoff should be stored on a bunded impervious area.
- Storage of liquid wastes require storage on impermeable surfaces that are within a secondary containment system, ideally a bund with 100% capacity of the container.
- Different waste streams should be segregated to facilitate accurate description for transport of waste and disposal to landfill; reuse and recycling of various waste streams; and the use of appropriate pollution controls.
- Segregation of waste at the point of generation should be provided by the use of designated areas or containers that are clearly labelled with bilingual and diagrammatic signs.
- Dedicated, signed containers should be provided in order to segregate waste materials for recycling or recovery.

Regular waste audits should be undertaken by the Contractor and the Client's Audit Team to check for the following:

- Containers are adequately signed.
- Containers are being filled fully prior to uplift.
- There is no cross contamination of materials (eg. hazardous and non-hazardous or wood and metal etc).
- Canteen and hazardous wastes are contained in covered containers.
- Containers are fit for purpose – i.e. adequately sized and structurally sound.
- Waste documentation is being retained.

Burning of waste is strictly prohibited unless permission is granted by NEMA. The burning of waste is subject to environmental legislation and requires approval from the Regulators.

5. Proper transportation of waste

To prevent the illegal transport of waste, the contractor or sub-contractor must comply with Regulation 12 of the National Environment (Waste Management) Regulations, 2020.

Waste handler appointed by the Contractor will be required to provide the Contractor with documentation necessary to transport waste legally. These details include but not limited to:

- Validity of Waste handler's License.
- Content of Waste Transfer Notes
- Identification of Disposal Site(s)

6. Monitoring

The contractor should be committed to minimizing the risks associated with the generation of wastes by the project. The monitoring of the quantity and types of wastes being generated by the project will be recorded in the wastes log book and kept on site at all times so that regular reviews can be undertaken.

Audits should be carried out by the Contractor to ensure compliance with the regulations.

7. Training, awareness and competency

The raising of environmental awareness is viewed as a crucial element in the appreciation and implementation of waste management strategies. It is important that the environmental requirements are appropriately communicated.

The contractor shall ensure that all personnel responsible for the execution of the waste management strategies are competent on the basis of education, training and experience.

8.2.4.8 Fire risks

Construction of the proposed bulk water supply and irrigation infrastructure will involve activities that have occupational health and safety risks like burns and electrocution with potential to cause loss of life and cause widespread damage to the property stored at the site. Fire may result from smoking in or near fuel storage areas or throwing smoldering cigarette butts onto dry combustible materials and improper electrical connections. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Impact mitigation

a) The developer/contractor should encourage individual safety by providing materials like gloves, fire blankets, fit fire detectors and emphasize on firefighting equipment installed in construction areas.
b) Develop and implement a fire management plan. The fire emergency plan should involve all the stakeholders in the neighborhood together with Uganda Police.
c) Fire assembly points should be designated within the abstraction point station and office for human safety in case of a fire outbreak;
d) Fire extinguishers of the correct class e.g. A, B or C class extinguishers, based on the fire potential should be placed at locations easily accessible to the people around and at the abstraction point station and office coupled with thorough training of all the workers in firefighting and safety skills.
e) Fire prone behavior such as smoking should be strictly prohibited and signs such as ‘NO SMOKING’ signs should be displayed at fire prone areas. Smoking zones should be demarcated for inevitable smokers.

8.2.4.9 Occupational health and safety incidents

During the construction phase, workers are exposed to various occupational health and safety risks. These risks include accidents, injuries from machinery and equipment, falls from heights, exposure to hazardous materials, and adverse environmental conditions. Occupational health and safety incidents can lead to severe injuries, illnesses, and even fatalities, impacting worker well-being and project timelines. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Conduct comprehensive safety training programs for all workers, emphasizing the importance of adhering to safety protocols. Provide ongoing safety awareness sessions to reinforce safe working practices.
b) Ensure that all workers are provided with appropriate PPE, such as helmets, gloves, safety glasses, high-visibility clothing, and fall protection gear. Regularly inspect and replace PPE to ensure it is in good condition.
c) Install clear and visible safety signage throughout the construction site to warn of potential hazards.
d) Conduct regular hazard identification and risk assessments to identify and mitigate potential safety risks. Implement control measures to minimize identified risks.
e) Develop an emergency response plan to handle accidents and incidents, including procedures for evacuation, first aid, and medical assistance.
f) Conduct regular emergency drills to ensure workers are prepared for various emergency scenarios.
g) Appoint dedicated health and safety officers to monitor compliance with safety protocols and conduct regular site inspections.
h) Establish a system for reporting and investigating accidents and near-misses to identify root causes and prevent recurrence.
i) Restrict entrance to the construction site and take record/stock of workers and visitors entering and leaving the site.
j) Provide on-site medical facilities and trained first aid personnel to respond to injuries and health emergencies promptly. Ensure that first aid kits are readily available and stocked with necessary supplies.

8.3 Operational Phase

8.3.1 Socio-Economic Impacts (Positive)

8.3.1.1 Employment generation and poverty alleviation

After the construction phase, employment opportunities will be presented during operation of the water treatment plant and offices. People will be employed as vehicle drivers, machine operators and attendants, project administrator and potters. The jobs available during this phase will be highly technical requiring skilled people however semi-skilled employees like cleaners might be employed. This will serve as an economic multiplier and alternative source of income to mostly the youth. The impact is local, permanent, high in magnitude, and highly probable, with an overall assessment of moderate before enhancement and severe after enhancement.

Enhancement measures

a) The majority of workers should be recruited from within the locality of the project site.
b) The contractor should ensure that the staffs have contracts which are designed in accordance with the law.

c) The contractor should also ensure prompt payment of wages and salaries.

8.3.1.2 Provision of market for locally available goods and services

Food stuff and other services like airtime and mobile money may be obtained from the local market. As a result, the local market for such products will be boosted through increased sale.

Enhancement measures

a) The contractor should continue purchasing materials and utilizing services that will be locally available from the local markets; and
b) Local people should be encouraged to start up small enterprises to serve the project workers.

8.3.1.3 Increased Agricultural Productivity and Food Security

The irrigation of 15,000 hectares will significantly increase crop yields and extend growing seasons, directly improving food security for the local population and the country at large.

Impact Intensity: High

Enhancement Measures:

a) Promote sustainable farming practices.
b) Provide agricultural training for farmers on efficient water usage.
c) Establish cooperatives to improve market access for agricultural produce.

8.3.1.4 Economic Growth

The project will boost agribusiness opportunities, and stimulate rural industrial growth. The increased agricultural output will also contribute to Uganda's GDP, fostering economic stability.

Impact Intensity: High

Enhancement Measures

a) Provide capacity-building programs for local entrepreneurs
b) Strengthen linkages between farmers and agribusinesses.

8.3.1.5 Climate Resilience and Drought Mitigation

By providing a reliable water source, the project will help communities cope better with climate change, reducing the vulnerability of agriculture to droughts and erratic rainfall patterns.

Impact Intensity: Moderate to High

Enhancement Measures

a) Incorporate climate-smart agricultural techniques, such as efficient irrigation methods (e.g., drip irrigation)

b) Establish early warning systems for water shortages and droughts.

8.3.1.6 Sustainable Water Supply for Domestic and Industrial Use

Beyond agriculture, the project will explore developing a sustainable water source for domestic consumption, rural industries, and livestock, which will help meet the growing population's needs, projected to double by 2050.

Impact Intensity: Moderate

Enhancement Measures

a) Ensure equitable access to water resources by developing infrastructure for water distribution to underserved communities.
b) Promote the sustainable use of water in industrial and livestock sectors.

8.3.1.7 Improved accessibility to safe drinking water

This is the most significant positive impact of the project. It moves along with construction of appropriate sanitation facilities so as reduce on the spread of water-borne diseases such as dysentery and potential for outbreaks of epidemic infectious diseases such as cholera.

Enhancement measure

a) Set tariffs that will allow the most vulnerable members of society to access the new water services.

8.3.1.8 Transformation of Agricultural Practices

The MWACRID project will catalyse a shift from traditional rainfed agriculture to modern, irrigated farming systems, covering over 12,673 hectares in the project area. With reliable access to water and pressurized distribution, farmers can adopt improved agronomic practices, mechanization, and precision irrigation. This will increase crop yields and production cycles, reducing vulnerability to seasonal variability and drought.

Enhancement measures

a) Establish demonstration plots to promote good agronomic practices and irrigation scheduling.
b) Train farmers in climate-smart agriculture, water-use efficiency, and equipment maintenance.
c) Collaborate with agricultural extension officers for continued knowledge transfer.

8.3.1.9 Sustainable and optimal use of irrigation water resources

The project's advanced design incorporates pressurized pipelines, SCADA (Supervisory Control and Data Acquisition) systems, and farm-level water control mechanisms that minimize water losses and prevent over-irrigation. These technologies promote efficient water

use, helping to maintain the long-term sustainability of Nile water resources, which is critical for both the environment and downstream users.

Enhancement measures

a) Develop a Water User Association (WUA) to manage equitable distribution and prevent over-abstraction.
b) Promote drip and sprinkler systems at farm level through input subsidies or matching grants.
c) Monitor abstraction volumes and efficiency regularly in partnership with DWRM.

8.3.1.10 Improved food security in the region

By enabling consistent water supply throughout the year, the project enhances food production, reduces crop failure risk, and allows for multiple growing seasons. This will contribute to both household food security and increased supply to local and national markets, especially for staple crops such as maize, beans, rice, and horticultural produce.

Enhancement measures

a) Link smallholder and commercial farmers to agro-processors, cooperatives, and markets.
b) Introduce nutrition-sensitive agriculture programs to improve dietary diversity.
c) Promote post-harvest handling facilities to reduce losses and improve food availability.

8.3.1.11 Improved access to social services

The project integrates domestic water supply systems alongside irrigation infrastructure. Over 87,000 people are expected to benefit from potable water, improving health, sanitation, and school attendance, particularly for women and children who often bear the burden of water collection.

Enhancement measures

a) Establish community water user committees to oversee public standpipes and minor maintenance.
b) Conduct WASH campaigns (Water, Sanitation, and Hygiene) in schools and health centers.
c) Prioritize provision of gender-friendly water access points close to homesteads and public institutions.

8.3.1.12 Crop diversification and intensification

Irrigation enables the cultivation of high-value and non-traditional crops such as vegetables, fruits, rice, and pasture for livestock. This diversification improves income resilience, food variety, and climate adaptation, while intensification allows better use of limited land resources.

Enhancement measures

a) Partner with agribusiness firms and off-takers to introduce contract farming models.
b) Promote access to improved seed varieties, fertilizers, and mechanization through organized farmer groups.
c) Provide agronomic training on crop rotation, soil health, and integrated pest management.

8.3.1.13 Tourism potential and aesthetic value

The creation of large reservoir at Kaduku Hill and farm-level irrigation infrastructure enhances the local landscape. These areas, surrounded by rehabilitated green zones and afforestation areas, can become eco-tourism attractions or serve as recreational and educational sites for local schools and visitors.

Enhancement measures

a) Promote community-based eco-tourism initiatives in collaboration with local governments and the Uganda Tourism Board.
b) Support planting of indigenous and ornamental trees around reservoirs and public spaces.
c) Install viewpoints, signage, and trails to increase public access and educational value.

8.3.2 Socio-Economic Impacts (Negative)

8.3.2.1 Prostitution, Crime, and Substance Abuse

The constant influx of travellers and workers may lead to increased demand for sex work, and potentially a rise in prostitution, crime, and substance abuse, which could disrupt community safety and social stability. The impact is local, long-term, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Enforce a strict code of conduct for all project employees and service providers.

b) Enhance security measures through collaboration with local authorities and community policing efforts.
c) Conduct regular awareness campaigns on the dangers of prostitution, crime, and substance abuse, targeting both project staff and the local community.
d) Provide support and counselling services for individuals at risk of engaging in these activities.

8.3.2.2 Child Labor and Educational Disruption

The proposed project 's operations may affect nearby schools and residential areas as the young youths seek employment, increasing the risk of child labour. Furthermore, it is likely that project workers will engage in sexual relationships with school and under aged children, increasing the risk of abuse, and school dropouts. The impact is local, long-term, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Establish and enforce clear policies against child labour.
b) Collaborate with local schools and community leaders to monitor and address incidents of child abuse or labour.
c) Conduct outreach programs in schools to educate children and parents about the importance of education and the risks of child labour.
d) Implement a child protection plan in collaboration with local authorities and community leaders.

8.3.2.3 Family and Social Disruption

Higher disposable incomes among project workers may lead to social issues such as extramarital affairs, family breakdowns, and an increase in street children due to neglected family responsibilities. The impact is local, long-term, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Promote financial literacy programs for employees to manage their income responsibly.
b) Foster a culture of family values and responsible behaviour through regular counselling and support services.
c) Empower community leaders to address and mitigate the impacts of increased disposable income on family dynamics.
d) Implement grievance redress mechanisms (GRMs) to address family-related issues promptly.

8.3.2.4 Gender-Related and vulnerable groups issues

Gender-related challenges may arise, including sexual harassment, unequal employment opportunities, and inadequate facilities for women, potentially leading to health risks and social exploitation. Without intentional design, women, youth, persons with disabilities, and other vulnerable groups may have reduced access to irrigation benefits, credit, and decision-making roles. The impact is local, long-term, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures:

a) Ensure comprehensive gender sensitization training for all project staff.
b) Install gender-sensitive facilities such as separate toilets
c) Designate a specialist to oversee the implementation of the gender action plan.
d) Promote equal employment opportunities and fair treatment of all genders.
e) Conduct regular awareness campaigns about gender rights and responsibilities.
f) Ensure gender-sensitive extension services and training.
g) Form or strengthen inclusive WUAs with at least 30% female representation.
h) Prioritize vulnerable households for on-farm support packages (e.g., equipment, grants).
i) Monitor participation and benefit-sharing disaggregated by gender and vulnerability status.

8.3.2.5 Community health and safety impacts

Risks may emerge from chemical use, stagnant water near homes, open canals, and unsafe access to water points, potentially causing accidents or exposure to harmful substances. The impact is local, long-term, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Enforce safe agrochemical handling through training and licensing.
b) Fence-off high-risk infrastructure (e.g., reservoirs, treatment units).
c) Provide community safety education on water handling, hygiene, and equipment use.
d) Establish and promote a grievance redress mechanism for health and safety concerns.

8.3.2.6 Impacts on water supply and flood control

Over-reliance on irrigation water may reduce recharge to nearby shallow aquifers or interfere with natural flood cycles that recharge wetlands and support groundwater systems. The impact is local, long-term, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Monitor groundwater levels and surface water interactions.
b) Maintain buffer zones to reduce surface sealing.
c) Plan seasonal irrigation to accommodate local flood cycles.
d) Implement integrated water resource management at the catchment scale.

8.3.3 Environmental Impacts (Negative)

8.3.3.1 Impact from poor waste management

Poor waste management especially food waste attracts various small mammals and primates that could cause various risks to the workers. Operation will generate significant quantities of sludge, which can negatively impact soil, groundwater, and surface water if not managed properly. Implementing the proposed mitigation measures is expected to reduce impact intensity to a "very low" level, resulting in a residual impact of minor significance.

Mitigation Measures

a) Develop a robust waste management plan that allows for waste segregation per waste stream
b) The project shall engage the services of licensed waste handlers to manage different wastes in order to avoid waste accumulation.

8.3.3.2 Pollution of soil, surface water and ground water

Oil spills from equipment and structures at the abstraction points and offices such as vehicles and generators have potential to lead to contamination of soil, surface water and ground water of the project area. Intensive irrigation and agrochemical use (fertilizers and pesticides) may lead to runoff into water bodies, contaminating rivers, wetlands, and groundwater. This could reduce water quality downstream in the Nile and its tributaries.

Impact intensity before mitigation is medium, potential oil spills from equipment could contaminate local soil and water bodies, posing risks to the environment and community health.

Impact intensity after mitigation is low, constructing trenches, establishing special collection points, and using interceptors will effectively contain spills and prevent contamination, significantly lowering the pollution risk.

Mitigation Measures

a) A trench should be constructed below the proposed site to channel the running water so as to avoid contamination.
b) A special collection point should be put in place for the generator.
c) Hazardous material and parts obtained from the generators during service should be properly stored on site until collection by the registered waste handlers.
d) The drainage system within the proposed sites should be fitted with oil and grease interceptors.
e) Onsite repairs /maintenance and fueling activities should be limited. These areas should be located away from drainage channels and surface water bodies.

f) Train farmers on integrated pest management (IPM) and safe agrochemical use.
g) Establish buffer zones (vegetated strips) along irrigation canals and rivers.
h) Monitor water quality regularly through a community-supported Water Quality Surveillance Plan.
i) Promote organic farming practices where possible.

8.3.3.3 Downstream impact of water withdrawal from the Nile River

The monthly water demand for "Port bulk water supply and irrigation infrastructure in Masindi District" has been estimated considering the total irrigation water requirement and domestic demand.

As described in the Feasibility Study Report, the monthly water abstraction (for the entire project area) ranges from 0.63 m^3/s to 3.75 m^3/s that represents the 0.1% and 0.4% of the average flow of River Nile. Considering the available flow for abstraction (80% dependable flow - 20% environmental flow) the maximum water abstraction represents the 0.6%. In terms of water levels, the impact is not significant (a decrease of 1 centimetre as per hydraulic model simulation).

Considering a project phasing, the water abstraction in the first phase is more than halved, so that the withdrawal would range from 0.05% to 0.2%.

Downstream Masindi Port, the Kyoga Nile carries water through a series of rapids and floodplains, eventually entering Lake Albert at its southern end. The Kyoga Nile and Semliki River are the main rivers supplying Lake Albert[1] [2]. The available data at lake Kyoga and lake Albert show no significant flow differences at the two stations, but a balance between the water losses, abstractions and additional contribution from the inter-catchment[3]. In recent decades, flow at Masindi Port has exhibited both increasing and decreasing trends due to factors such as climate variability, land use changes, and upstream water management. Changes in flow at Masindi Port are likely to result in corresponding changes in water levels in Lake Albert, unless influenced differently by the Semliki River.

Downstream of Masindi Port, the Kyoga Nile continues towards Lake Albert supports agriculture, domestic water needs, fisheries, hydropower, limited navigation, tourism, and vital ecological services. Water users along this stretch manage their water resources through a mix of local practices, government-led initiatives, environmental conservation efforts, and

[1] Sutcliffe, J.V. (2012). Nile Basin, Lakes. In: Bengtsson, L., Herschy, R.W., Fairbridge, R.W. (eds) Encyclopedia of Lakes and Reservoirs. Encyclopedia of Earth Sciences Series. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-4410-6_131
[2] Tumusiime, M.D., et al. Impacts of Climate Variability on Water Yield of River Akokorio and Kapiri Sub-Catchments. J Climatol Weather Forecast, 2022, 10(11), 001-009.
[3] https://nilebasin.org/nile-basin-flow-forecast-system

community engagement, though challenges in governance and infrastructure persist[4], [5]. The table below summarizes the Water Users Downstream of Masindi Port to Lake Albert.

Table 8-3: Water Users Downstream of Masindi Port to Lake Albert

User Type	Description
Agriculture	Downstream Masindi Port, rainfed and some irrigated agriculture are present, especially near the river and its floodplains where farmers grow crops such as maize, rice, and vegetables, and raise livestock. However, large-scale irrigation is limited compared to other regions in Uganda, and most agriculture remains rainfed[6]. The river's floodplains and wetlands are used for seasonal agriculture and grazing.
Domestic / Municipal	Community Water Supply: Villages and small towns along the river rely on it for drinking water, washing, and other domestic needs. Sanitation: The river and its tributaries are also used for waste disposal in some communities, though this is discouraged due to health and environmental concerns4 Large scale infrastructure: Feasibility Study & Preliminary Design for the Development of Water Supply and Sanitation Infrastructure for the new Cities of Fort Portal, Hoima and Lira (at initial stage)
Industry	There is limited industrial activity directly along this stretch of the river. Most industry is concentrated upstream near Jinja.
Fishing	Fishing is a key livelihood for communities, especially as the river approaches Lake Albert, which is known for its productive fisheries.
Hydropower	Water releases and flow management from upstream hydropower stations affect water availability and river conditions along Kyoga Nile and downstream. 80 km downstream Masindi Port, Karuma hydropower plant is installed with a capacity of 600 MW[7].
Transport / Navigation	Navigation is limited in this stretch due to rapids and falls, particularly as the river approaches Murchison Falls. However, local communities use boats for transport and fishing, especially near Lake Albert.

[4] NBI: Integrated lakes management plan (ILMP) for the fisheries and ecosystems of Lakes Edward and Albert (2008)
[5] Nsubuga, F. , Namutebi, E. and Nsubuga-Ssenfuma, M. (2014) Water Resources of Uganda: An Assessment and Review. *Journal of Water Resource and Protection*, **6**, 1297-1315. doi: 10.4236/jwarp.2014.614120.
[6] Mutenyo I (2009): Impacts of Irrigation and Hydroelectric Power Developments on the Victoria Nile in Uganda.
[7] https://www.uegcl.com/power-plants/karuma-hydropower-project/

User Type	Description
Tourism / Recreation	The river is a significant tourist attraction, especially near Murchison Falls National Park, where activities include wildlife viewing, boat safaris, and fishing.
Environmental / Ecological	The river supports extensive wetlands and floodplains, which are critical habitats for wildlife and biodiversity, especially as it nears Lake Albert. The Murchison Falls-Albert Delta Wetland, a Ramsar site, is a key ecological area at the northern end of Lake Albert, supporting both local livelihoods and biodiversity[8].

In terms of water resources availability, the available flow largely covers the maximum water demand for Masindi Port Bulk Water Supply and Irrigation system.

Based on the current hydrological and socio-economic context of the Kyoga Nile between Masindi Port and Lake Albert, the water abstraction from the Nile River is not expected to result in significant negative impacts on existing water users or the riverine ecosystem. The available river flow in this stretch of the Nile is considerably higher than the proposed abstraction volume, indicating a strong natural capacity to accommodate additional withdrawals without affecting overall river health or downstream availability. Furthermore, human and ecological demands along this section are relatively limited.

It is recommended, however, to monitor water flows and abstractions at the catchment level, particularly in light of the additional large-scale water systems planned for the area.

Mitigation measures

a) Set abstraction limits through water permits issued by DWRM.
b) Monitor real-time water use via SCADA systems.
c) Introduce tiered water tariffs to discourage overuse.
d) Promote water-efficient technologies (drip and sprinkler systems).
e) Maintain environmental flow thresholds in line with national standards.
f) Use hydrological modelling to guide seasonal irrigation schedules.
g) Coordinate with DWRM to align water releases with ecosystem needs and community usage patterns.

8.3.3.4 Sediment loading and wetland management

Land disturbance from irrigation, especially on sloped terrain, may increase soil erosion and sedimentation into wetlands such as those near Myeba and Wayibango, degrading biodiversity and water storage functions.

[8] https://rsis.ramsar.org/ris/1640

Before mitigation, land disturbance from irrigation particularly on sloped terrain poses a major negative impact due to the high likelihood of soil erosion and sedimentation into nearby wetlands such as those in Myeba and Wayibango. This could lead to long-term degradation of biodiversity and a decline in the wetlands' natural water storage and purification functions. The impact is high in magnitude, site-specific to local in extent, partially reversible, and probable without intervention. However, after implementing mitigation measures such as contour farming, vegetative buffers, terracing, and sediment traps the impact is expected to be significantly reduced to minor or moderate. The residual impact becomes low to moderate in magnitude, short- to medium-term in duration, site-specific, reversible, and unlikely to occur if managed effectively.

Mitigation measures

a) Promote soil conservation practices (e.g., contour ploughing, grass strips).
b) Maintain drainage channels and remove accumulated silt periodically.
c) Rehabilitate wetlands by planting native species and restoring hydrology.
d) Implement catchment-based sediment management plans.

8.3.3.5 Water loss impacts

Leaks from the pressurized irrigation network or inefficient practices may result in significant water losses, affecting system performance and downstream water availability.

Mitigation measures

a) Conduct routine inspections and preventive maintenance of pipelines.
b) Use leak detection sensors and pressure gauges.
c) Train WUAs on identifying and reporting leaks.
d) Promote efficient on-farm irrigation practices to reduce overuse.

8.3.3.6 Introduction of invasive species

Open water storage and disturbed soil can promote the spread of invasive aquatic and terrestrial species such as water hyacinth or *Lantana camara*, which can outcompete native flora and reduce biodiversity. Before mitigation, open water storage and disturbed soils present a moderate to major negative impact by creating favorable conditions for the spread of invasive species such as water hyacinth in aquatic environments and Lantana camara in terrestrial areas. These invasive species can rapidly outcompete native vegetation, leading to a loss of biodiversity, disruption of ecosystem functions, and long-term habitat degradation. The impact is considered moderate to high in magnitude, local to regional in extent, long-term in duration, partially reversible, and probable without control measures. However, with appropriate mitigation including routine monitoring, early detection and removal of invasive species,

biological control where feasible, and rehabilitation of disturbed areas using native plant species the significance of the impact is reduced to minor. Post-mitigation, the impact becomes low in magnitude, site-specific, short- to medium-term in duration, reversible, and unlikely to occur with sustained management.

Mitigation measures

a) Monitor and map invasive species spread as part of environmental audits.
b) Engage community members in manual removal and surveillance.
c) Use biological control agents under guidance from NARO and NEMA.
d) Avoid planting exotic species in rehabilitation areas.

8.3.3.7 Impacts on fish and fishing

Changes in water quality, flow regimes, and sedimentation can reduce fish spawning grounds and fish stocks, affecting artisanal fishers who rely on local rivers and wetlands.

Mitigation measures

a) Maintain minimum environmental flows during key spawning periods.
b) Install fish screens at intake points.
c) Train communities in sustainable fishing practices.
d) Support alternative livelihoods such as aquaculture where needed.

8.3.3.8 Impacts on climate change

Though beneficial for resilience, the system's energy use for pumping, clearing of forested areas (e.g., Kaduku Hill), and intensified land use may increase greenhouse gas emissions.

Mitigation measure

a) Use solar or hybrid pumping systems to reduce fossil fuel dependence.
b) Replant cleared forest areas as part of an approved reforestation plan.
c) Promote conservation agriculture to enhance carbon sequestration in soils.
d) Implement a greenhouse gas monitoring plan as part of the ESMP.

8.3.4 Health and Safety Impacts (Negative)

8.3.4.1 Impacts of safety and Security

The operation of the water treatment plant will introduce various safety and security challenges. These challenges include the unauthorized access to restricted areas, and the safety of passengers, staff, and property. Ensuring robust safety and security measures is crucial to protect the water treatment plant's operations. The impact is site-specific, short-term, high in

magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation Measures

a) Install advanced surveillance systems, including CCTV cameras and motion detectors, throughout the premises to monitor activities and detect suspicious behaviour.
b) Implement access control systems with biometric verification to restrict entry to sensitive areas to authorized personnel only.
c) Employ and train a dedicated team of security personnel to monitor and manage security operations effectively.
d) Establish rapid response teams to handle security breaches, emergencies, and incidents promptly.
e) Develop and regularly update emergency response plans to handle various security threats, including terrorist attacks, natural disasters, and accidents.
f) Collaborate with local law enforcement agencies to enhance security measures and ensure coordinated responses to security incidents.

8.3.4.2 Noise Emissions

Noise will be generated from a series of activities and equipment utilized for delivery of materials to the sites. During operation phase, noise in the project area could be as a result of vehicular traffic, water pump, generators and other machinery in the area. The main noise receptors are workers at the abstraction points and offices and neighbors.

Impact intensity before mitigation is medium noise from construction activities, traffic, and machinery can disrupt the community and affect the health and well-being of workers and nearby residents, particularly those who are sensitive to noise. Impact intensity after mitigation is low, using noise suppressors, providing ear protection, maintaining machinery, and limiting operations to daytime hours will significantly mitigate noise levels, reducing its impact on the community and workforce.

Mitigation measures

a) The generator should be fitted with noise suppressor equipment.
b) Workers should be supplied with personal protective equipment (ear pads) in order not to impair on their health as a result of over exposed to noise.
c) The contractor should carry out periodic maintenance of machinery.
d) Operation activities should be restricted to day time.

8.3.4.3 Poor Sanitation at the Water Treatment Plant and offices

There is a likelihood of some workers littering the compound.

Impact intensity before mitigation is low, while littering may pose a nuisance, it does not present a significant health risk without proper mitigation measures in place.

Mitigation Measures

a) The developer/contractor should have enough dustbins located within strategic locations at the abstraction points and offices and ensure that the waste bins are promptly emptied by the waste handlers at regular intervals of the day;

b) Training of workers on waste management.

8.3.4.4 Pollution of soil, surface water and ground water

Oil spills from equipment and structures at the abstraction points and offices such as vehicles and generators have potential to lead to contamination of soil, surface water and ground water of the project area.

Impact intensity before mitigation is medium, potential oil spills from equipment could contaminate local soil and water bodies, posing risks to the environment and community health. Impact intensity after mitigation is low, constructing trenches, establishing special collection points, and using interceptors will effectively contain spills and prevent contamination, significantly lowering the pollution risk.

Mitigation Measures

a) A trench should be constructed below the proposed site to channel the running water so as to avoid contamination.
b) A special collection point should be put in place for the generator.
c) The drainage system within the proposed sites should be fitted with oil and grease interceptors.
d) Onsite repairs /maintenance and fueling activities should be limited. These areas should be located away from drainage channels and surface water bodies.

8.3.4.5 Health and safety of workforce and community

Risks to health and safety will apply to project personnel and community during execution of operation activities therefore the public health and safety of workforce and the community at large needs to be taken care of.

Impact intensity before mitigation is high, without proper training and safety measures, risks to health and safety are considerable for both workers and the surrounding community. Impact intensity after mitigation is medium, implementing comprehensive training, conducting risk assessments, and ensuring the presence of medical support will reduce health risks but may not eliminate them entirely.

Mitigation measures

a) Workers should be given induction training and tool box talks on the use of machinery, firefighting and first aid services. This training should be conducted regularly during operation and should be conducted by qualified safety personnel.
b) The developer should implement the health and safety policy. Copies of this policy should be kept onsite.

c) A risk assessment should be conducted to identify the hazards that may be involved in the construction and operation phases and their mitigation measures to ensure that the activities are completed safely.
d) A fully stocked first aid kit should be procured and kept onsite to cater for emergency injuries before the injured person can be transported for extensive medical attention.
e) A well trained first aider should be available at the site.
f) Signing of a memorandum of understanding with an established hospital or clinic and ambulance on call to handle severe injuries on work force or community.
g) Recruit an Occupational Health and Safety who will implement all the OHS mitigation measures.

8.3.4.6 Fire outbreaks

Operation of the Water treatment plant and offices will involve activities that are prone to fire outbreaks. Fire may result from smoking in or near fuel storage areas or throwing smoldering cigarette butts onto dry combustible materials and improper electrical connections. Fire can also be of risk to human beings. While economic implication of the impact may be temporary, fatalities that could result from such a destructive occurrence can be permanent.

Impact intensity before mitigation is medium, the risk of fire from equipment and combustible materials poses significant dangers to personnel and the environment, requiring proactive management. Impact intensity after mitigation is low, inducting employees in fire safety, conducting drills, and clearly marking fire hazards will substantially mitigate fire risks, reducing the likelihood of incidents.

Mitigation measures

a) All employees should be inducted on fire safety and undertake regular fire evacuation drills.
b) The Safety Officer should be required to produce routine reports on fire safety management and awareness.
c) All potential fire hazard areas should be screened off including fuel storage areas. Appropriate signage should also be displayed on such areas.
d) Install “no smoking” signage in high fire risk, public and communal areas.
e) All buildings at the abstraction points and offices should have emergency fire exit well marked for all people.
f) A well designated fire assembly point should be availed at the abstraction points and offices.
g) Ware houses for all inflammable materials should be well labelled and precaution signage posted.

8.3.4.7 Water and vector-borne disease risks

Poorly drained fields and stagnant water in canals may lead to breeding of mosquitoes and snails, increasing incidence of malaria, bilharzia, and other diseases.

Mitigation measures

- Ensure canal design allows for free flow and easy drainage.
- Conduct routine vector surveillance and use of ecofriendly pesticides.
- Promote community awareness on disease prevention and symptoms.
- Partner with local health centres to support treatment campaigns.

8.3.4.8 Water system leaks and pressure loss

Operational failures may result in low water pressure, especially in downstream farms or higher elevations, limiting irrigation effectiveness and damaging equipment.

Mitigation Measures:

- Design the system with pressure zones and pressure-reducing valves.
- Implement real-time pressure monitoring using SCADA.
- Schedule routine maintenance and establish a rapid-response unit.
- Train local technicians for minor repairs and system checks.

8.4 Impacts Specific to Masindi Port Area

8.4.1 Impacts on Masindi MV Ferry Operations

The Masindi MV Ferry plays a crucial role in transporting vehicles and passengers across the River Nile, with a loading capacity of 12 vehicles and 300 passengers, operating daily. The construction of the water intake structures and pipelines in the vicinity of the ferry could lead to several specific impacts

Disruption to Ferry Operations: Construction of the water intake and pipelines may interfere with ferry docking, passenger boarding, and vehicle loading/unloading. This could result in delays or temporary suspension of services.

Increased Traffic Congestion: Construction vehicles and equipment could congest access roads to the ferry terminal, especially given the ongoing construction of the Masindi Port road (7 km).

Increased River Traffic: The movement of construction barges and equipment in the river may interfere with the ferry's safe navigation and docking.

Impact intensity before mitigation is high; without mitigation, ferry operations would face significant delays and disruptions due to construction activities, potentially causing large-scale inconvenience for passengers. Impact intensity after mitigation is medium; after mitigation (e.g., scheduling and alternative docking), the disruptions would be minimized, reducing overall severity and duration.

Mitigation Measures

a) Schedule construction activities during off-peak ferry operating hours to minimize disruptions.

b) Ensure coordination with ferry operators to avoid conflicts between river traffic and construction activities.

8.4.2 Impacts on Small Businesses

There are small businesses, such as food kiosks, located near the Masindi MV Ferry terminal that serve passengers and the local community. These businesses are vital for livelihoods but are vulnerable to disruptions from construction activities.

Temporary Business Disruption: Construction noise, dust, and traffic congestion may reduce customer flow to these kiosks, leading to loss of income during the construction phase.
Reduced Accessibility: If construction activities block access routes or pedestrian pathways, customers may find it difficult to reach these kiosks, further impacting their operations.
Impact intensity before mitigation is moderate. Impact intensity after mitigation is low.

Mitigation Measures

a) Engage business owners early on to develop compensation plans for loss of income due to construction.
b) Provide clear signage and alternative pathways to ensure customers can still access the kiosks during construction.
c) Offer temporary relocation options for affected businesses during the peak construction period if necessary.

8.4.3 Impacts on High Voltage Transmission Line

A high voltage transmission line runs through the Masindi Port area. Construction near this infrastructure poses risks of electrical hazards and potential damage to the transmission line.
Risk of Power Interruptions: Construction activities near the high-voltage line could accidentally damage the poles.
Safety Hazards: Working in close proximity to high-voltage lines increases the risk of electrical hazards to workers and nearby community members.
Impact intensity before mitigation is high. Impact intensity before mitigation is low.

Mitigation Measures

a) Conduct detailed site surveys to map the location of the transmission line and ensure that construction activities maintain a safe distance from the high-voltage poles.
b) Coordinate with the relevant electricity supply authorities to establish safety protocols for working near high-voltage lines, including isolation of the power supply if necessary.
c) Use signage and barriers to mark hazardous areas and prevent unauthorized access during construction near the transmission line.

8.4.4 Impacts on Masindi Port Road (7 km under construction)

The Masindi Port road is currently under construction, which may compound the impacts of additional construction activities related to the water supply project.

Increased Construction Traffic: Both the road construction and water infrastructure projects will result in an increased volume of construction traffic, which could lead to traffic congestion and road degradation.

Disruption to Road Construction: The proximity of the two projects may lead to logistical challenges, such as conflicting construction schedules or overlapping work zones.

Impact intensity before mitigation is high. Impact intensity before mitigation is low

Mitigation Measures

a) Coordinate schedules with the contractors working on the Masindi Port road to avoid overlapping construction phases and ensure smooth traffic flow.
b) Implement a traffic control plan to manage the movement of construction vehicles, ensuring minimal disruption to ongoing road construction and public use of the road.
c) Ensure road condition monitoring and undertake regular maintenance to prevent degradation caused by heavy construction vehicles.

8.5 Decommissioning Phase

The MWACRID project is designed as a permanent infrastructure project aimed at supporting long-term agricultural transformation and water supply in the region. As such, core infrastructure components, including the Bulk Water Transfer Facility (intake works, pumping stations, pipelines), reservoirs, pressurized irrigation networks, and domestic water supply systems, are not intended to be decommissioned. These assets will remain operational beyond the construction phase and are central to the project's long-term objectives. Decommissioning will apply only to temporary construction-related installations. Therefore, at the end of the construction phase, the following temporary structures and facilities established to facilitate construction will be dismantled, demolished, and removed by the contractor:

- Contractor’s workers’ camps (including accommodation units, kitchens, ablution blocks).
- Concrete batching plants and fabrication yards.
- Workshops and site offices used for construction coordination and equipment maintenance.
- Temporary storage areas for construction materials, tools, and spares.
- Mobile sanitary facilities (e.g., portable toilets and septic tanks).
- Temporary access roads, where they are not integrated into the final access network.
- Material extraction sites such as borrow pits and quarries, if not permanently converted to other uses.
- Waste management and fuel storage facilities, including hazardous substance containment areas.

All such facilities will be decommissioned in accordance with a NEMA-approved Decommissioning and Site Restoration Plan. Structures or systems forming part of the permanent MWACRID infrastructure will remain functional and unaffected by the decommissioning process.

8.5.1 Socio-Economic Impacts (Positive)

8.5.1.1 Employment opportunities for demolition workers

During the decommissioning phase of the proposed project, there will be opportunities for employment of demolition workers to dismantle and remove contractor's facilities used during the construction period. These facilities may include temporary structures at borrow areas, campsites, and other temporary structures. Providing employment opportunities for local workers in this phase can contribute positively to the local economy, mitigate potential unemployment issues post-construction, and ensure the proper closure of construction-related sites. The impact is site-specific, temporary, minor in magnitude, and moderately probable, with an overall assessment of moderate before enhancement and severe after enhancement.

a) Prioritize hiring local residents and communities for demolition and cleanup activities to maximize economic benefits and minimize social disruption.
b) Offer training programs and workshops to enhance the skills of local workers in demolition techniques and safety procedures.
c) Implement fair wage policies and ensure timely payment of wages to demolition workers, adhering to labour laws and regulations.
d) Provide equal opportunity for employment regardless of gender, ethnicity, or background, promoting inclusivity in the workforce.
e) Provide adequate PPE and ensure its proper use to protect workers from potential hazards during demolition work.
f) Provide support services such as transportation, accommodation, and childcare facilities to facilitate participation of local workers in demolition activities.

8.5.2 Socio-Economic Impacts (Negative)

8.5.2.1 Unemployment

On closure of the project, employees are expected to lose employmentparticularly among workers who were engaged in construction and related activities. This phase involves the winding down of construction operations, leading to a reduced demand for labour in the project area. Unemployment can have negative socio-economic impacts, including loss of income, reduced standards of living, and social instability. The impact is local, temporary, high in magnitude, and highly probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

d) Sensitization of the employees and community about financial literacy.
e) Provide career counselling and guidance services to help workers identify alternative career paths and opportunities.
f) Prioritize hiring local residents for decommissioning and cleanup activities, including demolition, environmental remediation, and site restoration.
g) Encourage private sector companies involved in the project to allocate resources towards local community development and job creation.

h) Provide specialized skills training and support services tailored to the needs of vulnerable populations.

8.5.3 Environmental Impacts (Negative)

8.5.3.1 Decommissioning waste

Demolition of the structures will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, large quantities of such waste may lead to release of certain hazardous chemicals into the environment. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before mitigation and minor after mitigation.

Mitigation measures

a) Implement recycling programs to segregate and recycle materials such as concrete, metal, and wood from demolition waste.
b) Conduct a thorough assessment of demolition waste to identify and safely remove hazardous materials such as lead-based paints, and other toxic substances.
c) Demolished rubble should be sold to interested people.
d) A certified waste collection firm should be hired to collect the demolition waste for proper disposal to designated areas.

8.5.4 Health and Safety Impacts (Negative)

8.5.4.1 Accidents to the demolition workers

Demolition activities involve use of machinery which may cause injuries. There is also a likelihood of injuries from falling objects, and scrap metal during demolition. This can cause loss of lives if not mitigated. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before and after mitigation.

Mitigation measures

a) Demolition workers should be provided with protective equipment like helmets, gumboots and overalls to protect against injuries.
b) A functional first aid kit should be kept on site in case of any emergencies.
c) Safety guidelines and regulations should be communicated to all demolition workers and contractors and appropriate warning signage should be displayed around the site.

8.5.4.2 Noise due to demolition of structures and disassembling of machinery

The demolition and disassembling works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be because of the noise and vibration that will be experienced as a result of these works. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before and after mitigation.

Mitigation measures

a) The site should be hoarded off prior to demolition to restrict the noise to the site.
b) Appropriate ear protection equipment like ear plugs should be provided to demolition workers.
c) Demolition should be carried out during the day at the less noise intensive time.

8.5.4.3 Dust impacts

Large quantities of dust will be generated during demolition works. This will affect demolition workers as well as the neighbors. The impact is site-specific, temporary, medium in magnitude, and moderately probable, with an overall assessment of moderate before and after mitigation.

Mitigation measures

a) Develop and implement a decommissioning plan
b) Enclose demolition areas with temporary enclosures or barriers to contain dust within the work site.
c) Demolition staff should be provided with masks.
d) Schedule demolition activities during periods of low wind and humidity to reduce the potential for dust dispersion.
e) On-site dust should be suppressed by sprinkling of water.
f) Notify neighbouring communities in advance about upcoming demolition activities and potential dust impacts.

8.6 Cumulative Impacts

Cumulative impacts are caused by the accumulation and interaction of multiple impacts on the functions of an ecosystem over time. The IFC has defined cumulative impacts as Cumulative impacts are those that result from the incremental impact of the Project when added to other existing, planned and reasonably predictable future projects and developments. Considering the specific regional context, existing and planned developments, and their combined impacts here's an identification of cumulative impacts based on the past, present, and future projects that may have similar impacts.

8.6.1 Habitat Degradation and Loss of Biodiversity

The construction and operation phases may lead to habitat degradation, particularly in areas adjacent to the Victoria Nile and Kaduku CFR. The introduction of invasive species during construction could exacerbate existing ecological pressures and diminish biodiversity in the region.

Impact intensity before mitigation: Medium
Impact intensity after mitigation: Low

Mitigation Measures

a) Implement strict protocols for vehicle and equipment cleaning to prevent the introduction of invasive species.

b) Restore habitats where construction activities occur and replace lost vegetation with native species.
c) Monitor ecosystems for invasive species post-construction to manage and control their spread.

8.6.2 Increased Traffic and Road Safety Risks

The construction and operational phases will increase traffic volumes, especially along major roads. This heightened activity may lead to more accidents, increased congestion, and risks to pedestrian safety.

Impact intensity before mitigation: Major
Impact intensity after mitigation: Moderate
Mitigation Measures

a) Develop a comprehensive traffic management plan that includes monitoring traffic conditions and adjusting operations as necessary.
b) Conduct community awareness campaigns about road safety, particularly targeting local residents and schoolchildren.
c) Install traffic control measures, such as speed bumps, signage, and dedicated pedestrian crossings.

8.6.3 Unsustainable Resource Extraction and Demand

The cumulative demand for murram, sand, gravel, and water will place stress on local resources, leading to depletion of non-renewable resources and potential long-term impacts on the availability of renewable resources.

Impact intensity before mitigation: Moderate
Impact intensity after mitigation: Low
Mitigation Measures:

a) Obtain all necessary extraction permits and comply with established regulations for sustainable resource use.
b) Establish a monitoring system to track resource use and ecological impacts, allowing for timely adjustments.
c) Encourage water conservation practices among construction and operational staff to minimize overuse.

.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP)

9.1 Introduction

This section presents the Environmental and Social Management Plan (ESMP). Whereas efforts are usually made to develop mitigation measures for a proposed project, it is during the operation lifespan of the project that actual impacts are noted or experienced. It is therefore important to integrate in the Environmental and Social Impact Assessment process, an Environmental and Social Management and Monitoring Plan that includes the monitoring of the progress of enhancement/mitigation measures being implemented while also monitoring the project for any new negative impacts that were not earlier considered or anticipated.

Key stakeholders in the implementation and monitoring of the ESMMP activities are: the client MWE with ultimate responsibility for Environmental & Social performance on the project; the Supervising Engineer (with an Environment and Social Specialist on their team) responsible for monitoring and supervising the implementation of the ESMP and contract requirements by the contractor(s); and the Contractor (with an Environmental Specialist, Social Development Specialist and Health & Safety Specialist) who has responsibility for implementing the ESMP. MWE will ensure that both the Supervising Engineer and Contractor are doing their jobs effectively and that the ESMP is delivering the necessary environmental and social protection measures, Masindi and Kiryandongo District Local Government, the Contractor, government agencies such as NEMA, local authorities and to some extent members of the public.

It is recommended that, during the construction phase, a formal environmental liaison person / Health Safety and Environmental (HSE) Officer and Sociologist be appointed as part of the Project Management Team, on site, to act as a link between the project, members of local communities and other identified stakeholders regarding environmental and social issues. The same environmental liaison person / HSE officer will also ensure the projects and Contractor's compliance with the requirements of the ESMMP and the requirements of the National Legislation are implemented.

The ESMMP will form part of the Contractor's working brief for contract pricing and management. The cost of implementing mitigation measures will thus be fully determined in the appointed contractor's bid.

9.2 Objectives of the ESMP

The main objective of the Environmental and Social Management and Monitoring Plan (ESMMP) is to ensure that environmental and socio-economic issues continue to be fully integrated into the decisions by the developer/contractor while promoting resource allocation efficiency throughout the lifetime of the project.

The specific objectives of the ESMMP include:

- To assist in ensuring continuous compliance with Ugandan legislation and the AfDB Standards; this is done through provision of a framework for the contractor's compliance, auditing and Developer's inspection programs
- Provide a mechanism for ensuring that measures identified in the ESIA report mitigate potentially adverse impacts and unforeseen or unidentified impacts are implemented until construction is complete.
- Provision of assurance to regulators and stakeholders that their requirements with respect to environmental and socio-economic performance will be met.

9.3 Implementation of the ESMMP

The effective implementation of the Environmental and Social Management and Monitoring Plan (ESMMP) requires clear commitments and adequate resourcing from all key stakeholders involved in the project. This section outlines the specific commitments and resources allocated by the MWE, and the Contractor to ensure the successful execution of the ESMMP.

9.3.1 Ministry of Water and Environment (MWE)

Monitoring will be undertaken by MWE and Environmental Officers from the project districts who represent NEMA at local administrative level. Monitoring by NEMA in this case can be considered "third party monitoring" but this is its regulatory mandate according to sections 6 and 7 of the National Environment Act (Cap 181).

Another government agency that may undertake "third party monitoring" is the Occupational

Health & Safety Department in Ministry of Gender, Labour & Social Development (MGLSD). This unit has authority to inspect any facility for compliance with national requirements on safety in workplaces. The project shall make no funding to MGLSD since this is provided for in its annual budget.

Monitoring will be done through site inspection, review of site records (Accident Log, issuance of PPE, waste records, trainings and inductions, permits and approvals, etc.), review of grievances logged by stakeholders and ad hoc discussions with potentially affected persons (construction workers, residents near the project facilities). At each monitoring, a discussion with chairpersons of environment committees of the areas' local councils (LC) could provide insight into views and grievances communities have about the project since they regularly interact with their community members.

9.3.2 Ministry of Gender, Labour and Social Development (MoGLSD)

The Ministry will play a critical role in monitoring labor standards and occupational health and safety (OHS) compliance at construction sites. This includes conducting inspections to ensure fair labor practices, prevention of child labor, enforcement of gender equity in employment, and adherence to national safety guidelines. MoGLSD may also offer technical guidance in addressing community and workers' grievances related to social protection.

9.3.3 Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)

The Ministry will provide support for integrating climate-smart agriculture, irrigation best practices, and post-harvest handling into the project. Through its extension services, MAAIF will contribute to training farmers on water-use efficiency, sustainable land management, and improved agronomic practices. It may also work with the Water User Associations (WUAs) and cooperatives to enhance productivity and food security.

9.3.4 Ministry of Trade, Industry and Cooperatives (MoTIC)

The Ministry will be engaged to facilitate linkages with farmer cooperatives, agro-processors, and markets. Their role includes supporting the formalization of farmer groups, promotion of agro-based enterprises, and enabling value addition to agricultural produce through capacity building and industrial development support.

9.3.5 Uganda Investment Authority (UIA)

UIA will be instrumental in identifying opportunities for private sector participation in agribusiness and agro-processing. The project may engage UIA to attract investors in irrigation-based commercial farming, storage facilities, and related rural enterprises that enhance the economic value of the MWACRID scheme.

9.3.6 National Environment Management Authority (NEMA) Commitments and Resourcing

As part of preconstruction activities, NEMA will undertake environmental and social due diligence including review and consideration of this ESIA for project support facilities in consultation with other relevant stakeholders for issuance of permits and licenses. Furthermore, NEMA will monitor implementation of the Project ESIA certificate conditions of approval and provide feedback for continuous improvement.

9.3.7 Kiryandongo and Masindi District Local Governments

Both Kiryandongo and Masindi District Local Governments will have direct roles in environmental and social monitoring, stakeholder engagement, and grievance redress throughout project implementation. Their District Environmental Officers (DEOs), District Community Development Officers (CDOs), and District Engineers will participate in site inspections and coordinate with MWE and NEMA to ensure compliance with national and district-level development priorities.

These local governments will also help mobilize communities, facilitate dialogue between stakeholders, and ensure that project activities align with local development plans. The LC1 and LC3 leadership structures will support grievance management, provide local oversight of

employment practices, and help mediate in case of conflicts between contractors and communities.

9.3.8 Supervising Consultant

The appointed Supervising Consultant will be responsible for the day-to-day oversight of the contractor's environmental, health, safety, and social (EHSS) performance. This includes reviewing the contractor's implementation of the Contractor's ESMP (C-ESMP), ensuring timely reporting on environmental and social indicators, and enforcing contractual compliance with mitigation measures.

The Consultant will also lead monthly site audits, verify monitoring data (e.g., air quality, water quality, noise), review incident reports, and ensure that corrective actions are implemented. The Consultant will coordinate with MWE and other stakeholders for technical backstopping and provide guidance to the contractor on compliance matters.

9.3.9 Project Implementation Support Mission (Involving AfDB)

The Mission, comprising representatives from the AfDB and relevant government agencies, will periodically assess the project's progress, including compliance with the environmental and social safeguard requirements outlined in the ESMP and AfDB's Integrated Safeguards System (ISS).

During supervision missions, the team will review implementation reports, conduct site visits, meet with stakeholders (including project-affected persons), and recommend measures for improving performance. Their oversight helps ensure that environmental and social risks are effectively managed and that the project continues to align with AfDB's safeguard and development objectives.

9.3.10 Contractor's Commitments and Resourcing

The Contractor, responsible for the construction activities of the proposed bulk water supply and irrigation infrastructure project, commits to fully complying with the ESMMP requirements. This includes integrating ESMMP provisions into their work plans, appointing an Environmental and Social Officer (ESO) to oversee on-site implementation, and allocating necessary resources such as budget, personnel, and equipment. The Contractor will also conduct training sessions on ESMMP requirements for all workers, establish a system for reporting and managing environmental and social incidents, and appoint a Community Liaison Officer (CLO) to engage with local communities and address their concerns, ensuring their feedback is incorporated into project activities.

9.4 Structure of the ESMMP

The ESMMP is structured to provide a comprehensive framework for managing the environmental and social impacts associated with the construction and operation of proposed

bulk water supply and irrigation infrastructure project. The ESMP delineates the impact, and specific measures to enhance positive effects and mitigate negative ones. The plan also outlines desired outcomes, performance indicators/targets, frequency of monitoring, clear roles and responsibilities for implementation and the cost as seen the table below.

Table 9-1: Environmental and Social Management and Monitoring Plan

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
CONSTRUCTION PHASE							
			Socio-Economic Impacts				
1.	Provision of Employment	a) Prompt payment and clear contracts. b) Establish good contractor-employee relationships. c) Employ 30% locals and 70% expatriates. d) Register workers with LC1 chairperson. e) Avoid child labour.	a) Improved local employment. b) Enhanced worker satisfaction. c) Strong community support. d) Easy traceability. e) No child labour.	a) Number of local workers. b) Worker satisfaction. c) Community feedback. d) Registration records. e) Absence of child labor.	Monthly inspections.	Contractor's HR	1,500
2.	Boost to Construction Sector	a) Prioritize local suppliers. b) Train and support suppliers. c) Partner with local associations. d) Offer long-term contracts. e) Ensure fair procurement. f) Track local material usage. g) Ensure materials meet standards. h) Source from environmentally responsible suppliers.	a) Strengthened construction sector. b) Increased local economic activity. c) Sustainable procurement. d) Improved local supplier capacity. e) Fair market practices. f) High local content. g) High-quality materials. h) Reduced environmental impact.	a) Local material percentage. b) Number of trained suppliers. c) Partnership agreements. d) Number of long-term contracts. e) Procurement audit results. f) Local supplier usage data. g) Material quality reports. h) Environmental compliance reports.	Bi-monthly	Contractor's Procurement team	2,200

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
3.	Increased Revenue / Taxes	a) Spend within local economy. b) Encourage formal employment. c) Incentivize tax-compliant suppliers. d) Maintain financial transparency. e) Collaborate with URA. f) Educate on tax obligations. g) Conduct regular audits. h) Favor local suppliers. i) Ensure timely tax payments. j) Use local banks.	a) Enhanced local revenue. b) Increased tax compliance. c) Strengthened local financial institutions. d) Clear financial transactions. e) Streamlined tax processes. f) Higher tax compliance. g) Accurate tax reporting. h) Local economic boost. i) Improved revenue streams. j) Enhanced local banking sector.	a) VAT and PAYE contributions. b) Number of formal employees. c) Supplier tax compliance. d) Financial audit results. e) Collaboration records with URA. f) Tax education sessions. g) Audit outcomes. h) Local supplier usage data. i) Timely tax payments. j) Usage of local banks.	Monthly	Contractor's Finance department	2,500
4.	Capacity Building	a) Implement comprehensive training programs. b) Provide on-the-job training. c) Offer certification courses d) Establish mentorship programs e) Introduce modern technology f) Assign leadership roles to locals.	a) Improved skills and capacity b) Enhanced practical experience c) Recognized qualifications d) Effective skill transfer e) Technological advancement f) Leadership experience	a) Number of training programs. b) On-the-job training completion. c) Certification achievements. d) Mentorship participation. e) Technology usage f) Local leadership roles. g) Access to learning resources h) Performance evaluation results.	Monthly	Contractor's Training department Local institutions	3,500

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		g) Encourage continuous learning. h) Monitor and evaluate performance.	g) Ongoing professional development h) Targeted training.				
5.	Traffic Disturbance	a) Develop traffic management plan. b) Schedule deliveries off-peak c) Install clear signage. d) Promote alternate routes. e) Inform the public. f) Employ traffic control personnel. g) Monitor traffic conditions. h) Ensure emergency access.	a) Minimized traffic disruptions. b) Reduced congestion. c) Safe and efficient traffic flow. d) Public awareness.	a) Traffic flow reports. b) Delivery schedules. c) Signage effectiveness. d) Public feedback.	Monthly	Contractor's EHS Officer	1,500
6.	Spread of HIV/AIDS and other sexually Transmitted Diseases	a) Contractor HIV/AIDS policy. b) Regular awareness campaigns c) Health education programs d) Provide free condoms e) Access to health services f) Collaborate with health organizations g) Engage local leaders h) Provide safe accommodation.	a) Reduced spread of HIV/AIDS. b) Increased awareness c) Access to prevention and care d) Safe housing.	a) HIV/AIDS policy compliance b) Campaign attendance c) Condom distribution records d) Health service usage.	Monthly	Contractor's EHS Officer	2,500

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
7.	Prostitution, crime and drug abuse	a) Implement worker code of conduct. b) Develop security plans with LC leaders and police. c) Sensitize workers on responsible behaviour d) Raise awareness on risks. e) Enhance local authority capacity.	a) Reduced crime and drug abuse. b) Improved community safety c) Responsible worker behaviour.	a) Incident reports. b) Worker conduct evaluations. c) Community feedback.	Monthly	Contractor's Sociologist	2,200
8.	Child labor, potential of child abuse and school dropouts	a) Report abuse to police. b) Minimize child-worker interaction. c) Conduct awareness campaigns. d) Collaborate with communities. e) Develop child protection plan.	a) Prevention of child labour b) Safe environment for children. c) Community support.	a) Incident reports. b) School attendance records. c) Community feedback.	Monthly	Contractor's Sociologist	1,500
9.	Disruption of families	a) Institute administrative controls b) Create community awareness c) Implement employee codes of conduct d) Empower community leaders.	a) Stable family units b) Responsible use of income c) Community awareness d) Effective GRMs.	a) Family disruption reports b) Community feedback c) GRM usage records.	Monthly	Contractor's Sociologist	1,700

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		e) Enhance local authority capacity. f) Sensitize community on income impact g) Implement GRMs. h) Conduct community engagements.					
10.	Gender concerns	a) Educate workers on sexual offenses. b) Display violence-free zone signs. c) Install gender-sensitive facilities. d) Appoint a gender specialist. e) Ensure gender sensitivity in tasks. f) Sensitize workers on gender rights. g) Conduct gender sensitization sessions.	a) Safe workplace for women. b) Reduced gender-based violence. c) Gender-sensitive facilities.	a) Incident reports. b) Worker feedback. c) Facility inspections.	Monthly	Contractor's Sociologist	2,200
11.	Impact on vulnerable groups	a) Engage with vulnerable groups. b) Inclusive project planning. c) Develop protection programs.	a) Protection of vulnerable groups. b) Inclusive development. c) Improved access to resources.	a) Engagement records. b) Employment statistics. c) Resource access reports. d) Grievance records.	Monthly	Contractor's Sociologist NGOs	3,500

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		d) Provide employment opportunities. e) Ensure access to resources. f) Monitor impacts on vulnerable groups. g) Collaborate with NGOs. h) Conduct training sessions. i) Set up grievance redress mechanism.	d) Effective grievance redress.				
12.	Impacts on cultural property	a) Conduct cultural assessments. b) Engage with local communities. c) Train construction staff. d) Establish grievance mechanism. e) Collaborate with cultural institutions. f) Restore disturbed areas.	a) Protection of cultural heritage. b) Community involvement. c) Reduced damage to cultural sites.	a) Assessment reports. b) Community feedback. c) Grievance records.	Monthly	Contractor's Sociologist	2,500
13.	Labour influx and social disruption	a) Implement Labour Influx Management Plan b) Hire locals Enforce code of conduct	Controlled labour presence and improved community relations	Local hires; No. of grievances; worker registration logs	Monthly	Contractor, Community Liaison Officer	3,500
14.	Loss of structures and assets	Implement RAP with full replacement compensation	Fair resettlement; reduced disputes	No. of PAPs compensated; RAP audit results	Quarterly	Project RAP Team, Local Government	18,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
15.	Interference with water supply	a) Map and protect existing water points Provide alternative supply	Continued water access during works	No. of water points protected; complaints logged	Monthly	Contractor, District Water Officer	3,000
16.	Physical displacement	a) Follow RAP b) Offer resettlement support	Safeguarded rights of displaced households	Livelihood restoration records; satisfaction surveys	Bi-annually	RAP Team, Social Specialist	25,000
Environmental Impacts							
17.	Loss of vegetation cover and suitable habitat	a) Optimize project layout to minimize space use. b) Conduct preclearance surveys to identify and avoid species of concern. c) Limit vegetation clearance to project footprint. d) Sensitize workers to avoid unnecessary clearing. e) Replant native trees to create habitats. f) Develop a tree planting strategy.	a) Minimized vegetation loss and habitat preservation.	a) Reduced area of vegetation cleared. b) Increased number of native trees replanted.	Monthly during construction and bi-annually post-construction.	Contractor's Environmental Manager	7,500
18.	Likelihood of introduction and spread of invasive species	a) Conduct preclearance surveys for invasive species. b) Rehabilitate with native species. c) Develop an Invasive Species Management Plan.	Prevention of invasive species colonization.	Absence or reduction of invasive species.	Bi-monthly during construction and bi-annually post-construction.	Contractor's Environmental Manager	2,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
19.	Impact from noise pollution and vibration effects	a) Use low-noise equipment and silencers. b) Limit work to daytime. c) Create noise barriers where possible.	Minimized noise and vibration impact	Noise levels within acceptable limits.	Weekly	Contractor's Environmental Manager	1,300
20.	Soil erosion	a) Minimize soil disturbance. b) Compact loose soil. c) Install adequate drainage facilities.	Reduced soil erosion and sedimentation.	Erosion rates and sediment levels in runoff.	Monthly	Contractor's Environmental Manager	1,800
21.	Pollution of soil, surface water and ground water	a) Use well-maintained machinery. b) Designate and line fueling areas. c) Implement a waste management plan. d) Develop a spill contingency plan.	Prevention of soil and water pollution.	Incidents of spills and contamination. Water quality parameters.	Monthly	Contractor's Environmental Manager	3,500
22.	Impacts on and of Storm Water	a) Develop a comprehensive stormwater management plan. b) Establish vegetative buffers. c) Implement construction BMPs. d) Regularly inspect and maintain stormwater measures.	Effective stormwater management.	Stormwater quality and flow rates.	Bi-monthly	Contractor's Environmental Manager	2,500

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
23.	Impacts of auxiliary facilities (quarries, borrow sites and campsites)	a) Conduct environmental assessments. b) Develop and implement specific management plans. c) Engage local communities. d) Establish monitoring programs.	Minimized impact from auxiliary facilities.	Compliance with management plans. Community feedback.	Monthly	Contractor's Environmental Manager	4,000
24.	Impacts on landscape general aesthetics	a) Plan construction layout to minimize visual impact. b) Preserve natural features. c) Use native plants for screening. d) Limit land disturbance. e) Implement phased construction. f) Maintain clean and orderly sites. g) Organize materials storage. h) Begin revegetation efforts early. i) Inform communities about activities.	Preservation of landscape aesthetics.	Community feedback. Visual assessments.	Monthly	Contractor's Environmental Manager	2,000
25.	Impact on faunal groups	a) Conduct pre-clearing surveys Adjust schedule to avoid breeding seasons	Faunal species protected and habitats maintained	Wildlife logs; incident reports; site inspection records	Monthly	Ecologist, Contractor	6,000
26.	Impacts on wetlands	a) Avoid wetland areas b) Use culverts	Maintained wetland function and hydrology	Wetland buffer presence; culvert installation records	Monthly	Environmental Officer,	8,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		c) Restore disturbed sections				Wetland Officer	
27.	Access road construction	Design with proper drainage and erosion controls	Stable and safe access roads	Number of culverts; slope stabilization implemented	Bi-monthly	Engineer, Environmental Specialist	10,000
28.	Pipe laying activities	a) Notify landowners b) Backfill quickly Restore land use	Minimal disruption to land and access	% of land restored; number of complaints	Weekly	Contractor, Land Valuer	4,000
29.	Hydrology and sedimentation	a) Use silt traps Schedule around rainy seasons stabilize soils	Controlled sedimentation and stable hydrological patterns	Turbidity measurements; erosion monitoring	Monthly	Hydrologist, Contractor	7,000
30.	Fish and fishing	a) Install fish screens b) Maintain environmental flows Consult local fishers	Protected fish populations and community livelihoods	Fish monitoring reports; flow data	Quarterly	Fisheries Officer, Contractor	4,000
Health and Safety Impacts							
31.	Dust and Air emissions	a) Water sprinkling to contain dust emission. b) Control speed of trucks to 30km/hr. c) Provide safety means for workers (masks). d) Use well-conditioned and serviced equipment.	a) Minimized dust and air emissions. b) Reduced dust from truck movements. c) Protected workers from dust inhalation. d) Reduced emissions from equipment. e) Compliance with air quality standards.	a) Levels of Particulate Matter (PM10). b) Speed records of trucks. c) PPE compliance records. d) Maintenance records of equipment. e) Monitoring reports.	Weekly Monthly	Contractor's EHS Officer	9,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		e) Regular monitoring of dust emissions (PM10).					
32.	Impacts of Noise	a) Use noise reduction mechanisms (well-conditioned equipment, silencers, etc.). b) Restrict noisy activities to normal working hours. c) Prohibit night work unless exceptional circumstances. d) Provide earmuffs to workers exposed to noise >80 dBA.	a) Minimized noise pollution. b) Reduced disturbance to residents. c) Minimized night-time disturbances. d) Protected workers from hearing impairments.	a) Noise level measurements. b) Work schedule adherence records. c) Work schedule adherence records. d) PPE compliance records.	Weekly	Contractor's EHS Officer	5,500
33.	Increased spread of communicable diseases	a) Conduct health screenings for all workers before joining and periodically during construction. b) Establish on-site clinic with licensed medical personnel. c) Provide health education sessions on disease prevention. d) Ensure a steady supply of medical supplies and PPE. e) Develop an emergency response plan for disease outbreaks.	a) Early detection and management of communicable diseases. b) Accessible healthcare for workers. c) Increased awareness and prevention of communicable diseases. d) Adequate resources for disease prevention and treatment.	a) Health screening records. b) Clinic establishment and operation records. c) Training attendance records. d) Inventory records of medical supplies and PPE. e) Emergency response plan and drill records.	Before construction Continuous Monthly Monthly Quarterly	Contractor's EHS Officer	15,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
			e) Preparedness for disease outbreaks.				
34.	Human Waste Disposal Impacts	a) Ensure sanitary facilities/mobile toilets are installed before construction begins. b) Train workers on proper sanitation practices.	a) Sanitary conditions maintained. b) Improved sanitation practices among workers.	a) Records of sanitary facilities installation. b) Training attendance records.	Before construction Monthly	Contractor's EHS Officer	2,000
35.	Solid waste generation	a) Implement best practices for waste minimization. b) Segregate waste streams by type or category. c) Ensure proper storage and transportation of waste. d) Conduct regular waste audits and compliance checks. e) Train workers on waste management practices.	a) Reduced waste generation. b) Effective waste management and recycling. c) Prevent environmental contamination. d) Compliance with waste management regulations. e) Increased awareness and adherence to waste management practices.	a) Waste audit records. b) Waste segregation records. c) Waste storage and transportation records. d) Audit and compliance reports. e) Training attendance records.	Monthly Weekly Weekly Monthly Monthly	Contractor's EHS Officer	7,000
36.	Fire risks	a) Provide fire safety materials (gloves, fire blankets, fire detectors).	a) Enhanced fire safety. b) Effective fire risk management.	a) Fire safety equipment records. b) Fire management plan and drill records.	Monthly Quarterly	Contractor's EHS Officer	6,500

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		b) Develop and implement a fire management plan. c) Designate fire assembly points and install fire extinguishers. d) Prohibit fire-prone behavior such as smoking in non-designated areas.	c) Improved emergency response readiness. d) Reduced fire risk.	c) Fire assembly point and extinguisher installation records. d) Compliance records and signs installation.	Monthly Weekly		
37.	Occupational health and safety incidents	a) Conduct comprehensive safety training programs. b) Provide appropriate PPE and regularly inspect and replace. c) Install clear and visible safety signage. d) Conduct regular hazard identification and risk assessments. e) Develop and implement an emergency response plan. f) Conduct regular emergency drills. g) Appoint dedicated health and safety officers.	a) Enhanced worker safety and reduced incidents. b) Protected workers from occupational hazards. c) Increased awareness of potential hazards. d) Early identification and mitigation of safety risks. e) Preparedness for handling accidents and incidents. f) Enhanced preparedness for emergency scenarios.	a) Training attendance records. b) PPE compliance records. c) Safety signage installation records. d) Risk assessment reports. e) Emergency response plan and drill records. f) Emergency drill records. g) Appointment records and site inspection reports. h) Accident and near-miss reports. i) Medical facility records and first aid logs.	Monthly Weekly Monthly Monthly Quarterly Quarterly Monthly Continuous Monthly	Contractor's EHS Officer	18,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		h) Establish a system for reporting and investigating accidents and near-misses. i) Provide on-site medical facilities and trained first aid personnel.	g) Improved monitoring and enforcement of safety protocols. h) Identification of root causes and prevention of recurrence. i) Prompt response to injuries and health emergencies.				
38.	Pressure on public health and sanitation	a) Provide on-site medical facilities Support nearby health centers (e.g., Masindi Port HC III) with supplies and personnel.	j) Minimized strain on local health facilities and improved worker welfare.	j) Clinic support records; medical attendance logs	Monthly	Contractor, District Health Officer	4,500
39.	Insecurity risks	a) Register workers b) Fence camps and equipment yards c) Collaborate with local police and LCs for patrols and reporting.	k) Safer environment for workers and host communities.	k) Security patrol records; incident reports	Monthly	Site Manager, Local Security Liaison	3,000
						Subtotal	220,400
OPERATION PHASE							
			Socio-Economic Impacts				
40.	Employment generation and poverty alleviation	a) Recruit majority from local community. b) Ensure staff contracts comply with law.	a) Local employment increase. b) Legal compliance.	a) Number of local hires. b) Compliance with contract standards.	Monthly	Developer's HR Department	4,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		c) Ensure prompt payment of wages.	c) Improved worker satisfaction.	c) Timeliness of wage payments.			
41.	Provision of Market for Locally Available Goods and Services	Contractor to purchase materials and utilize services from local markets; Encourage small enterprises	Boosted local market and economic activity	Percentage of materials sourced locally	Quarterly	Contractor, Procurement Officer	10,000
42.	Increased Agricultural Productivity and Food Security	Promote sustainable farming, train farmers on water efficiency, establish cooperatives	Improved yields and food security	Crop yield data, farmer participation	Bi-Annual	Agricultural Extension Officers, Project Developer	35,000
43.	Economic Growth	Provide capacity-building for entrepreneurs, strengthen agribusiness linkages	Enhanced agribusiness and GDP contribution	Number of businesses supported	Bi-Annual	Project Developer, Economic Development Officers	40,000
44.	Climate Resilience and Drought Mitigation	Promote climate-smart techniques, establish early warning systems	Reduced vulnerability to climate change	Number of climate adaptation projects implemented	Annual	Environmental Specialist, Meteorological Authorities	30,000
45.	Sustainable Water Supply for Domestic and Industrial Use	Develop equitable water distribution, promote sustainable use	Reliable water access for various sectors	Number of households/industries served	Quarterly	Water Resource Manager, NEMA	80,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
46.	Improved Accessibility to Safe Drinking Water	Set tariffs to ensure affordability for vulnerable groups	Universal access to safe drinking water	Water quality reports, affordability surveys	Quarterly	NWSC, Local Government	55,000
47.	Transformation of agricultural practices	a) Establish demo plots b) Train farmers in climate-smart agriculture Collaborate with extension officers	Adoption of modern farming; Increased yields; Reduced drought vulnerability	No. farmers trained; Yield increase; Irrigated area coverage	Quarterly	Agricultural Extension Officers, Project Agronomist, WUA Leaders	15,000
48.	Sustainable & optimal use of irrigation water	a) Form Water User Association (WUA) b) Promote drip/sprinkler systems Monitor water abstraction with DWRM	Efficient water use; Sustainable water availability	Water use efficiency; WUA status; Abstraction volumes	Monthly	WUA, DWRM, Project Water Manager	12,000
49.	Improved food security	a) Link farmers to markets b) Nutrition-sensitive agriculture programs Promote post-harvest facilities	Increased food production and availability	Market volumes; Nutrition program reach; Post-harvest losses	Biannual	Agricultural Extension, Cooperatives, Food Security Officers	14,000
50.	Improved access to social services	a) Establish community water committees b) Conduct WASH campaigns Provide gender-friendly water points	Improved health and sanitation; Increased school attendance	Functioning committees; WASH campaign coverage; Water point access	Quarterly	Community Health Workers, WASH Coordinators, WUAs	7,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
51.	Crop diversification and intensification	a) Partner with agribusinesses b) Provide seeds, fertilizers, mechanization Agronomic training on rotation and pest management	Increased income resilience; Crop variety	No. farmers diversifying; Crop types cultivated; Training sessions held	Quarterly	Agribusiness Partners, Extension Officers	14,000
52.	Tourism potential and aesthetic value	a) Promote eco-tourism b) Tree planting around project components Install signage and trails	Enhanced landscape; New tourism income	Eco-tourism initiatives; Tree survival rate; Visitor numbers	Annually	Local Government, Tourism Board, Community Groups	8,000
53.	Prostitution, Crime, and Substance Abuse	a) Enforce strict code of conduct for employees. b) Enhance security measures in collaboration with local authorities. c) Conduct awareness campaigns on dangers of prostitution, crime, and substance abuse. d) Provide support and counselling services.	Improved community safety and social stability.	a) Number of reported incidents. b) Participation in awareness campaigns.	Monthly	Developer's Project Manager Local community leaders	1,500
54.	Child Labor and Educational Disruption	a) Establish and enforce policies against child labour. b) Collaborate with schools and community leaders to monitor child abuse or labour.	Reduced child labour and educational disruption.	a) Number of child labor cases. b) School dropout rates.	Quarterly	Developer's Project Manager	1,300

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		c) Conduct outreach programs in schools. d) Implement a child protection plan.				Community Liaison Officer:	
55.	Family and Social Disruption	a) Promote financial literacy programs. b) Foster family values through counselling and support services. c) Empower community leaders to address income-related issues. d) Implement grievance redress mechanisms.	Improved family stability and social cohesion.	a) Number of financial literacy sessions. b) Number of grievances reported and resolved.	Quarterly	Developer's Project Manager District Social Welfare Officer	1,300
56.	Gender-Related and vulnerable group issues	a) Conduct gender sensitization training. b) Install gender-sensitive facilities. c) Designate a specialist to oversee gender action plan. d) Promote equal employment opportunities. e) Conduct awareness campaigns on gender rights. f) Gender-sensitive extension services	Enhanced equality and reduced exploitation. Equitable access and participation	a) Number of gender training sessions. b) Incidents of gender-related complaints. c) Female WUA membership d) Beneficiary surveys by gender/vulnerability	Quarterly	Developer's Project Manager Masindi and Kiryandongo District Gender Specialist	1,300

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		g) Inclusive WUAs (≥30% female) h) Prioritize vulnerable households i) Monitor participation by gender and vulnerability					
57.	Community health & safety	a) Agrochemical safety training b) Fence hazardous infrastructure c) Safety education campaigns Grievance redress mechanism	Reduced accidents and health risks	Safety training attendance; Incidents reported; Grievances managed	Quarterly	Health & Safety Officers, Community Leaders	8,000
58.	Impacts on water supply & flood control	a) Monitor groundwater and surface water b) Maintain buffer zones c) Seasonal irrigation planning Integrated catchment water management	Maintained recharge and flood cycles	Groundwater levels; Buffer zone status; Flood cycle adherence	Biannual	Water Resource Managers, Environmental Officers	10,000
Environmental Impacts							
59.	Impact from poor waste management	a) Develop a robust waste management plan with waste segregation. b) Engage licensed waste handlers to manage different wastes and avoid waste accumulation.	Improved waste management	a) Waste segregation compliance.	Monthly	Developer's Project Manager	1,300

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
60.	Pollution of Soil, Surface Water, and Ground Water	Construct a trench to channel running water; Set up a special collection point for the generator; Fit drainage systems with oil and grease interceptors; Limit onsite repairs, maintenance, and fueling activities	Minimized risk of contamination	Water and soil quality test results	Quarterly	Developer's Environmental Specialist, Site Manager	35,000
61.	Downstream water withdrawal impacts	a) Set abstraction limits (DWRM permits) b) SCADA real-time monitoring c) Tiered water tariffs d) Maintain environmental flows Hydrological modelling	Sustainable water use; Protected downstream ecosystems	Abstraction compliance; Environmental flow levels; Water tariff collection	Monthly	DWRM, Project Water Manager, WUA	15,000
62.	Sediment loading & wetland management	a) Promote soil conservation (contour ploughing) b) Maintain drainage; remove silt c) Wetland rehab with native species Sediment management plans	Reduced erosion and sedimentation; Biodiversity conservation	Sediment levels; Wetland vegetation cover; Soil conservation adoption	Biannual	Environmental Officers, Farmers, Wetland Managers	12,000
63.	Water loss impacts	a) Routine pipeline inspection b) Leak detection sensors c) Train WUAs on leak reporting Promote efficient on-farm irrigation	Reduced water losses; Improved irrigation efficiency	Leak reports and repairs; Water loss metrics	Monthly	Maintenance Team, WUA	9,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
64.	Introduction of invasive species	a) Monitor invasives b) Manual removal by community c) Biological control agents Avoid exotic plantings	Controlled invasive spread; Biodiversity preservation	Invasive species coverage; Removal campaigns; Biological control usage	Quarterly	Environmental Officers, Community, NARO	7,000
65.	Impacts on fish & fishing	a) Maintain environmental flows b) Install fish screens c) Train sustainable fishing Support aquaculture alternatives	Fish stock protection; Sustainable fisheries	Fish population data; Fish screens installed; Fisher training numbers	Annually	Fisheries Dept., Community Leaders, Environmental Officers	10,000
66.	Climate change impacts	a) Use solar/hybrid pumping b) Reforest cleared areas c) Conservation agriculture GHG monitoring plan	Reduced emissions; Enhanced carbon sequestration	Renewable energy use; Reforested area; GHG data	Annually	Project Engineer, Environmental Officers	18,000
Health and Safety Impacts							
67.	Impacts of safety and Security	a) Install advanced surveillance systems. b) Implement access control systems with biometric verification. c) Employ and train a dedicated security team. d) Establish rapid response teams. e) Develop and update emergency response plans.	Enhanced safety and security measures to protect project operations.	a) Number of security incidents. b) Response time to incidents. c) Compliance with safety standards.	Monthly	Developer's Project Manager	7,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		f) Collaborate with local law enforcement. g) Use state-of-the-art screening technology. h) Conduct random security checks. i) Provide regular safety and security announcements.					
68.	Noise Emissions	a) Fit generators with noise suppressor equipment. b) Provide ear protection for workers. c) Conduct periodic maintenance of machinery. d) Implement continuous noise monitoring. e) Use electric or low-noise equipment. h) Conduct awareness campaigns.	Minimized noise levels and reduced impact on health and well-being.	a) Noise level measurements b) Number of noise-related complaints. c) Equipment maintenance records.	Monthly	Developer's Project Manager District Environment Officer	4,000
69.	Poor Sanitation at the Water Treatment Plant and Offices	Provide dustbins at strategic locations; Train workers on waste management	Improved sanitation and cleanliness	Number of waste bins installed, waste management reports	Monthly	Contractor, Site Supervisor	15,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
70.	Health and Safety of Workforce and Community	Provide induction training, implement health and safety policies, conduct risk assessments, ensure first aid provisions, hire Occupational Health and Safety officer	Reduced workplace incidents, improved health and safety	Number of safety drills, accident reports	Monthly	Occupational Health and Safety Officer	50,000
71.	Fire Outbreaks	Conduct fire safety training, establish fire assembly points, install warning signage, implement fire emergency plans	Minimized fire risks, improved emergency preparedness	Fire drill reports, number of fire incidents	Bi-Annual	Fire Safety Officer, Contractor	40,000
72.	Water & vector-borne disease risks	a) Canal design for drainage b) Vector surveillance and eco-pesticides c) Community awareness Support health center treatment	Reduced disease incidence	Vector density; Awareness session numbers; Disease incidence	Quarterly	Health Officers, Environmental Health Dept.	10,000
73.	Water system leaks and pressure loss	a) Design pressure zones and valves b) SCADA pressure monitoring c) Routine maintenance and rapid response Train local technicians	Reliable water pressure; Reduced equipment damage	Pressure data logs; Maintenance reports; Repair response times	Monthly	Maintenance Team, WUA, SCADA Operators	12,000
IMPACTS SPECIFIC TO MASINDI PORT PROJECT AREA							
74.	Impacts on Masindi MV Ferry Operations	Schedule construction during off-peak hours; Coordinate with ferry operators to avoid conflicts	Minimized disruption to ferry services	Number of reported delays or suspensions	Monthly	Contractor, Ferry Operators	40,000

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
75.	Impacts on Small Businesses	Engage business owners early, provide signage and alternative pathways, offer temporary relocation if necessary	Sustained business activity during construction	Number of affected businesses compensated or relocated	Quarterly	Project Developer, Local Authorities	35,000
76.	Impacts on High Voltage Transmission Line	Conduct site surveys, maintain safe working distances, coordinate with electricity authorities, install signage and barriers	Minimized electrical hazards and uninterrupted power supply	Number of incidents involving power interruptions	Quarterly	Contractor, Electricity Supply Authorities	55,000
77.	Impacts on Masindi Port Road (7 km under construction)	Coordinate schedules with road contractors, implement traffic control plan, monitor and maintain road conditions	Reduced congestion and smooth project implementation	Traffic congestion reports, road maintenance logs	Monthly	Contractor, Traffic Management Team	45,000
						Subtotal	876,500
DECOMMISSIONING PHASE							
Socio-Economic Impacts							
78.	Employment opportunities for demolition workers	a) Prioritize hiring local residents. b) Offer training programs in demolition techniques. c) Implement fair wage policies. d) Ensure equal employment opportunities. e) Provide adequate PPE.	a) Increased local employment. b) Enhanced worker skills. c) Fair and timely wage payment. d) Inclusive workforce. e) Worker safety. f) Facilitated worker participation.	a) Number of local hires. b) Training completion rates. c) Wage payment records. d) Employment diversity statistics. e) PPE availability and usage. f) Utilization of support services.	Monthly.	Developer's Project Manager Local community leaders.	1,500

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		f) Offer support services for workers.					
79.	Unemployment	a) Sensitize employees and the community about financial literacy. b) Provide career counseling and guidance services. c) Prioritize hiring local residents for decommissioning and cleanup activities. d) Encourage private sector investment in local community development and job creation. e) Provide specialized skills training and support services.	Minimized unemployment impacts and enhanced local employment opportunities post-project closure.	a) Number of sensitization sessions held. b) Number of employees receiving career counseling. c) Percentage of local residents hired for decommissioning. d) Private sector investment reports. e) Skills training completion rates.	Monthly	Developer's Project Manager Community Liaison Officer:	1,800
Environmental Impacts							
80.	Decommissioning waste	a) Implement recycling programs for demolition materials. b) Conduct assessments to identify and remove hazardous materials safely. c) Sell demolished rubble to interested parties.	Effective waste management and reduced environmental impact from demolition activities.	a) Recycling rates for demolition materials. b) Assessment reports for hazardous materials. c) Volume of rubble sold. d) Waste disposal records from certified firms.	Monthly	Developer's Project Manager District Environment Officer	2,800

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		d) Hire a certified waste collection firm for proper disposal.					
Health and Safety Impacts							
81.	Accidents to the demolition workers	a) Provide protective equipment (helmets, gumboots, overalls). b) Maintain a functional first aid kit on site. c) Communicate safety guidelines and display warning signage.	Improved safety and reduced accidents among demolition workers.	a) Number of protective equipment issued. b) First aid kit inventory. c) Incident and accident reports. d) Safety training records.	Weekly	Developer's Project Manager District Environment Officer	1,700
82.	Noise due to demolition of structures and disassembling of machinery	a) Hoard off the site prior to demolition. b) Provide ear protection equipment. c) Schedule demolition during less noise-intensive times of the day.	Minimized noise pollution and reduced impact on workers and surrounding community.	a) Noise level measurements. b) Number of ear protection equipment issued. c) Demolition schedules and adherence records.	Daily	Developer's Project Manager District Environment Officer	1,600
83.	Dust impacts	a) Develop and implement a decommissioning plan. b) Enclose demolition areas with temporary barriers. c) Provide masks to demolition staff.	Controlled dust generation and reduced impact on health and surrounding environment.	a) Number of masks issued. b) Dust suppression records. c) Community notification records. d) Dust level measurements.	Daily	Developer's Project Manager District Environment Officer	1,800

	Impact	Mitigation/Enhancement	Desired Outcomes	Performance Indicators	Frequency For monitoring	Responsible Personnel	Costs (USD)
		d) Schedule demolition activities during periods of low wind and humidity. e) Suppress on-site dust by sprinkling water. f) Notify neighboring communities in advance about demolition activities.					
						Subtotal	11,200
						Grand Total	$1,108,100

9.5 Grievance Redress Mechanisms:

This section describes avenues for affected persons to lodge a complaint or express a grievance against the project staff or contractors during project implementation. It also describes the procedures, roles and responsibilities for addressing grievances and resolving disputes. Every aggrieved person shall be able to trigger this mechanism to quickly resolve their complaints. The project will operate a Worker's grievance redress mechanism, however, in all cases, criminal matters shall be explicitly handled in accordance with the Criminal Code Act and other laws governing criminal issues in Uganda.

The objectives of the grievance process are:

1. Ensure that appropriate and mutually acceptable corrective actions are identified and
2. implemented to address complaints;
3. Verify that complainants are satisfied with outcomes of corrective actions;
4. Avoid the need to resort to judicial proceedings.

The employee grievances may include;

1. Undesirable working conditions in physical terms.
2. Changes without prior notice.
3. Poor employee relations.
4. Improper wage adjustments.
5. Dissatisfactory office policies in case of: Promotion, Demotion, Leaves, Overtime
6. Violation of laws.
7. Inadequate safety, health, and welfare amenities.
8. Labour-management hostility.
9. Incidences of workplace favouritism and nepotism, among others.

9.5.1 Workers' Council

The MWACRID project will employ over 200 workers. For better organisation and management of workers' grievances, this substantial number shall necessitate the establishment of a Workers' Council. The workers' council shall consist of each category of workers organizing themselves and selecting male and female representatives. These categories will include;

1. Casual workers
2. Drivers, Operators and Turn men

3. Flag Personnel
4. Site Cooks & Cleaners
5. Technical
6. Consultant Site Sociologist

For effective confidence building and confidentiality, the Consultant Site Sociologist shall be the secretary to document and manage the grievance log, minutes, and writing workers' council reports. The other members will select a Chairperson and Vice Chairperson. The council shall meet at least once every week to ensure timely management of workers' issues.

9.5.2 Role Of the Workers Council

The role of the workers council shall include;

1. With management support from the contractor, Supervising consultant and MWE, the workers' council shall play a significant role in proactive management of employer – employee relations, workers' welfare and grievances within the workplace. This council shall not interfere with either Management's authority or its obligation to manage their contracts but rather provides a formally recognized opportunity and avenue for their grievances to be lodged and managed and their rights to be heard and respected. Workers' Council shall;

2. Provide a forum for consultation, frank exchange of information, discussion and joint problem solving between management and employee representatives on issues pertaining to staff welfare, rights, discipline; any proposed changes dealing with policies, procedures and working conditions.

3. Receive and report workers complaints/grievances to management and negotiate for timely redress, / participate in arbitration of cases between workers and management through disciplinary hearings and / or between fellow workers through conflict resolution meetings.

4. Represent the interests of workers pertaining to their terms and conditions of employment, staff welfare, staff development and other matters of concern to the workers, and to negotiate with the contractor's management on their behalf accordingly.

5. Educate Workers on their rights, discipline, code of conduct, spirit of staff unity across the project as well as on respect for cultural diversity pertaining to workers of different races, tribes, religion, and other cultural differences.

6. Regularly solicit for employees' suggestions/opinions to management through appropriate and organized channels such as their representatives, suggestion box, or joint meetings from time to time. Act as a point of contact between the employees and management; establish and maintain good relations, foster effective two-way communication and mutual understanding between workers on one hand, and with management on another.

7. Identify and represent concerns of special interest groups on the project such as women, expectant and lactating mothers, workers with disability etc.

8. Organize and conduct monthly Workers' Grievance Management Committee (GMC) meetings to review and discuss staff welfare, discipline, and related matters; compile and share in timely manner meeting minutes with the contractor, supervising consultant and MWE pointing to key action areas requiring attention.

9. Report any incident(s) of violation of workers' rights, staff indiscipline and related issues to management for redress.

10. Keep adequate log of all matters that come before the Workers' GMC for better reference and effective management.

9.5.2.1 Representatives on the Workers Council

For timely management of complaints, the project shall have a grievance desk at the site (Site GMC). The Site GMC shall include the following members.

1. Resident Engineer- Chairperson
2. Site Engineer
3. Contractor's Sociologist
4. Contractor's Health and Safety Officer
5. Consultant's Sociologist- Secretary
6. Consultant's Environmentalist

Under the supervision of the consultant's Sociologist, the Site GMC shall make immediate responses to grievances related to contractor's workers, agents, sub-contractors, or suppliers. A toll-free telephone number can be provided at the site GMC desk to enable workers report any complaints. For unresolved workers' grievances, the site GMC shall escalate these to MWE.

9.5.2.2 Stages of Handling Workers' Grievances

Option 1: Informal discussion

If workers have a grievance or complaint regarding their work, they shall, wherever possible, raise their concern with a supervisor or manager as it may be possible to find a solution informally. This shall make it more likely that disputes can be resolved quickly, closer to the source of the problem, making it less likely that the issue escalates into an intractable problem. Nonetheless, the issue and response shall still be logged and tracked from the perspectives of checking outcomes and monitoring.

Option 2: Formal complaint

If the grievance is not resolved informally, the aggrieved shall proceed to resort to the formal grievance redress mechanisms, following the following steps;

Step 1: Lodging the compliant to Workers' Council

If the matter is serious and/or the worker wishes to raise the matter formally, the worker shall set out the facts of the grievance in writing to the committee, with support and guidance from the section representative who then forwards the complaint to the secretary. The secretary then records the complaint in the logbook and notifies the chairperson. Alternatively, the worker may raise complaint through suggestion boxes, phone calls, text messages or email to the secretary (Consultant's Site Sociologist).

Step 2: Assessment of compliant and investigation by Workers' Council within 5 days

On receipt of the complaint, the secretary shall make further investigations and in consultation with Chairperson shall schedule for a meeting (depending on the urgency of the complaint) to assess the complaint and determine the corrective action. The assessment shall also identify the key issues that have been raised, together with any root causes, and shall determine the outcome that the worker is looking for from the process. Any additional information shall be gathered to allow a full assessment.

The appropriate form of investigation will depend on the type of complaint and the seriousness of the allegation. In general terms, the committee shall try to understand the key issues and interview the individuals involved in a complaint, e.g. those managing the workers, or those responsible for the activity or service that is raised in the grievance. The workers council shall conclude the issues or escalate the issues to the Disciplinary committee.

Concluded issues which require attention of management shall be communicated formally by the Secretary to Contract Manager for action with a copy to the Resident Engineer. The issues which require escalation shall be referred to the Secretary of the Site Disciplinary committee (Contractor's Human Resource Officer).

Step 3: Determination of corrective action by Disciplinary committee within 7 days

A disciplinary committee shall hold hearings and invite both the offender and the offended. The disciplinary committee shall give fair hearing to anyone suspected as offender in order to make fair judgment guided by the Workers' Code of Conduct. On assessment of the complaint and judgement derived from hearings convened for complaints of disciplinary nature, the disciplinary committee will advise / recommend to the contractor's management in writing on the appropriate course of action to be taken against the suspected offender. The submission shall be made by the Chairperson to Contract Manager with a copy to the Resident Engineer.

Step 4: Site GMC (act within 5 days upon receipt of Grievance)

The Site GMC shall handle workers' complaints with utmost commitment and with a view of getting a settlement. The Site GMC may review the views of the workers' council and/or the disciplinary committee to ascertain the merits and demerits pertaining to the complaint in a bid to find an amicable solution. The Site GMC shall handle grievance resolution in line with the safeguard's provisions of the project and acceptable just mechanisms. For unresolved grievances, the site GMC shall escalate or refer these to MWE.

Step 4: Feedback from the affected parties

The contractor or worker shall give feedback to the GRC on the implementation of the Committee recommendation, and this shall be recorded in the logbook.

Step 5: Appealing to MLHUD against the Verdict of the Site GMC

Any issues that require escalation beyond Site GMC shall be referred to MLHUD. The issues shall be referred by the Resident Engineer and addressed to Permanent secretary MLHUD with Attention to Social Development Specialist.

Upon the receipt of case the project management team shall review and handle the matter within 10 days. The team shall comprise at the minimum the following.

1. Project Engineer (Chairperson)
2. Social Development Specialist (Secretary)
3. Environment Specialist
4. Communication Specialist

In the event that MWE finds a valid case, it would then re-visit the process of investigation in consultation with the District Labour Office and/or any other relevant office/ agency.

Step 6: Feedback from the affected parties

The contractor or worker shall give feedback to the GMC on the implementation of the Committee recommendation, and this shall be recorded in the logbook.

9.6 Supplementary Management Plans

The effective implementation of the proposed bulk water supply and irrigation infrastructure Project necessitates a comprehensive suite of site-specific management plans the supplement the general ESMMP. These plans are tailored to address the specific environmental, social, and operational challenges and opportunities associated with the project. Below are some of these management plans.

9.6.1 Client / Developer's Action Plans

The developer, will establish robust action plans to ensure adherence to environmental and social safeguards. These action plans will include detailed schedules for the implementation of each mitigation measure. Resources will be allocated specifically for environmental and social management activities, ensuring all necessary tools and personnel are available. A clear responsibility matrix will delineate tasks among project staff, consultants, and contractors. Regular compliance monitoring will be conducted to ensure all activities meet set environmental and social standards, with adjustments made as necessary to address any non-compliance issues promptly.

9.6.2 Public Consultation and Disclosure Plan (PCDP)

The PCDP will ensure continuous and meaningful engagement with all stakeholders. This plan will involve stakeholder mapping to identify all relevant stakeholders, including local communities, NGOs, and government bodies. A regular consultation schedule will be established, with consultations at key project stages such as planning, construction, and operation. Systems will be implemented to collect and address stakeholder feedback effectively. Transparent sharing of project information will be maintained through public meetings, websites, and reports, ensuring all stakeholders are well-informed and can contribute to the project's development.

9.6.3 Contractor's Labor Force Management Plan (LFMP)

The LFMP will manage labor-related issues, ensuring fair treatment and safe working conditions for all workers. Specific measures will include fair and transparent hiring practices, prioritizing local employment where possible. Compliance with labor laws regarding working hours, wages, and benefits will be strictly enforced. Occupational health and safety standards will be adhered to rigorously, with regular training provided to all workers. A clear grievance mechanism will be established, allowing workers to raise and resolve issues effectively and confidentially.

9.6.4 Contractor's Action Plans

Contractors will be required to develop detailed action plans to ensure compliance with the ESMP. These plans will include the integration of ESMP measures into their work plans and operational procedures. Tailored actions will address the unique challenges of each construction site, with frequent reporting on ESMP compliance and performance to ensure ongoing adherence to environmental and social standards.

9.6.5 Traffic Management Plan (TMP)

The TMP will address the impacts of increased traffic during construction and operation. Key strategies will include managing traffic flow by scheduling transport activities to avoid peak traffic times, implementing road safety measures such as signage and speed limits, and collaborating with local traffic authorities to minimize disruptions and ensure smooth traffic movement.

9.6.6 Waste Management Plan (WMP)

The WMP will ensure responsible waste management throughout the project lifecycle. Specific actions will include the segregation of waste for proper collection and disposal, recycling programs to reuse materials wherever possible, and the safe disposal of waste in designated and approved sites to prevent environmental contamination and ensure public health safety.

9.6.7 Pollutant Spill Contingency Plan (PSCP)

The PSCP will provide a comprehensive response to potential pollutant spills. Immediate response procedures will be clearly outlined, with regular training for staff on spill response protocols. A robust reporting system will be established for prompt documentation and management of spill incidents, ensuring rapid and effective mitigation of any environmental impact.

9.6.8 Contractor's Labor Force Management Plan

This plan will ensure the fair and effective management of the contractor's workforce. Employment standards will comply with national labour laws and international labour standards. Safe working conditions will be maintained through regular safety drills and equipment checks, with worker welfare programs supporting health and well-being.

9.6.9 Hazardous Materials Management Plan (HMMP)

The HMMP will manage the use and disposal of hazardous materials to prevent environmental contamination. Inventory management will ensure detailed records of all hazardous materials used on-site. Safe storage protocols will be implemented to prevent leaks and spills, with environmentally safe disposal methods for hazardous waste ensuring compliance with environmental standards.

9.6.10 Health and Safety Management Plan

This plan will ensure the health and safety of all project personnel and stakeholders. Regular risk assessments will identify and mitigate health and safety risks. Comprehensive training on safety practices and emergency response will be provided, with well-defined procedures for responding to health and safety incidents, ensuring a safe working environment for all involved in the project

9.6.11 Pest Management Plan (PMP)

Given the scale of irrigation and agricultural intensification under the MWACRID Project, a Pest Management Plan (PMP) will be developed to address the risks associated with increased use of pesticides and agrochemicals. The plan will promote Integrated Pest Management practices to reduce reliance on chemical pesticides, ensuring that all products used comply with WHO and FAO standards. It will include training for farmers on IPM and safe pesticide application, monitoring of pesticide use and residue levels in soil and water, and proper management of pesticide procurement, storage, and disposal in line with national and international guidelines.

9.6.12 Biodiversity Management Plan (BMP)

The Biodiversity Management Plan (BMP) provides a framework for mitigating, monitoring, and enhancing capacity to address the project's cumulative impacts on terrestrial and aquatic biodiversity, as outlined in the Environmental Management Plan. Its objectives are to reduce biodiversity loss - particularly in the reservoir for water storage and the pipe transmission line route that will traverse the area - through targeted mitigation actions, establish monitoring parameters and programs for key species during construction and operation, and build capacity among construction workers and local communities on biodiversity conservation. Key measures include reforestation of affected areas, especially part of Kaduku Central Forest Reserve, using indigenous species; implementation of integrated monitoring and reporting plans for both construction and operation phases; and community-based wildlife monitoring and awareness programs. The plan will be implemented in collaboration with MWE, NFA, UWA, NEMA, local authorities, and community representatives, under the oversight of a local biodiversity consultant to ensure its effectiveness and alignment with its objectives.

10 CONCLUSION AND RECOMMENDATION

10.1 Conclusions

The Environmental and Social Impact Assessment undertaken for MWACRID project confirms that the proposed development is both environmentally and socially viable. The identified impacts ranging from vegetation loss (including in sensitive ecosystems such as Kaduku Central Forest Reserve), water quality risks, potential displacement, and community health concerns are typical for infrastructure projects of this magnitude but are neither irreversible nor unmanageable. The ESIA has proposed a comprehensive Environmental and Social Management and Monitoring Plan supported by specific supplementary management plans, to guide mitigation and enhancement measures.

A key environmental consideration is the project's encroachment into the Kaduku CFR for the siting of the storage reservoir. While this may result in forest loss and ecological disruption, the ESIA recommends a compensatory afforestation program in line with National Forestry Authority guidance, biodiversity offsetting, and ecological monitoring to minimize long-term impacts. Socially, while the project involves resettlement and labour influx risks, the associated Resettlement Action Plan and Labour Management Procedures provide mechanisms to manage these risks fairly and transparently.

From a strategic standpoint, this project is well-positioned to address persistent water scarcity affecting agricultural productivity in Kimengo, Mirya, and Masindi Port sub-counties in Masindi and Kiryandongo Districts. By guaranteeing year-round water availability for irrigation across 15,000 hectares, the project will significantly reduce dependence on erratic rainfall, enabling sustained agricultural production, increased household income, and climate resilience. This aligns directly with Uganda’s Agriculture Sector Strategic Plan (2015/16–2019/2020) and the National Irrigation Policy.

Therefore, there is no critical environmental or social obstacle to the implementation of the project, provided that the proposed mitigation and enhancement measures are fully implemented. With robust monitoring, stakeholder engagement, and regulatory compliance, the project can deliver substantial and sustainable benefits while minimizing its environmental and social footprint.

10.2 Recommendation

In light of the above, the following recommendations are made to ensure the successful and responsible implementation of the project:

1. **Implement All Mitigation and Enhancement Measures as Outlined in the ESMMP**

   Allocate sufficient human and financial resources to implement the ESMMP, RAP, and supplementary plans such as the Pest Management Plan, Hazardous Materials Management Plan, and Health and Safety Management Plan. These tools will ensure that environmental and social risks are effectively controlled throughout the project lifecycle.

2. **Address Impacts on Kaduku Central Forest Reserve (CFR) Proactively**

   Obtain the necessary forest use permits from NFA and undertake compensatory afforestation at a minimum ratio of 2:1. Monitor ecological health and biodiversity trends around Kaduku CFR to guide adaptive environmental management.

3. **Strengthen Stakeholder Engagement and Grievance Redress**

   Maintain ongoing and transparent dialogue with all stakeholders, including potentially affected persons, host communities, local leaders, and civil society. Implement a functional and inclusive grievance redress mechanism accessible to all, especially vulnerable groups.

4. **Enhance Environmental and Social Monitoring and Reporting**

   Conduct regular compliance audits and monitoring of key indicators such as air and water quality, vegetation cover, vulnerable group inclusion, and resettlement outcomes. Engage independent monitors as needed to meet NEMA, African Development Bank Group, and donor requirements.

5. **Promote Sustainable Agricultural Practices**

   Ensure that extension services and Water User Associations (WUAs) promote efficient water use, safe pesticide application under the PMP, and adoption of climate-smart agriculture. This will sustain productivity while protecting human health and natural resources.

6. **Support Local Development and Economic Integration**

   Maximize local employment, invest in rural infrastructure, and support local enterprises in construction, supply, and post-project agribusiness. This will enhance project ownership and multiplier effects on the regional economy.

7. **Ensure Regulatory and Donor Safeguard Compliance**

   Align all project phases with Uganda's environmental laws, including the National Environment Act Cap 181 and associated regulations, and comply with applicable donor environmental and social safeguard standards.

With full commitment to mitigation and adaptive management, the MWACRID Bulk Water and Irrigation Infrastructure Project is not only environmentally and socially feasible but holds transformative potential for livelihoods, climate resilience, and national development. By addressing water scarcity, it will contribute to Uganda's economic growth and sustainability, improving the quality of life for over 600,000 people in Masindi and Kiryandongo districts.

REFERENCES

1. Foster, M. S. 1994. Sampling with artificial cover. In: Heyer W R, Donnelly M A, McDiarmid R W, Hayek L C, Foster M S. eds. Measuring and monitoring Biological Diversity: Standard methods for Amphibians. Washington, DC: Smithsonian Institution Press, pp. 146-150.
2. IFC: Environmental, Health, and Safety General Guidelines, 2007.
3. Langdale-Brown, I., Osmaston, H.A. & Wilson, J.G. 1964.The vegetation of Uganda and its bearing on land uses. Uganda Government Printer, Entebbe.
4. National Environment Management Authority (NEMA), 1997: Environmental Impact Assessment Guidelines for Uganda.
5. National Environment Management Authority 2010. State of Environment report
6. The Republic of Uganda (2020) Environment (Environmental and Social Assessment) Regulations.
7. The Republic of Uganda, 1995: Constitution of the Republic of Uganda
8. The Republic of Uganda, 1995: The Water Act.
9. The Republic of Uganda, 2020: National Environment (Waste Management) Regulation.
10. The Republic of Uganda, 2000: The National Environment (Wetlands, River Banks and Lake Shores Management Regulations).
11. The Republic of Uganda, 2019: The National Environment Act.
12. National Environment Management Authority 2007. 2006/07 State of Environment
13. UBOS, 2014.The District Abstract, Local Government, and Republic of Uganda.
14. Kalema, J. (2005) Diversity and distribution of vascular plants in the wetland and dryland Important Bird Areas of Uganda. Ph.D. thesis, Makerere University, Kampala, Uganda.
15. Kalema, J., Namaganda, M., Ssegawa, P.Kabuye, C., Maganyi, O. & Muncuguzi, P. (2010). Status of higher plants in Uganda. In: J.B. Kaddu & H. Busuulwa (Eds.) Baseline report on state of biodiversity in the Nile Uganda 2010. Wetlands and Biodiversity Conservation Component of the Nile Transboundary Environmental Action Project. Nile Basin Initiative Secretariat.
16. Langdale Brown, I., Osmaston, H. A., & Wilson, J. G. (1964). The vegetation of Uganda and its bearing on land use. The Vegetation of Uganda and Its Bearing on Land Use.

APPENDICES

APPENDIX A: TOR APPROVAL LETTER

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

NEMA House
Plot 17, 19, & 21, Jinja Road.
P .O. Box 22255, Kampala,
UGANDA
Tel: 256-414-251064, 251065,
251068
Fax: 256-414-257521
Toll free: 0800-1444444
E-mail: info@nema.go.ug
Website: www.nema. go.ug
Twitter @nemaug
Facebook @NemaUG

NEMA/4.5

11th June, 2025

The Permanent Secretary
Ministry of Water and Environment
Plot 3-7 Kabalega Crescent Road, Luzira
P.O. Box 20026
KAMPALA.
Tel: +256414505942
C/o: Directorate of Water Development
Tel 256-782717329
Email:mot.motram@gmail.com

RE: APPROVAL OF THE TERMS OF REFERENCE AND SCOPING REPORT FOR ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE MULTIPURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT, MIRYA AND KIMENGO IN MASINDI DISTRICT – ESIATOR/15843/2025/5

Reference is hereby made to the Terms of Reference and Scoping Report for environmental and social impact assessment for the above mentioned

1

project that you submitted to this Authority for review and consideration. This Authority has finalized the review of the said Scoping Report and ToR and issues formal APPROVAL of the said TOR.

Please, Note That Approval of the Scoping Report and ToR, Does Not Constitute Permission to Start Implementing Any of the Proposed Project Activities. **THIS IS NOT A CERTIFICATEE OF APPROVAL.**

In addition to the scope of work provided in the ToR, ensure that the key aspects highlighted below are taken into consideration during the conduct of the Environment and Social Impact Assessment and preparation of the ESIA report.

(a) Carryout comprehensive consultations with key stakeholders including the District Local Government Authorities in Kiryandongo and Masindi respectively, the Department of Occupational Safety and Health in the Ministry of Gender and Social Development, among others and communities living with the Project catchment area and develop a clear stakeholder engagement plan for the entire project cycle to regularly respond to stakeholder concerns in a timely manner. Ensure that the views/concerns of the stakeholders consulted are well documented and addressed in the report and lists of persons consulted appended to the ESIA report.

(b) **Undertake consultations with the Nile Basin Commission concerning the proposed project on the River Nile and have their views incorporated in the ESIA to be submitted.**

(c) Include in the ESIA report, details of the **water source and the water source protection plan** that will support the Water Supply System.

(d) Provide a clear description of the water supply scheme, including:

(i) the project designs and installed capacity;
(ii) water treatment processes;
(iii) detailed lay-out plan for the entire project;
(iv) Inventory of targeted beneficiaries for the irrigation infrastructure development under the 15000hactares of land.

(e) In addition to the above, provide details of the geographical boundaries of the project including total area to be covered – preferably **in tabulated format** – by **names of villages, parish, and corresponding GPS coordinates** (*in UTM format)* marking the location of the key components of the WSS system.

(f) Undertake a comprehensive assessment of the potential impacts of the project associated components, particularly the options for water abstraction on the hydrology and ecosystem of the water source.

(g) Evaluate the risks associated with the project and emergency preparedness options in case of breakdown of the system and discuss these options in the ESIS.

(h) Provide detailed description of site specific baseline information of the project sites for the different project components.

(i) Assess the different types of waste streams likely to arise from the project activities and propose measures for managing such waste.

(j) Ensure that detailed soil and water analyses are carried out for the project site, and the results provided in (appended to the) ESIA report.

(k) Assess any other critical environmental aspects/ concerns which may have not been initially foreseen during the preparation of the scoping report and ToR are addressed, and include an evaluation of such concerns in the ESIA report.

(l) Include in the ESIA report, a comprehensive **analyses of alternatives/options** to the selected project location, design, and technology applications, among other aspects.

(m) Provide **detailed evaluation of the potential environmental impacts and risks** (e.g., in case of breakdown of the system) associated with the proposed project components and activities.

(n) Include in the ESIA report **comprehensive mitigation and environmental management and monitoring plans**, respectively *(preferably in table matrix format)*, that related to the identified potential environmental impacts and risks.

(o) Include the total cost of the Project based upon estimates provided by and **copy of certificate of valuation issued by a** certified valuer, in accordance with Regulation 19(1) of the National Environment (Environment and Social Assessment) Regulations, S.I. No. 143/2020.

(p) Accompany the ESIA report submission with evidence of payment of the 30% ESIA fees, in accordance with Regulation 49 of the National Environment (Environment and Social Assessment) Regulations, S.I. No. 143 of 2020.

Please note that the ESIS to be submitted should be accompanied with a forwarding letter clearly highlighting the contact details of the developer/proponent (Contact Person, Official email address and Telephone number, among others.

You may proceed with carrying out the ESIA for the proposed Project. We look forward to receipt of a comprehensive copy of the ESIA report, for our further action.

Leila Akello Gonasa
For: Executive Director

APPENDIX B: RECORD STAKEHOLDER ENGAGEMENTS

Appendix B-1: MINUTES OF RAP PREPARATION CONSULTATION MEETING

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 17th June 2025
Time of Meeting: 10:00 p.m.
Venue of Meeting: Mirya Sub-County LC IIIs Office

Agenda

1. Self-Introductions
2. Remarks from the Consultant (Ardent Services International).
3. Remarks from the LC III Chairperson
4. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The consultants team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project, emphasizing that the Ministry of Water and Environment (MWE), as the implementing agency, is mandated to ensure environmentally and socially responsible development. In this regard, the consultants highlighted that a key component of the project involves the preparation of a Resettlement Action Plan (RAP) to guide the fair and lawful acquisition of land and compensation of affected persons. The Consultant noted that while the project aims to minimize displacement by prioritising road reserves and public land, any unavoidable land acquisition will be addressed in accordance with national legal frameworks and African Development Bank (AfDB) safeguards. The team further informed the Chairperson that the RAP will be informed by comprehensive technical, socioeconomic assessments, including analysis of land use, livelihoods, population dynamics, and community infrastructure, ensuring that stakeholder engagement and gender-sensitive planning are integral to mitigating resettlement impacts and promoting community acceptance.

The team thanked the LC III Chairperson for spearing time to meet and discuss this important project and indicated they looked forward to the Chairperson's contribution.

Minute 3: Remarks from the LC III Chairperson

He started by welcoming the Consultant to Mirya Sub-county. He indicated the Sub-County is busy because of the mass enrolment for National Identification registration. He proceeded and indicated that the community is eagerly waiting for the project to commence. He indicated that the communities are aware of the project so they will not be difficult to manage. He expressed gratitude to the Government of Uganda for extending clean water and water for irrigation to the people of Masindi. He requested the project to be extended to cover Kyamwitta because in the previous engagement it was proposed to be included as part of the project. He indicated that he envisages no hardships in the community during the survey processes indicating that the people are already aware of the project.

Minute 4: Closure

The meeting closed with scheduling of the village level meetings in which PAPs are going to be engaged.

The Chairperson thanked the consultant for coming and closed the meeting.

Appendix B-2: Meeting with Kimengo Sub County Officials

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 17th June 2025
Time of Meeting: 12:00 p.m.
Venue of Meeting: Kimengo Sub-County LC IIIs Office

Agenda

1. Self-Introductions
2. Remarks from the Consultant (Ardent Services International).
3. Remarks from the LC III Chairperson
4. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The consultants team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project, emphasizing that the Ministry of Water and Environment (MWE), as the implementing agency, is mandated to ensure environmentally and socially responsible development. In this regard, the consultants highlighted that a key component of the project involves the preparation of a Resettlement Action Plan (RAP) to guide the fair and lawful acquisition of land and compensation of affected persons. The Consultant noted that while the project aims to minimize displacement by prioritising road reserves and public land, any unavoidable land acquisition will be addressed in accordance with national legal frameworks and African Development Bank (AfDB) safeguards. The team further informed the Chairperson that the RAP will be informed by comprehensive technical, socioeconomic assessments, including analysis of land use, livelihoods, population dynamics, and community infrastructure, ensuring that stakeholder engagement and gender-sensitive planning are integral to mitigating resettlement impacts and promoting community acceptance.

The team thanked the LC III Chairperson for spearing time to meet and discuss this important project and indicated they looked forward to the Chairperson's contribution.

Minute 3: Remarks from the LC III Chairperson

He started by welcoming the Consultant to Kimengo Sub-county. He proceeded and indicated that the community wants water and are willing to offer free land as long as they are assured that they will benefit. He indicated they have been attending several project meetings during the design phase and indicated that the communities are aware of the project so they will not be difficult to manage. He expressed gratitude to the Government of Uganda for extending clean water and water for irrigation to the people of Masindi. He requested the project to be extended to cover the whole sub-county because Kimengo is a water stressed area.
Minute 4: Closure The meeting closed with scheduling of the village level meetings in which PAPs are going to be engaged. The Chairperson thanked the consultant for coming and closed the meeting.

Appendix B-3: Meeting with Kiryandongo District Local Government

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 17th June 2025
Time of Meeting: 2:00 p.m.
Venue of Meeting: C.A.Os Office Kiryandongo District

Agenda

1. Self-Introductions
2. Remarks from the Consultant (Ardent Services International).
3. Remarks from the C.A.O
4. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The consultant's team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project, emphasizing that the Ministry of Water and Environment (MWE), as the implementing agency, is mandated to ensure environmentally and socially responsible development. In this regard, the consultants highlighted that a key component of the project involves the preparation of a Resettlement Action Plan (RAP) to guide the fair and lawful acquisition of land and compensation of affected persons. The Consultant noted that while the project aims to minimize displacement by prioritising road reserves and public land, any unavoidable land acquisition will be addressed in accordance with national legal frameworks and African Development Bank (AfDB) safeguards. The team further informed the Chairperson that the RAP will be informed by comprehensive technical, socioeconomic assessments, including analysis of land use, livelihoods, population dynamics, and community infrastructure, ensuring that stakeholder engagement and gender-sensitive planning are integral to mitigating resettlement impacts and promoting community acceptance.

The team thanked the C.A.O for spearing time to meet and discuss this important project.

Minute 3: Remarks from the C.A.O

He started by welcoming the Consultant to Kiryandongo District. He proceeded and indicated that he is relatively new in the district and if stakeholders have been consulted. He indicated that he has no objection to the planned study and encourage the engagement of relevant technical and political leaders

in the district during the execution of any project related activities. He concluded by appreciating the process. He proceeded by granting the team permission to proceed with all the necessary engagements in the district and pledged to offer support whenever reached out to.
Minute 4: Closure The meeting closed with the Consultant indicating that the RAP team will be in the district for at least two weeks undertaking stakeholder engagements from Sub-County to Village level, Cadastral Surveys and Valuation surveys. The C.A.O closed the meeting and wished the team a nice stay.

Appendix B- 4: Meeting with Kiryandongo District Stakeholders

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 17th June 2025
Time of Meeting: 2:30 p.m.
Venue of Meeting: Resident District Commissioner (RDC) Kiryandongo District

Agenda

1. Self-Introductions
2. Remarks from the Consultant (Ardent Services International).
3. Remarks from the RDCs
4. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The consultants team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project, emphasizing that the Ministry of Water and Environment (MWE), as the implementing agency, is mandated to ensure environmentally and socially responsible development. In this regard, the consultants highlighted that a key component of the project involves the preparation of a Resettlement Action Plan (RAP) to guide the fair and lawful acquisition of land and compensation of affected persons. The Consultant noted that while the project aims to minimize displacement by prioritising road reserves and public land, any unavoidable land acquisition will be addressed in accordance with national legal frameworks and African Development Bank (AfDB) safeguards. The team further informed the Chairperson that the RAP will be informed by comprehensive technical, socioeconomic assessments, including analysis of land use, livelihoods, population dynamics, and community infrastructure, ensuring that stakeholder engagement and gender-sensitive planning are integral to mitigating resettlement impacts and promoting community acceptance.

The team thanked the RDC for spearing time to meet and discuss this important project.

Minute 3: Remarks from the Deputy RDC

The Deputy RDC expressed appreciation for the ongoing efforts under the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. He affirmed that he is fully aware of the project and emphasized that monitoring government programs falls within the RDC's mandate. He commended the MWE and the consulting team for actively involving stakeholders, noting that the people of Kiryandongo are generally friendly and welcoming. The RDC acknowledged that several stakeholder meetings have already taken place, reflecting a commendable level of engagement. He further offered the use of his office's radio airtime to facilitate public awareness and ensure effective outreach within the project area at any stage of the project.
Minute 4: Closure In closing, the RDC thanked the Ministry for its inclusive approach, wished the team a pleasant stay in the district, and assured them of his offices full support toward the successful implementation of the project.

Appendix B-4 (a): KEY INFORMANT – KIRYANDONGO

A. HEAD OF PRODUCTION KIRYANDONGO DISTRICT

The Production Officer for Kiryandongo District expressed strong support for the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project, emphasising its timeliness and strategic alignment with current government development initiatives. He noted that the project is being conceived at a particularly opportune moment, as the government is actively working to consolidate and integrate its rural development interventions under the Parish Development Model (PDM). The project's location is highly suitable, as Masindi Port and Kimengo sub-counties are situated in a dry belt of the district, frequently experiencing prolonged dry spells that severely affect agricultural productivity. Implementation of this project is expected to provide a much-needed solution to this persistent climatic challenge by enabling year-round irrigation and improved water access for farming communities.

The Production Officer highlighted that geographical coverage and community inclusion will be essential to the project's success. He strongly recommended that the project design incorporate areas such as Kaduku and its neighbouring communities, not only for reasons of equitable development but also for security and local mobilization. Involving surrounding communities will increase local buy-in, foster a sense of ownership, and help protect the infrastructure from vandalism or neglect. It was emphasized that inclusive planning and outreach will be vital to ensuring that the benefits of the project are widely distributed and that no section of the target population is left behind.

A major point of concern discussed was the affordability and accessibility of irrigation services to the intended beneficiaries—particularly smallholder and micro farmers. According to the Production Officer, one of the barriers to successful adoption of irrigation technologies in the region has been the high cost of system installation at the farm level. While it is appreciated that the Ministry of Water and Environment (MWE) may extend bulk water up to the farm gate, the informant urged that the project go further by ensuring water is delivered directly to individual farms, especially for resource-constrained farmers. This, he said, would remove a major cost burden and enable more farmers to benefit from the initiative.

To promote widespread uptake and equitable access, the Production Officer proposed a starter fee of UGX 50,000 per season for every 2.5 acres, which he believes would be affordable for most farmers. He recommended that this initial payment be revisited and adjusted periodically, based on the tangible improvements in agricultural yields and household incomes experienced by the farmers. Any attempt to introduce higher charges at the onset could discourage participation and ultimately limit the reach of the project.

In terms of institutional arrangements, the officer commended the formation of a project oversight committee at the district level, which will play a key role in the rollout and monitoring of project activities. However, he emphasized the importance of establishing Water User Committees (WUCs) at the community level to facilitate the day-to-day management of water resources. These committees should be supported by technical personnel from the district to ensure effective coordination, accountability, and response to emerging issues. He further suggested the development of a Project User Guideline, which would serve as a reference document outlining operational protocols, user eligibility, system maintenance procedures, and reporting mechanisms for faults. Such a guideline would empower local communities to take active roles in sustaining the infrastructure over time.

The current state of agricultural productivity in the district paints a compelling picture for the necessity of irrigation. As noted by the Production Officer, maize is one of the most commonly grown crops in the area, but due to inadequate water supply and other constraints, the average yield stands at only 0.8 tons per acre. With the introduction of irrigation and improved practices such as pest control, timely planting, and access to extension services farmers could potentially double their yields to 2 tons per acre. This boost in productivity would significantly enhance food security, household income, and overall livelihoods.

Additionally, access to reliable irrigation is expected to diversify the agricultural landscape in the district. At present, many farmers avoid cultivating high-value horticultural crops like tomatoes, which require consistent watering and are sensitive to dry conditions. With a dependable water supply, farmers will be able to confidently invest in a wider range of crops, including those with shorter maturity cycles and higher market demand. This will allow for year-round farming, better crop planning, and increased resilience against climate variability.

On the subject of agricultural extension services, the Production Officer acknowledged that the district is staffed with government extension workers. However, he stressed the need for enhanced logistical support, especially in terms of transportation. Many extension officers currently lack the means to reach remote farming communities regularly, limiting their ability to provide timely technical advice and monitoring. He urged that the project consider provisions for supporting extension mobility to improve farmer access to critical information and services.

In his conclusion, the Production Officer of Kiryandongo District articulated a clear and compelling case for the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project. He emphasized that for the project to be successful, it must be inclusive, affordable, technically sound, and locally managed. With careful planning, strong institutional support, and community involvement, the project holds the potential

to transform agricultural productivity, improve rural livelihoods, and contribute to the overall socio-economic development of the region.

B. District Inspector of Schools, Kiryandongo District

The District Inspector of Schools (DIS) for Kiryandongo District shared valuable information from the education sector, focusing on how the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project could positively impact schools and learning environments across the district.

The DIS explained that schools currently struggle to access clean and reliable water, which often leads to conflicts between schools and nearby communities, especially during the dry season. In many cases, schools and surrounding residents are forced to compete for the limited water available from local boreholes, wells, or shared sources. This not only affects relationships within the community but also disrupts the smooth operation of schools.

The officer emphasized that the availability of reliable water in schools would improve hygiene and sanitation, particularly in maintaining clean toilets and handwashing facilities. Many schools face challenges in keeping toilets clean and safe due to water shortages. With a steady water supply from the proposed project, schools would be able to provide better hygiene for both students and teachers, which would help prevent disease outbreaks and promote a healthier learning environment.

Regarding the ability of schools to pay for water services, the DIS explained that schools can make plans and budget for water bills, especially if the supply is dependable and reasonably priced. The officer pointed out that schools are currently connected to National Water and Sewerage Corporation (NWSC), but the service is unreliable, and water access is often disrupted. If the new water system offers a more consistent supply, the officer believes schools will be willing to pay for it, as long as the costs are manageable.

The officer also highlighted the financial struggles that schools face, particularly public schools under the Universal Primary Education (UPE) program. The funding received through UPE is not enough to cover all essential needs, including high water bills. For this reason, the officer suggested that it would be helpful if development partners or organizations could step in to provide free or subsidized water to schools, at least in the early stages of the project. This would ease the burden on school budgets and allow administrators to focus on other educational priorities.

In conclusion, the District Inspector of Schools strongly supports the proposed bulk water supply project and believes it will play a major role in improving school sanitation, reducing conflict over water, and supporting a better learning environment. He noted that while schools are ready to pay for water, affordability and reliability are key concerns, and current UPE funding may not be enough to cover rising

utility costs. The officer recommended considering options for free or subsidized water for schools, especially in the early phases of the project.

C. Senior Agriculture Officer - Kiryandongo District

The Senior Agriculture Officer from Kiryandongo District emphasized that access to water is a major challenge for farmers, especially in Masindi Port and the surrounding areas. The officer noted that water shortages have made it difficult for farmers to carry out productive agriculture, particularly during the dry seasons. This has limited crop production and affected household incomes.

Recognizing the importance of the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project, the Agriculture Department is already taking steps to support the process. The officer shared that agriculture staff at the sub-county level have been instructed to compile lists of farmers in their respective areas who could benefit from the project. These lists are being prepared to help with planning, targeting, and mobilization of the right farmers when the project begins.

The officer encouraged the project team to work closely with the sub-county agriculture officers, as they are in direct contact with local farmers and understand the specific needs and conditions in each area. He also assured that the district agriculture office is ready to provide additional support where needed, including mobilization, technical guidance, and coordination with farmer groups.

D. DISTRICT COMMUNITY DEVELOPMENT OFFICER - KIRYANDONGO DISTRICT

The District Community Development Officer (DCDO) for Kiryandongo District shared his thoughts on the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project, focusing on its potential impact on local communities and the importance of addressing certain concerns.

One of the primary points raised by the DCDO was the issue of compensation. The officer questioned whether the plans for compensating individuals whose land or property might be affected by the project were well-documented and properly captured in the project's design and planning stages. The DCDO emphasized that clear guidelines on compensation are crucial to avoid conflicts and ensure fairness, particularly for those directly impacted by the infrastructure development.

The officer also highlighted that, despite concerns about compensation, the overall project is seen as very beneficial for the social and economic development of the district. According to the DCDO, the project could greatly improve livelihoods by providing reliable water for irrigation, which would boost agricultural productivity and help improve the income of local farmers. This, in turn, could lead to broader

improvements in the community, including better access to water for domestic use and sanitation, which is crucial for health and well-being.

E. PROCESSING OFFICER: NARO HOLDINGS

The Processing Officer from NARO Holdings, the private business arm of the National Agricultural Research Organisation (NARO), shared key information about their operations and how the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project would benefit them. NARO Holdings operates as a profit-making company, but it is fully funded by NARO, and its work supports national agricultural goals. Their core activities include seed multiplication and processing, which are essential for supplying quality seeds to farmers. However, one of the main challenges they face is lack of adequate water for irrigation. Although they have constructed a valley dam to collect water for their operations, the amount available is still not enough to support farming across their land.

Currently, NARO Holdings does not have any formal irrigation system in place. They are in the process of setting up a tank to start supplying 1,000 cubic meters of water, but this will only cover 30 acres out of the 1,000 acres they own. This shows a large gap between their available water and their full operational needs, highlighting the urgency of accessing more reliable water sources.

The officer also pointed out that drought is a major problem affecting their farm productivity. The region experiences two planting seasons each year, but without irrigation, the yields are consistently low. For crops like maize, soybeans, and cassava, they expect an average yield of 1 ton per acre, but they are currently only achieving 0.7 tons per acre. This is not profitable, especially when compared to other regions with irrigation systems.

As an example, they compared their situation to Mubuku Irrigation Scheme in Kasese, where they were able to plant and harvest 1.5 tons of maize per acre more than double what they currently achieve. This clearly shows how important irrigation is for increasing productivity and profits.

NARO Holdings is interested in being part of the proposed irrigation project, as it would help expand their access to water beyond the small portion currently being served. With only a fraction of their land covered by their private system, the proposed project would allow them to improve overall productivity and better meet their seed production goals.

In terms of community engagement, the officer mentioned that NARO Holdings employs 66 local workers, with 80% being male and 20% female. By improving agricultural productivity, the project would also help sustain these jobs and possibly create more employment opportunities for the surrounding community.

In conclusion, the Processing Officer from NARO Holdings highlighted serious challenges related to water shortages and low crop yields. While they are trying to develop their own small irrigation system, it is not enough to meet the needs of their large farm. They see the proposed water supply and irrigation project as a much-needed solution that would help them scale up production, improve yields, and create more benefits for the local community.

F. DISTRICT PHYSICAL PLANER: KIRYANDONGO DISTRICT

The District Physical Planner for Kiryandongo District provided important information regarding land use and planning issues that must be considered in the implementation of the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project.

The officer noted that along the proposed transmission line from the River Nile side towards the Kampala–Gulu highway, there are old structures that are under the management of the Custodian Board. These properties originally belonged to Asians who were deported in the 1970s. The officer advised the project team to verify the legal status of these properties before making any development decisions.

In addition, the officer pointed out that Kafu Sugar Company holds a running leasehold on the land where the proposed treatment plant is to be located. The officer emphasised that this should be taken into account when planning for land acquisition or infrastructure development, and the necessary coordination must be done with the leaseholder and relevant authorities.

The officer noted that land ownership for the proposed water reservoir site is unclear, as the area has previously been claimed by both the Bunyoro Kingdom and the National Forestry Authority. However, at one point, both parties disclaimed ownership of the land. The officer recommended that further clarification regarding rightful ownership should be sought from the Masindi District Zonal Lands Office.

Regarding land tenure, the officer explained that the area is predominantly under freehold and customary ownership, although there are also a few cases of titled and leasehold land. Due to this diversity in land ownership, the officer recommended that the project team consult the Masindi District Zonal Lands Office to confirm the legal ownership of land at the proposed infrastructure sites, such as the transmission line, treatment plant, and reservoir points.

The officer also highlighted that Rwenkunye and Kaduku trading centres already have approved physical development plans. It is essential that the project be aligned with these existing plans to avoid land use conflicts and to support orderly development in the area.

Another issue raised was that the project area is waterlogged, which may present construction and environmental challenges. The officer advised that technical assessments be conducted, including soil and hydrological studies, to ensure that the project design can adapt to these conditions.

Finally, the officer stressed the importance of submitting the proposed project design to the District Physical Planning Committee for review and formal approval before implementation.

G. Assistant Commandant: Office of the Prime Minister (Bweyale Refugee Settlement)

The Assistant Commandant from the Office of the Prime Minister responsible for Bweyale Refugee Settlement shared detailed information about the refugee population and the challenges they face, particularly concerning water access and agricultural activities.

The officer explained that refugees have the legal freedom to move within and outside the camp in search of better opportunities. As a result, some refugees live in areas where the proposed water infrastructure project will be located, especially in parts of Masindi and Kiryandongo Districts, such as Mutunda and Karuma sub-counties. While the command monitors refugees within the camp, it also tracks those who live outside. Currently, about 30% of the refugees stay outside the camp, while 70% remain within the camp boundaries.

Concerning the population, the Assistant Commandant noted that as of the end of March 2025, the total refugee population in Kiryandongo Refugee Settlement stood at 148,238 individuals, with the majority originating from South Sudan (84,831) and Sudan (62,751). Other nationalities include people from the Democratic Republic of Congo, Kenya, Burundi, and smaller numbers from other African countries. The settlement is divided into two main ranches: Ranch 1 (90,695 people) and Ranch 37 (57,543 people), comprising a total of 39,930 households.

The average household size in the camp is about 2.5 people per household. The total land area for the refugee settlement is 27 square miles, with space still available that could accommodate approximately 80,000 more households. Refugees are allocated land plots for housing and farming. For housing, a family of fewer than five people is given a 15x25 meter plot, and for farming, the same plot size is provided per person in the household. Refugees are also organized into farming groups, cultivating blocks of land ranging from 5 to 25 acres, with the largest groups farming up to 30 acres.

When it came to water need, water access is a major issue in the settlement. Currently, each person receives only 10 litters per day, far below the minimum international standard of 15 to 20 litters per day needed for drinking, cooking, and personal hygiene. The officer emphasized the urgent need for more water, both for domestic use and agricultural production.

The situation has worsened following a cutback in food assistance by the World Food Programme (WFP), which has reduced food support by over 64%. This has increased the pressure on refugees to produce their own food, making the provision of irrigation water critical to sustaining livelihoods and nutrition in the community.

The officer also noted that the refugee settlement is also surrounded by government ranches, many of which remain unused, and could potentially be integrated into development planning or considered for additional settlement or agricultural use.

The officer welcomed the Masindi Port Bulk Water Supply and Irrigation Project and highlighted its potential to improve both livelihoods and food security among refugee populations and nearby host

communities. Access to water will reduce dependency and help stabilize refugee populations that often move in search of better conditions.

In conclusion, the Assistant Commandant recommends that the project coordinate with refugee authorities, particularly in areas where refugee and host communities overlap. With adequate planning, the project can serve as a lifeline for both refugees and local farmers, enabling sustainable farming and improving access to clean water.

H. Environment Officer, Kiryandongo District

The Environment Officer for Kiryandongo District emphasised that environmental safeguards and proper planning must be a key part of the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project.

The officer recommended that the project team should carry out a full Environmental and Social Impact Assessment (ESIA) to understand the potential effects of the project on the natural environment and communities. This assessment will help identify potential risks and ways to avoid or reduce them during implementation.

In addition, the officer highlighted the need for a Resettlement Action Plan (RAP) if the project will lead to the displacement of any people or affect homes, farms, or community property. The RAP will guide how affected persons are compensated or relocated in a fair and organised manner.

The officer also called for the development of a Catchment Restoration Plan to protect and restore the areas around the water sources that the project will rely on. This would include efforts like tree planting and soil conservation to ensure the long-term sustainability of the water supply.

Finally, the officer stressed the importance of creating a River Bank Management Plan to protect the riverbanks from degradation due to increased activity around the water source. Proper management will prevent erosion, pollution, and environmental damage that could affect water quality.

I. Interview Summary – Commercial Officer, Kiryandongo District

The Commercial Officer noted that the proposed project area is heavily involved in livestock farming, and that lack of water has been a serious challenge for many farmers, especially during dry seasons.

The officer observed that under the Parish Development Model (PDM), several farmers have had to sell off their animals prematurely due to the lack of grass and water. This has led to reduced income and poor returns on their livestock investments.

Additionally, the officer pointed out that crop farmers also suffer losses due to the lack of water for irrigation, especially during prolonged dry periods. These conditions lower productivity and make it hard for smallholder farmers to sustain their livelihoods.

The officer supports the water project, stating it will be a big step toward improving both crop and livestock production in the area. With a reliable water source, farmers will be able to maintain their animals, grow more crops, and earn a better income.

J. Senior Probation Officer: Kiryandongo District

The Senior Probation Officer welcomed the proposed irrigation project both in their official capacity and personally as a farmer. The officer owns 60 acres of customary land and has struggled with previous irrigation efforts, which were often too costly. Although there is a small-scale irrigation initiative under the World Bank-funded Merennial Irrigation Scheme, the process involves applications, site assessments, and partial payments, making it difficult for many farmers to benefit.

The officer is engaged in fruit farming and is setting up a goat project. Plans are also in place to venture into horticulture as part of a retirement plan. The new irrigation project is seen as a great opportunity to support such agricultural activities and contribute to becoming a more productive and self-reliant farmer.

One of the biggest challenges for farmers in the district has been the heavy reliance on rainfall. There is limited knowledge and infrastructure for water harvesting, making it hard to store water even when it is available. There have been no formal irrigation systems in the district so far. Most farmers use basic, labor-intensive methods like fetching pond water by hand, which is very inefficient.

The officer emphasized that if the project is fully run by the government, there is a risk of disorganization. However, if it is implemented under a public-private partnership model, with beneficiaries contributing a small amount, it could promote better ownership and accountability. Charging for water usage, even at a subsidized rate, helps prevent misuse.

There was concern that handing the project to a private company might lead to monopoly and high charges, especially if the company is the only provider of water. On gender roles, the officer noted that while men traditionally dominate land ownership and decision-making, women are gradually gaining influence through involvement in savings groups and income-generating activities. Though men still take most of the agricultural proceeds, more households are beginning to share earnings fairly.

Regarding participation in training, women are more likely to attend and engage, while men often assume they already have the knowledge and resist attending such sessions. The officer also raised issues around marketing. Farmers struggle with value addition due to the lack of processing facilities. For instance, mangoes rot during peak seasons because there are no systems in place for juicing or drying them.

Infrastructure, particularly roads, is not in perfect condition but still usable. Trucks continue to access farms even during bad weather. Socially and culturally, the officer pointed out that the introduction of a large-

scale irrigation project would likely change community routines. Leisure time, traditionally respected during off-seasons, might now be spent working more intensively on farms. There could also be a shortage of labor, making mechanization and technical training essential.

The officer was comfortable with a proposed seasonal fee of UGX 200,000 for 3 acres over three months, stressing that the output from well-managed irrigation could far outweigh this cost. Flat-rate payments were preferred over per-unit billing, especially if the project is subsidized, to avoid overburdening farmers with larger plots.

In terms of sustainability, the officer expressed concerns over maintenance, citing a past experience in Kigumba where a government water project failed due to lack of fuel and upkeep. There was also concern about bill defaulters, which could cripple the system as has been seen with national water utilities.

Finally, there was caution that some communities may not be ready to adopt the irrigation system, especially those still heavily reliant on rain-fed agriculture. Ensuring that the catchment areas are clearly mapped and inclusive is important to avoid leaving out households that may later want to join.

K. Water officer: Kiryandongo District

The District Water Officer expressed general support for the proposed irrigation project, but raised several critical concerns based on prior experience and ongoing observations within the district. The foremost fear is that the project may not be completed as promised. Many government-led projects begin with consultations and strong presentations but fail to deliver tangible outcomes. This inconsistency has built scepticisms, and the officer emphasized that the community would welcome the project only if it is implemented as committed.

Another major concern relates to equity and inclusiveness. From earlier presentations and maps shared, it appeared that the project would primarily benefit large-scale or "commercial" farmers many of whom are external investors or non-locals. According to the officer, most of the district's population consists of smallholder farmers who risk being excluded, particularly those in the interior parts of Kiryandongo that the project may not reach. There's a worry that only those living near large commercial farms, especially along the main road from the Nile to Masindi via Kafu, will benefit directly.

The officer also criticized the conditions of other government-supported irrigation schemes particularly small-scale or micro schemes which are riddled with impractical requirements, such as asking farmers to first present their own water source. This undermines the whole purpose of public irrigation assistance, especially in areas suffering from water scarcity.

Another point of concern was land acquisition. The officer noted that the proposed sizes for key infrastructure sites (e.g., 10 acres for water installations, 80 acres for treatment plants and housing estates)

are substantial. These areas often involve complex land ownership, including departed Asian property managed by custodians, sub-county land, kingdom land, and land owned by Indian investors. Navigating these stakeholder dynamics will be critical to avoid disputes and delays.

Despite the concerns, the officer acknowledged the urgent need for water and agricultural support in the district. Some local leaders and farmers are very enthusiastic and would welcome the project immediately if it became available. However, the officer also recognized that many layers of bureaucracy—including parliamentary approval will likely delay implementation.

A significant issue raised was the sustainability and future management of the project. Although infrastructure often appears solid at commissioning, problems begin to surface once responsibility is transferred to operational entities. The officer suspects that the Ministry may hand over the system to a service provider, such as National Water or a local organization. Based on past experiences with National Water in the district, the officer cited multiple operational failures ranging from broken-down production wells to unreliable backup generators which have left some communities underserved. There's concern that management inefficiencies, poor response times, and infiltration by unqualified contractors may compromise the project's long-term success.

When asked about preferred management, the officer made it clear that, based on local experiences, infrastructure projects are better handled by government institutions. While private operators may have good intentions, there is little confidence in their ability to manage large-scale public utility systems effectively in this context.

L. LC II Chairperson, Waibango Parish in Masindi Port Sub County – Kiryandongo District

The LC II Chairperson of Waibango Parish provided valuable views into the current water challenges and practices within the community, particularly around Masindi Port Health Centre III. He reported that the main source of water in the area is a borehole located near the health centre. However, these borehole yields salty water, which many community members find unsuitable for drinking or cooking. As a result, some residents prefer to use water directly from the river, especially for cooking and for preparing fish, a key part of the local diet.

Water for livestock is a major concern in the parish, where approximately 80% of households are engaged in livestock farming. The chairperson noted that during the dry season, particularly between October and February, water scarcity becomes severe. This leads to significant livestock losses, forcing some residents to migrate temporarily with their animals in search of water. Those who are financially able resort to transporting water using tanks to sustain their animals during these months.

Cultural practices and personal beliefs also shape water use patterns in the community. For instance, an elderly resident, about 80 years old, relies solely on harvested rainwater, reflecting traditional methods of water conservation. Such practices highlight the diverse ways residents adapt to the limited and sometimes poor-quality water sources available to them.

In summary, the LC II Chairperson highlighted several key challenges, including the salinity of borehole water, seasonal drought impacts, insufficient infrastructure for water storage and transport, and unequal access based on economic means. These issues point to the urgent need for a reliable and inclusive water supply system that caters to both domestic and production (irrigation and livestock) needs in Waibango Parish and the wider Masindi Port area.

Appendix B-5: Meeting with Masindi District Stakeholders

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 17th June 2025
Time of Meeting: 4:30 p.m.
Vee of Meeting: Resident District Commissioner (RDC) Office Masindi District

Agenda

1. Self-Introductions
2. Remarks from the Consultant (Ardent Services International).
3. Remarks from the ARDC
4. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The consultants team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project, emphasizing that the Ministry of Water and Environment (MWE), as the implementing agency, is mandated to ensure environmentally and socially responsible development. In this regard, the consultants highlighted that a key component of the project involves the preparation of a Resettlement Action Plan (RAP) to guide the fair and lawful acquisition of land and compensation of affected persons. The Consultant noted that while the project aims to minimize displacement by prioritising road reserves and public land, any unavoidable land acquisition will be addressed in accordance with national legal frameworks and African Development Bank (AfDB) safeguards. The team further informed the Chairperson that the RAP will be informed by comprehensive technical, socioeconomic assessments, including analysis of land use, livelihoods, population dynamics, and community infrastructure, ensuring that stakeholder engagement and gender-sensitive planning are integral to mitigating resettlement impacts and promoting community acceptance.

The team thanked the RDC for spearing time to meet and discuss this important project.

Minute 3: Remarks from the Assistant RDC

She affirmed that the office of the RDC is fully aware of the project and that they have attended several meetings. She encouraged the team to carry out it work diligently without being compromised.

Minute 4: Closure

In closing, the ARDC pledged that she will communicate to the RDC informing him of the presence of the consultant in the district.

Appendix B – 5 (a): Meetings within Masindi District:

Office of the CAO

Brief introductions of all participants.

The team, led by the Water officer, visited the office of the CAO. The reconnaissance team, led by the Ministry of Water and Environment (MWE), included a consortium of four contractors. The team from the MWE and the consortium of consultants introduced themselves to the CAO.

Presentation: Overview of the project objectives, scope, and expected outcomes:

- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting its objectives, scope, and expected outcomes. The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers.
- The project targets four sub-counties: two in Masindi District (Mirya and Kimengo) and two in Kiryandongo District (Masindi-Port and Kigumba). The scope may be adjusted to fit the budget.
- The project aims to develop a sustainable source for potable water, water for rural industries, and livestock. It focuses on bringing water to farmers, particularly in the Kimengo sub-county, where livestock farmers are struggling, as well as to small-scale industries and for domestic use.
- The feasibility study is funded by a grant from the African Development Bank (AfDB). The MWE is working to secure full funding for the project.
- This is the first project of its kind, receiving significant attention. The MWE will engage with the Ministry of Finance to explore funding options.
- Land acquisition is a key concern, and the MWE has identified stakeholders (farmers and other potential users). The list can be shared for review and the district can add other potential users.
- The MWE team leader requested the support of the CAO and her technical team, particularly in providing documentation and raising awareness of the project within the hosting communities to facilitate the feasibility studies.

Remarks from the Consortium of Consultants:

- The team leader for the consortium of consultants thanked the CAO for hosting the team and appreciated the brief provided by the MWE team leader.
- He informed the CAO that various teams will be collecting data on the ground soon, including a socioeconomic team. He requested support from the CAO in this process.

Remarks and concerns by the CAO:

- The CAO thanked the MWE for proposing the Bulk Water Supply and Irrigation Infrastructure project. She noted that she was only two days into her role as CAO.
- The CAO acknowledged that since the project is demand-driven, people are likely to be willing to use and pay for the service. However, she sought clarity on whether the project would be free or if users would have to pay, how the management system would work, and whether the District Development Plan (DDP) captures these future plans.

Responses:

- Regarding user payment, the MWE team leader replied that there would be a cost. The consultant will propose the rate in consultation with stakeholders like the National Water and Sewerage Corporation (NWSC).
- The team leader informed the CAO and members that a management system would be established, as stakeholders need to know the water they require.
- Concerning the management system, the MWE team leader mentioned that the consultant for the feasibility study has been asked to benchmark the Katosi water supply system and develop a better system for managing the Bulk Water Supply and Irrigation Infrastructure project.
- Regarding the DDP capturing the plans, the leader asked the CAO to provide the DDP for review to support the feasibility study. He also urged the consultant to consult with the NWSC about the plans for water supply in the proposed area and the entire district.

Summary of Closing Remarks by the CAO

- The CAO thanked the Ministry of Water and Environment team and the consortium of consultants for their presentation and visit. She expressed appreciation for the proposed project and its potential benefits for farmers, livestock, and rural industries in the district.
- The CAO assured her full support and emphasized the importance of collaboration and communication to address challenges, particularly land acquisition and community awareness.
- She committed to mobilizing her technical team to assist with documentation and community engagement. The CAO looked forward to a successful partnership, ensuring the project's objectives are met efficiently and effectively.

Office of the District Chairperson:

Brief introductions of all participants.

The team, led by the Water officer, visited the office of the district chairperson. The reconnaissance team, led by the Ministry of Water and Environment (MWE), included a consortium of four contractors. The team from the MWE and the consortium of consultants introduced themselves to the district chairperson and the political leadership

Presentation: Overview of the project objectives, scope, and expected outcomes;

- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting its objectives, scope, and expected outcomes. The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers.
- The project targets four sub-counties: two in Masindi District (Mirya and Kimengo) and two in Kiryandongo District (Masindi-Port and Kigumba). The scope may be adjusted to fit the budget.
- The project aims to develop a sustainable source for potable water, water for rural industries, and livestock. It focuses on bringing water to farmers, particularly in the Kimengo sub-county, where livestock farmers are struggling, as well as to small-scale industries and for domestic use.
- The feasibility study is funded by a grant from the African Development Bank (AfDB). The MWE is working to secure full funding for the project.
- Land acquisition is a key concern, and the MWE has identified stakeholders (farmers and other potential users). The list can be shared for review, and the district can add other potential users.
- The MWE team leader requested the support of the district chairperson and his political team, particularly in raising awareness of the project within the hosting communities to facilitate the feasibility studies. He further noted that the MWE needs the project to be bankable to ease the process of securing funding. Currently, MWE has funding only for the feasibility studies.

Remarks and concerns by the District Chairperson

- The district chairperson thanked the MWE for proposing the Bulk Water Supply and Irrigation Infrastructure project.
- The district chairperson noted that this project has come at a much-needed time for the people. He informed the team that, as a district, they have tried to drill boreholes in this area but have not succeeded.
- The district chairperson assured his full support and emphasized to the team
- He committed to mobilizing his political team to assist with community engagement. The district chairperson looked forward to a successful partnership, ensuring the project's objectives are met efficiently and effectively.

Office of the RDC:

Brief introductions of all participants.

After a courtesy visit to the District Chairperson, the team was introduced to the RDC's Office by the District Water Officer. The reconnaissance team was led by the Ministry of

Water and Environment (MWE). The team from MWE and the consortium of consultants introduced themselves to the RDC.

Presentation: Overview of the project objectives, scope, and expected outcomes.

- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting its objectives, scope, and expected outcomes. The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers.
- The project targets four sub-counties: two in Masindi District (Mirya and Kimengo) and two in Kiryandongo District (Masindi-Port and Kigumba). The scope may be adjusted to fit the budget.
- The project aims to develop a sustainable source for potable water, water for rural industries, and livestock. It focuses on bringing water to farmers, particularly in the Kimengo sub-county, where livestock farmers are struggling, as well as to small-scale industries and for domestic use.
- The feasibility study is funded by a grant from the African Development Bank (AfDB). The MWE is working to secure full funding for the project.
- Land acquisition is a key concern, and the MWE has identified stakeholders (farmers and other potential users). The list can be shared for review, and the district can add other potential users.
- The MWE team leader requested the support of the RDC, as some issues require the intervention of the RDC and security, as well as raising awareness of the project within the hosting communities to facilitate the feasibility studies. He further noted that the MWE needs the project to be bankable to ease the process of securing funding. Currently, MWE has funding only for the feasibility studies.

DISTRICT LEADERSHIP INITIAL PLANNING MEETING AND CONSULTATIONS

Consultation date: 17th – 18th July, 2024

Introduction

The feasibility study reconnaissance was conducted on July 17-18, 2024, to engage with key stakeholders, visit potential project sites, and assess the feasibility of the proposed Masindi Port Bulk Water Transfer and Irrigation Infrastructure project. This project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers in the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District. Additionally, the project seeks to develop a sustainable source for potable water, as well as water for rural industries and livestock.

The purpose of this reconnaissance was for the Ministry of Water and Environment (MWE) to introduce the Consortium of Consultants, to the hosting and benefiting stakeholders in the districts.

On July 17, 2024, the team, led by the MWE and the consortium of consultants visited Kiryandongo District. The day began with courtesy visits to the offices of the District Water Officer, who led the team to the offices of the Chief Administrative Officer (CAO), the Resident District Commissioner (RDC), and the District Chairperson. These visits were followed by site inspections, starting at Masindi Port, the location identified for the water intake. The team then proceeded to Kaduku Village to assess the proposed area for the Tank reserve at Kaduku Hill. The day concluded with a visit to the commercial farm, Soul Agric Business Company, where potential project benefits were discussed with the farm's management.

On July 18, 2024, the team continued with the reconnaissance in Masindi District. Similar courtesy visits were made to the offices of the CAO, RDC, and District Chairperson to discuss the project's scope and expected outcomes, and to further introduce the consortium of consultants. Site visits included an inspection of the sugar cane plantation, Kaduku Farm under Kiryandongo

Sugar, formerly known as Lokyamu Farm. Additionally, the team visited Kimengo Sub County, meeting with the Sub County Chairperson to further understand residents' needs and concerns.

These visits provided preliminary findings and considerations into the current infrastructure, stakeholder concerns, and the project's potential impact on local communities. The information gathered will inform the preparation of a comprehensive feasibility study report, which will provide significant justification for financial funding and guide the actual implementation and considerations for the project.

Date, Location

Date: July 17, 2024

Location: Kiryandongo District

Minute 1: Courtesy Visits - Kiryandongo District:

Water Engineer:

Brief Introductions:

The visit commenced with brief introductions of all participants. The team from the Ministry of Water and Environment (MWE) and the consortium of consultants introduced themselves to the Water Engineer and his colleagues from the Water Office.

Presentation:

- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project. The presentation highlighted the project's objectives, scope, and expected outcomes. The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers in the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District. Additionally, the project is designed to develop a sustainable source for potable water, as well as water for rural industries and livestock.
- The MWE team leader emphasized the need for support from the Water Engineer and his team, specifically requesting access to available information and documentation

concerning water use and coverage to facilitate the smooth undertaking of the feasibility studies.

- The team leader also requested the Water Engineer's assistance in guiding the team to the CAO, District Chairperson, and RDC, as well as leading the site visits to the proposed intake at Masindi Port, the Tank reserve area at Kaduku Hill, and the commercial farms. These requests were promptly implemented.

Concerns Raised the District office (Water Engineer):

- The Water Engineer expressed appreciation for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted the district's long-standing water stress issues and noted that the project's implementation would significantly support domestic use and production.
- The Water Engineer committed to providing necessary documentation, such as water coverage data and relevant statistics, to support the feasibility study report.

Responses:

The MWE team leader appreciated the Water Engineer and his colleagues for their willingness to support the team. The Consortium of Consultants was encouraged to work closely with the district team to obtain the required support and information.

Closing Remarks:

The Water Engineer thanked the team for their visit and echoed his commitment to provide any necessary support as needed.

Summary of Key Takeaways:

- The district will provide key information and documentation to the Consortium of Consultants.
- The MWE/Consortium of Consultants will formally request documentation such as the District Development Plan (DDP).

Office of the CAO:

- All participants introduced themselves.
- After a courtesy visit to the District Water Office, the team was introduced to the Chief Administrative Officer (CAO) by the District Assistant Water Engineer. The team from the Ministry of Water and Environment (MWE) and the consortium of consultants introduced themselves to the CAO.

Presentation: Overview of the project objectives, scope, and expected outcomes:

- The team leader informed the CAO that the team comprised personnel from the ministry and a consortium of four consultants. The purpose was to introduce the consultants to key stakeholders (District personnel, project-hosting sub-counties, and potential commercial farmers) and to show the team the location of the proposed intake and area for the water tank.
- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting the project's objectives, scope, and expected outcomes.
- The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers in the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District.
- The team leader informed the CAO that the project is designed to develop a sustainable source for potable water, as well as water for rural industries and livestock.
- The MWE team leader requested the support of the CAO and his technical team, particularly in providing documentation and raising awareness of the project within the hosting communities to facilitate the smooth undertaking of the feasibility studies.

Remarks and concerns by the CAO:

- The CAO thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted that the proposed area indeed lacks water for their animals.

- The CAO mentioned that the district has made several interventions like drilling boreholes, but these were insufficient. Even the valley tanks they constructed could not meet the needs.
- He noted that the number of animal farms is significant, and he believes the proposed project will support these farms and improve domestic water use.
- The CAO emphasized the need to consider small and subsistence farmers to benefit from the project. He asked the team to explain how this would be achieved and sought details on how the consortium of consultants would work and implement the assignment.
- He stressed the community's urgent need for water, particularly for modern farming practices, as the area is mainly occupied by maize growers.

Responses:

- Regarding project execution, the MWE team leader explained that water would be extracted from the bulk water source, the River Nile, and supplied to the Bulk Water Supply and Irrigation Infrastructure project. This would cater to large commercial farms, domestic farmers, and water for domestic use, thereby transferring a large volume of water for production.
- Concerning the consortium of four consultants and their roles, the consultant's team leader explained the responsibilities of each consultant.

Closing Remarks

The CAO reiterated his appreciation to the MWE and the consortium for considering Kiryandongo District for this important project.

The CAO assured the team of his full support and the district's commitment to facilitating the project's smooth implementation.

He encouraged continuous communication and collaboration between all stakeholders to ensure the project's success.

Office of the District Chairperson:

Brief introductions of all participants.

- All participants introduced themselves.
- After a courtesy visit to the CAO, the team was introduced to the District Vice Chairperson, who also represented the District Chairperson, by the District Assistant Water Engineer. The reconnaissance team was led by the Ministry of Water and Environment (MWE). The team from MWE and the consortium of consultants introduced themselves to the District Vice Chairperson.

Presentation: Overview of the project objectives, scope, and expected outcomes;

- The team leader informed the District Vice Chairperson that the team comprised of personnel from the MWE and a consortium of four consultants. The purpose was to introduce the consultants to key stakeholders (District personnel, project-hosting sub-counties, and potential commercial farmers) and to show the team the location of the proposed intake and area for the water tank.
- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting the project's objectives, scope, and expected outcomes.
- The District Vice Chairperson was informed that the feasibility studies are being funded by the AfDB.
- The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers in the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District.
- The team leader informed the District Vice Chairperson that the project is designed to develop a sustainable source for potable water, as well as water for rural industries and livestock.
- The team leader informed the District Vice Chairperson that a number of studies, including socioeconomic and geotechnical etc., will be conducted.

- The MWE team leader requested the support of the District Vice Chairperson and his political team, particularly in raising awareness of the project within the hosting communities to facilitate the smooth undertaking of the feasibility studies.

Remarks and concerns District Vice Chairperson:

- The District Vice Chairperson thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted that the proposed area indeed lacks water for their animals.
- The District Vice Chairperson acknowledged that Kiryandongo District cannot stand alone and manage without the support from the ministries, and therefore welcomed the team to Kiryandongo District. He committed to providing support to the team while executing the assignment. He added that when the right time comes, the district will support in mobilization and engagements.
- He noted that the project areas have some refugees who have bought land and settled in the areas where the project has been proposed.
- Responses:

Office of the RDC:

Brief introductions of all participants.

- All participants introduced themselves.
- After a courtesy visit to the District Chairperson, the team was introduced to the RDC's Office by the District Assistant Water Engineer. The reconnaissance team was led by the Ministry of Water and Environment (MWE). The team from MWE and the consortium of consultants introduced themselves to the District Vice Chairperson.

Presentation: Overview of the project objectives, scope, and expected outcomes.

- The team leader informed the RDC that the team comprised personnel from MWE and a consortium of four consultants. The purpose was to introduce the consultants to key stakeholders (District personnel, project-hosting sub-counties, and potential commercial farmers) and to show the team the location of the proposed intake and area for the water tank.

- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting the project's objectives, scope, and expected outcomes.
- The RDC was informed that the feasibility studies are being funded by the AfDB.
- The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers in the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District.
- The team informed the RDC that the project is designed to develop a sustainable source for potable water, as well as water for rural industries and livestock.
- The team leader informed the RDC that a number of studies, including socioeconomic and geotechnical, will be conducted.
- The MWE team leader requested the support of the RDC and his team, particularly in raising awareness of the project within the hosting communities to facilitate the smooth undertaking of the feasibility studies.

Remarks and concerns by the District Vice Chairperson:

- The RDC welcomed and thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project. He highlighted that the proposed area indeed lacks water for their animals.
- The RDC emphasized the serious need for water in the area and requested that the feasibility study be extended to other areas not initially considered for the Masindi Port Bulk Water Supply and Irrigation Infrastructure project.
- The RDC committed to supporting the project, including addressing accessibility, social, and cultural issues.
- The RDC assured the team that he would communicate with the local communities to prevent misunderstandings, such as mistaking the feasibility team for land grabbers.

- The RDC emphasized the importance of selecting serious contractors for the project to avoid issues of poor performance and contract terminations. He assured the team that Kiryandongo District will not tolerate unserious contractors.

Sub-Counties Visited:

The team proceeded to Masindi Port sub-County for a courtesy visit. However, the sub-county officials were not available. The support staff (office assistant) provided contacts for the personnel and local council I leadership for conducting feasibility studies.

SITE VISIT – OBSERVATIONS AND CONCERNS

Water Source Intake:

- The proposed intake area is along the Masindi Port (ferry), connecting Kiryandongo (Masindi Port Sub-County) to Apac District through the River Nile.
- Consideration must be given to the busy schedules of people moving from either side to avoid interruptions during feasibility and construction activities.
- Consultations with the Uganda National Roads Authority (UNRA) are necessary for clear movement and traffic flow in the area. Contacts for UNRA personnel on the ground were obtained.
- Economic activities like fishing, livestock farming, and selling ready food were observed. These activities highlight the presence of Project Affected Persons (PAPs), but also indicate the need for a Bulk Water Supply for production. Detailed information on economic activities will be captured during the socioeconomic survey.
- The road (Masindi Port Road) is under construction. The feasibility team will consult UNRA to gather necessary information, especially concerning way leaves and right of way.
- Consultations with utility entities like the Ministry of Energy and Uganda Electricity Transmission Company Limited (UETCL) are required to understand the rightful corridor and align the project with existing UETCL projects.

- Uganda Railway was identified as a stakeholder. Abandoned structures believed to belong to Uganda Railway (UR) were observed. The feasibility team will engage with the Ministry of Works and Transport to identify plans for the railway line and other structures.
- Settlement was observed along the proposed project corridor. Before construction, resettlement action plans must be in place. Feasibility studies will capture information on PAPs, including household members, land ownership, housing conditions, income, and willingness to allow the project to proceed through their land.
- Crop and livestock farming were observed along the proposed corridor. Feasibility studies will capture information on value addition processes and limitations.
- Adequate water flow and quality were observed.
- Accessibility for construction equipment was noted.
- Potential environmental impacts were identified, as the area is a catchment for fish breeding. Consultations with NEMA will be necessary.

Proposed Area for the Tanka Reserve – Observations and concerns

- The proposed water tank area is located on Kaduku Hill, Kaduku Village, Masindi Port, in Kiryandongo District.
- The topography is suitable for construction; however, geotechnical surveys are needed to confirm suitability.
- Proximity to target beneficiaries will be determined during the detailed feasibility survey.
- Existing infrastructure support was assessed. The UPDF had earlier indicated willingness to provide space for the tank area.

Proposed Actions:

- Conduct geotechnical surveys to confirm suitability.
- Design plans to optimize water storage capacity.
- Conduct community consultations for feedback on location.

Potential Commercial Farms Visited:

Brief introductions of all participants.

- After visiting the proposed intake and water reserve tank area, the team visited Soul Agri Business Company.
- The team was introduced to the commercial farm proprietor and his team by the District Assistant Water Engineer. The reconnaissance team was led by MWE. The team from MWE and the consortium of consultants introduced themselves.

Presentation

- The MWE team leader provided a background of the project.
- The team leader informed the commercial farm proprietor that the team comprised personnel from MWE and a consortium of four consultants. The purpose was to introduce the consultants to key stakeholders and show the team the location of the proposed intake and water tank area.
- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting its objectives, scope, and expected outcomes.
- The commercial farm proprietor was informed that the feasibility studies are funded by the AfDB.
- The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers in the sub-counties of Masindi-Port and Kigumba in Kiryandongo District, and Mirya and Kimengo in Masindi District.
- The team informed the commercial farm proprietor that the project is designed to develop a sustainable source for potable water, as well as water for rural industries and livestock.
- The team leader informed the commercial farm proprietor that various studies, including socioeconomic and geotechnical, will be conducted.

- The MWE team leader requested the support of the commercial farm proprietor in providing information, especially regarding crop and animal production, yield, and production timelines.

Remarks and concerns from Soul Agri Business Company

- The commercial farm proprietor mentioned that the farm spans approximately 4,000 acres, growing crops like cassava, soya beans, maize, coffee, macadamia, paw paws, and matooke, among others.
- He highlighted the difficulties faced during drought seasons and requested the expeditious extension of water supply for production to their farm.

Remarks and concerns by the RDC:

- The RDC welcomed and thanked the MWE for considering Kiryandongo District for the Bulk Water Supply and Irrigation Infrastructure project.
- The RDC noted that the project has environmental concerns and there is a need to consult and engage with NEMA.
- The RDC anticipated land wrangles and pledged to support the team, informing them to approach him at any time when encountering such land-related issues. He committed to providing security support whenever necessary.
- The RDC informed the team that the office of the president is committed to dealing with corruption. He committed to providing support in the sensitization process of the project.

Appendix B- 5 (b): Sub-Counties Visited:

Miirya Sub County:

The team proceeded to Miirya sub-County for a courtesy visit; however, the sub-county officials were unfortunately not available. The office assistant was present and provided contacts for the personnel and local council I leadership to facilitate communication during the preparation and conducting of the feasibility studies.

Office of Kimengo Sub County Chairperson:

Brief introductions of all participants.

The team, led by the Water officer, visited Kimengo Sub County where the team had an opportunity to be introduced and discuss with the sub county chairperson. The reconnaissance team, led by the Ministry of Water and Environment (MWE), included a consortium of four contractors. The team from the MWE and the consortium of consultants introduced themselves to the sub county chairperson.

Presentation: Overview of the project objectives, scope, and expected outcomes;

- The reconnaissance team leader noted that this was the second visit to the sub-county regarding water supply for domestic use and production.
- The MWE team leader provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project, highlighting its objectives, scope, and expected outcomes. The project aims to establish a multi-purpose bulk water transfer system to irrigate at least 4,000 hectares for both smallholder and commercial farmers.
- The project targets four sub-counties: two in Masindi District (Mirya and Kimengo) and two in Kiryandongo District (Masindi-Port and Kigumba).
- The team leader emphasized that Kimengo Sub County, being one of the proposed areas and water-stressed, especially for human consumption and livestock, was important to visit.
- The project aims to develop a sustainable source for potable water, water for rural industries, and livestock. It focuses on bringing water to farmers, particularly in the Kimengo sub-county, where livestock farmers are struggling, as well as to small-scale industries and for domestic use.
- The feasibility study is funded by a grant from the African Development Bank (AfDB). The MWE is working to secure full funding for the project.
- Land acquisition is a key concern, and the MWE has identified stakeholders (farmers and other potential users). The list can be shared for review, and the district can add other potential users.
- The MWE team leader requested the support of the sub-county chairperson and his political team, particularly in raising awareness of the project within the hosting communities to facilitate the feasibility studies.

Remarks and concerns by the Sub County Chairperson

- The sub-county chairperson thanked the MWE for proposing the Bulk Water Supply and Irrigation Infrastructure project.
- The sub-county chairperson noted that this project has come at a much-needed time for the people. He informed the team that the entire sub-county does not have adequate water for consumption or livestock. Efforts to drill boreholes have failed, and the sub-county has never seen tapped water.
- He mentioned that an animal census survey indicated Kimengo Sub County had the highest number of livestock in the area, yet they lack water for their livestock.
- The sub-county chairperson shared pictures of water-stressed people and livestock, requesting an expedited project timeline and the inclusion of other areas in the sub-county during the feasibility studies.
- He assured his full support and commitment to mobilizing his political team for community engagement. The sub-county chairperson looked forward to a successful partnership, ensuring the project's objectives are met efficiently and effectively.

Site (Proposed Scope) – Observations and Concerns

- **<u>Kaduku Farm under Kiryandongo sugar Factory</u>**
- During the reconnaissance exercise, the team observed various economic activities along the route from Masindi District to the two sub-counties (Miirya and Kimengo). The primary economic activities observed included maize farming and sugar cane growing.
- The team conducted a stopover at the sugar cane plantation and engaged in a discussion with the workers present at the farm. The workers provided some preliminary information, pending a detailed study. The key observations were as follows:
    - Kaduku Farm, formerly known as Lokyamu Farm, is now under the management of Kaduku Farm.
    - The farm has been in existence for 6 years.
    - The farm acquired 23 square miles from the Uganda Investment Authority (UIA) and has utilized 16 square miles for the sugar cane plantation.
    - At the time of the reconnaissance, the farm employed approximately 200 workers, with 15% of them being female.
    - The farm's yield was approximately 60 tons per hectare.
    - The farm has outgrowers, with an office located at Kisanja village.

Appendix B (c): KEY INFORMANT – MASINDI DISTRICT

A. HEAD OF PRODUCTION (DOUBLE AS PRINCIPAL VETERINARY OFFICER) FOR MASINDI DISTRICT

The Head of Production and Principal Veterinary Officer for Masindi District shared valuable information about the current challenges faced by farmers in the district and how the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project could help improve farming and livestock production.

He explained that farmers in Masindi are already spending money to access water, especially during dry periods. Many livestock farmers hire water bowsers to bring water from the River Kafu to their farms to provide for their animals. This shows that farmers are already willing and able to pay for water when needed. the officer believes that if the government can provide a reliable and well-managed water supply system for farming, many farmers will be ready to contribute a reasonable amount to maintain the system.

Water scarcity is a serious issue in the district, especially in places like Kimengo sub-county. During dry spells, boreholes often dry up, leaving people without clean water. In such times, communities are forced to share water from valley dams with livestock, which creates hygiene and health risks. The Head of Production pointed out that this situation puts both people and animals at risk, and that a steady and clean water source through the proposed project would greatly reduce such pressure.

The officer also raised concerns about the way farmers use extension services. Many farmers believe they can manage their farms and treat their animals on their own. Often, they only seek professional help when their own efforts fail, by which time the situation has worsened. This results in preventable losses. The officer recommended that farmers be encouraged to seek early assistance from trained agricultural and veterinary staff.

However, the number of extension workers in the district is too low to meet the needs of farmers. Out of 14 lower local governments in Masindi, only five have full-time extension staff. As a result, one extension worker serves around 1,800 households, which is more than double the national standard of one worker per 800 households. This shortage makes it difficult for farmers to get timely advice and support. The officer recommended that more extension staff be hired and supported, especially with transport, so they can reach farmers in rural areas.

Another issue discussed was the low and unreliable crop yields in the district. Because of poor and unpredictable rainfall, farmers cannot depend on rain-fed agriculture. The officer noted that with reliable irrigation, farmers would be able to increase their harvests and grow crops more consistently. the officer added that better access to water would also allow farmers to grow a wider variety of crops and farm all year round, not just during the rainy season.

The officer also spoke about the growing impact of climate change. the officer said that people are cutting down trees for charcoal and clearing land for sugarcane plantations. These activities are harming the environment and reducing rainfall. The officers suggested that the project should also include activities to protect the environment, such as tree planting and soil conservation, to help restore the natural balance and support the long-term water supply.

On gender issues, the officer pointed out that most land in Masindi is owned by men, since land is usually inherited by male family members. Women, even though they do a lot of farming work, rarely own the land they work on. This limits their ability to make farming decisions and reduces their benefits from agricultural support programs. the officer recommended that the project ensure women are not left out and that both men and women benefit equally from the services and opportunities provided.

Although most smallholder farmers in Masindi have land, usually about 2 to 3 acres, the main problem is not land size, but the lack of water. The officer said that if smallholder farmers are given access to irrigation water, they will be able to use their land more effectively and increase their productivity and income. The officer also noted that if the government plans to give land to farmers who do not have any, there must be a clear plan in place. This should include who qualifies for land, how long they can use it, and the rules they must follow to avoid misunderstandings and unfair treatment.

B. ZONAL LANDS OFFICER (CARTOGRAPHER), MASINDI DISTRICT

The Zonal Lands Officer for Masindi District, who also serves as the district cartographer, gave important guidance related to land ownership and mapping for the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project. The officer's comments focused mainly on land tenure, mapping procedures, and what is needed to support land-related planning for the project.

The officer explained that the area where the project is expected to be implemented has three main types of land ownership, also known as land tenure systems. These are freehold, customary, and leasehold. Most of the land in the project area falls under freehold and customary tenure, while only a small portion is held under leasehold arrangements. the officer also confirmed that there are no mile land cases (land held under the mailo system), which simplifies the process of land access and planning in this region.

The Lands Officer advised that, in order to properly support the project planning and mapping process, the project team should first provide clear GPS coordinates for all the specific locations where project infrastructure such as water pipelines, reservoirs, or irrigation blocks will be placed. With accurate coordinates, his office will be able to map the areas, verify land status, and support land documentation processes needed for the project's successful implementation.

The officer emphasised that once these GPS points are submitted, the Lands Office will provide the necessary cartographic and land administration support.

C. MASINDI DISTRICT FARMERS ASSOCIATION (MADFA) - MANAGER

The Manager of the Masindi District Farmers Association (MADFA) provided detailed information about the association's activities, coverage, and how their work aligns with the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project. MADFA is a well-established farmers' organization that plays a key role in improving the livelihoods of micro and smallholder farmers in the Bunyoro region, particularly in Masindi and Kiryandongo districts.

MADFA operates across all sub-counties within its area of coverage, including Labongo, Kiluli, Kigulya, Kimengo, Miirya, and Budongo, among others. Their approach is inclusive they do not segregate or exclude any category of farmers. Through their trained field teams, they extend services directly to local farmers at the grassroots level. These field officers are equipped to engage with farmers, provide technical support, and follow up on agricultural activities throughout the farming cycle.

One of MADFA's core roles is to empower farming communities by improving their access to financial services. They offer a variety of agricultural loan products tailored to support both crop and livestock farmers. This financial support enables farmers to invest in inputs such as seeds, fertilizers, and veterinary services, which directly helps to improve production and overall livelihoods.

Beyond loans, MADFA is actively involved in training and capacity building. They provide farmers with education in financial literacy and modern agricultural practices. These trainings are often delivered in partnership with other stakeholders such as Masindi Seed Farmers' Association (MASFA) and Masindi Seed Company, which specialize in agronomy training. Through these efforts, farmers are taught how to manage their resources better and adopt improved farming methods that lead to higher yields and better income.

The association also runs different financial products designed to support the broader needs of rural households. In addition to agricultural loans, they offer school fees loans, which help families keep children in school, and green financing, which supports environmentally friendly farming practices and sustainable agriculture. These services demonstrate MADFA's commitment to holistic rural development.

In conclusion, MADFA is a strong partner for agricultural development in Masindi and Kiryandongo districts. Their deep presence in local communities, combined with financial services, training programs, and partnerships with agronomy experts, makes them a key stakeholder in supporting farmers. The proposed irrigation and water supply project would align well with MADFA's mission, especially in

boosting farmer productivity and resilience. Their existing structures and experience working directly with farmers position them as an important collaborator in mobilizing communities, providing extension support, and helping ensure the success and sustainability of the project.

D. MASINDI DISTRICT PHYSICAL PLANNER

The Physical Planner for Masindi District shared important information about land use planning in relation to the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project, particularly in Miirya and Kimengo sub-counties, where key project infrastructure may be located.

The officer noted that, at present, there are no physical district assets or development plans in place for Miirya and Kimengo. This means the district has not constructed or planned for buildings or public infrastructure in these areas. The reason for this, the officer explained, is the limited budget available to the district for physical planning and development activities. Due to these funding constraints, it has not been possible for the district to invest in infrastructure in these specific sub-counties.

The planner confirmed that water stress is a serious issue affecting both Masindi and Kiryandongo districts. According to her, the lack of reliable water supply has made it very difficult for farmers to grow crops consistently and has negatively affected their standard of living. The officer believes that the proposed irrigation and water supply project will help address this major challenge and is a welcome development for the region.

The officer shared some important actionable recommendations to help ensure the project is accepted and runs smoothly;

First, the officer stressed that the cost of water for farmers must be affordable. Many people in these communities expect the water to be subsidized, meaning the government should cover part of the cost so that farmers can afford to use it. If water prices are too high, people may not use the service, and the project may not achieve its intended impact.

Second, officer mentioned that there are concerns about land use, especially for people whose land might be affected by the construction of water pipelines or other infrastructure. While some community members might expect compensation for land used by the project, the officer believes that proper sensitization can help address this issue. The officer explained that if the government engages with communities early, explains the purpose and benefits of the project, and builds trust, most people will cooperate even without demanding compensation.

The officer also emphasized the importance of involving local political leaders, such as LC1 chairpersons and local councillors, in community mobilization and communication. According to her, community

members trust and listen to these leaders, so their involvement can help reduce resistance and promote understanding of the project.

Lastly, the planner gave technical advice on long-term planning. The Officer recommended that, during the design and implementation of the project, the government should consider future infrastructure needs such as roads and other public services. The officer said there should be clear planning to avoid placing water lines in areas where future road or building projects might be developed. Proper planning now will help ensure that the water infrastructure is not damaged or relocated later due to other district activities.

E. LABOUR OFFICER: MASINDI DISTRICT

The Labour Officer from Masindi District shared important concerns and recommendations related to labour rights and employment practices that should be considered during the implementation of the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project.

He emphasized the importance of local content and community involvement. According to him, local residents should be given the opportunity to benefit directly from the project, not just through casual labour but also in technical jobs where possible. This would ensure that the community feels involved and supported throughout the project.

One of the key concerns raised was that, in many past projects, contractors often fail to provide written contracts to workers. This makes it difficult for workers to claim their rights or understand their terms of employment. the officer recommended that for this project, all contractors must issue formal contracts to the people they hire, both for accountability and for the protection of workers.

He also pointed out the issue of payment delays, which are common on many construction projects. To avoid disputes and dissatisfaction, the officer advised that there should be a clear and consistent payment schedule agreed upon and followed throughout the project period. When payment timelines are not clear, it often results in labour turnover, especially when combined with low wages and undefined work schedules. These conditions lead workers to leave their jobs early, which disrupts project progress.

In terms of safety, the Labour Officer stressed the need for proper use of Personal Protective Equipment (PPE). the officer recommended forming a dedicated team or appointing a team leader responsible for ensuring that workers are consistently using PPE. This would help to reduce injuries on site and promote a safer working environment.

On gender inclusion, the Labour Officer noted a gap in equal employment opportunities, with men more likely to be hired for skilled jobs. the officer observed that some employers are reluctant to hire women, even when they are capable. the officer called for fair and equal chances for both men and women to

participate in all areas of the project. the officer also raised a concern about sexual harassment, especially in cases where some workers are stationed far from home or separated from their families. To address this, the officer suggested sensitization sessions be conducted on appropriate workplace behaviour and gender respect.

In conclusion, the Labour Officer strongly supports the project but recommends strict attention to worker rights, safety, fair employment practices, and gender equality. The officer urged that the project must include clear employment contracts, timely payment, and proper use of safety gear. The officer also emphasized the importance of community involvement, particularly in offering both casual and skilled job opportunities to local residents.

F. ENVIRONMENT OFFICER, MASINDI DISTRICT

The Environment Officer for Masindi District emphasized several environmental and social concerns that should be considered in the planning and implementation of the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project.

The officer explained that the project area lies within a cattle corridor, characterized by semi-arid conditions. This means the region experiences long dry periods, making it difficult for both people and animals to access enough water. Because of the water scarcity, many residents are forced to walk long distances to find water for household use and livestock. This consumes a lot of time that could otherwise be used for productive activities like farming or education.

The Environment Officer also highlighted that in the absence of reliable water sources, communities are at risk of waterborne diseases, as they often resort to using unsafe and unclean water. These health challenges add to the burden of poverty and poor living conditions in the area. Therefore, the officer welcomed the water project as timely and necessary for improving public health and daily livelihoods.

Another major concern is environmental degradation, particularly the cutting down of trees. The officer noted that most of the natural vegetation in the area has been cleared, leaving no proper catchment areas for water. This not only reduces groundwater recharge but also increases the risk of erosion and poor soil quality. The officer stated that the introduction of the irrigation project must be accompanied by environmental protection measures, such as reforestation and sustainable land management.

The officer emphasized the importance of conducting an Environmental and Social Impact Assessment (ESIA) before project implementation. This would help identify potential risks, ensure the project is environmentally sustainable, and provide guidelines to prevent further damage to natural resources.

Additionally, the officer pointed out the need to understand the status of road tarmacking in the project area. Proper alignment between the water infrastructure and future road works is essential to avoid future disruptions or the need for costly relocations. Good coordination between different government departments will ensure that project infrastructure is well planned and protected.

Lastly, the officer noted that the value of land is likely to increase in the project area once the water supply infrastructure is in place. While this could be seen as a positive development, the officer advised that it be managed carefully to avoid land disputes and to ensure that local communities benefit fairly from the development.

In conclusion, the Environment Officer supports the proposed water supply and irrigation project, seeing it as a much-needed solution to semi-arid conditions, water scarcity, and health risks in Masindi District. However, the officer emphasized the importance of conducting a full Environmental and Social Impact Assessment, protecting remaining natural resources, and coordinating with infrastructure development plans such as road tarmacking.

G. ANIMAL HUSBANDRY OFFICER: MASINDI DISTRICT

The Animal Husbandry Officer for Masindi District emphasized the serious challenges farmers face in accessing water, especially in the Miirya and Kimengo sub-counties, which are located within the cattle corridor. These areas experience long dry spells and have very low water tables, making it difficult to drill boreholes or maintain reliable water sources.

Water scarcity is one of the biggest issues for farmers in the district, and the officer noted that there are other areas even worse off than Kimengo and Miirya, such as Bwijanga and Kijunjuba. These places should also be considered for inclusion in the water project because they face even more severe water shortages.

The officer explained that high mortality rates among animals, especially calves, are common due to lack of water and poor conditions during the dry season. Even adult animals suffer from stress and dehydration, leading to low milk production.

There is a significant difference in milk prices between the rainy and dry seasons, which clearly shows the impact of water availability. During the rainy season, milk at the farm gate costs about UGX 400 per litter, but in the dry season, it jumps to UGX 800–1,200 at the farm gate, and up to UGX 2,000 in town. These price changes reflect the reduced supply and increased demand during dry periods.

The officer confirmed that farmers, including small-scale and micro farmers, are willing to pay for water if it is made available. However, the cost should be fair and affordable, so that even the smallest farmers can benefit from the project and increase their production capacity.

H. DISTRICT POPULATION OFFICER: MASINDI DISTRICT

The Population Officer for Masindi District provided demographic information relevant to the planning and impact of the proposed water supply and irrigation project. The officer noted that Miirya Sub- County is one of the most densely populated areas in the district. In contrast, Kimengo Sub- County has a very low population density, mainly because it is part of the cattle corridor, where people are more involved in livestock farming and own large tracts of land.

The officer stressed the need for affordable water pricing for both domestic and agricultural use, particularly for low-income families. High water prices could prevent the poor from benefiting from the project, so tariffs should be designed with affordability in mind.

The officer also raised social concerns, pointing out that Masindi District has a high teenage pregnancy rate of 25%, while the wider Bunyoro region reports a rate of 32%. These figures suggest a need for broader development and livelihood interventions that could help address such social challenges through improved access to services and economic opportunities, which a reliable water supply could help support.

MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE PROJECT COMMUNITY CONSULTATION MEETING MINUTES

A. CONSULTATION MEETING HELD AT KIMENGO SUB-COUNTY HQ

1. Project details:

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date of Meeting: 29 November 2024

Venue: Kimengo Sub-County Headquarters

Client: Ministry of Water and Environment

Funder: African Development Bank (AfDB)

Total Participants: 38 (29 males, 9 females)

2. Opening remarks by LC I Chairperson

The meeting commenced with an address from the LC I Chairperson, who welcomed the team and expressed appreciation to the community members for their time and participation. He encouraged the community to provide any relevant information to the project team when requested, emphasising the importance of their input in shaping the project's success.

3. Purpose of the meeting

The meeting aimed to consult the residents of Myeba village (Kimengo Sub-County) about the proposed Masindi Port Bulk Water Transfer and Irrigation Infrastructure project. The engagement sought to introduce the project, clarify its goals, and collect community input regarding expected impacts, concerns, and opportunities.

4. Presentation and project overview by the consultant

The consultancy team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The team explained that the primary goal of the project is to establish a multi-purpose, large-scale water transfer system. This system is expected to provide safe and reliable water for domestic use and irrigation. The project targets four sub-counties: Miirya and Kimengo in Masindi District, and Masindi Port and Kigumba in Kiryandongo District. Within Miirya Sub-County, the villages of Bishenyi, Kitwetwe, and Kinumi have been identified as direct beneficiaries. The consultants emphasised that the feasibility study is being funded through a grant from the African Development Bank (AfDB), with the Ministry of Water and Environment (MWE) leading the implementation process.

In explaining the scope of the feasibility study, the team noted that the assessment includes technical, environmental, and socioeconomic analyses. This includes understanding local land use patterns, current water sources, economic activities such as farming and livestock rearing, environmental conditions, and population demographics. They also outlined the importance of understanding any anticipated challenges or barriers to implementation. The consultants highlighted that community engagement is vital to ensure the project is socially inclusive, environmentally sound, and technically feasible.

An important component discussed was land acquisition. The team acknowledged that implementing such infrastructure projects may result in temporary or permanent land use changes. However, they assured participants that the project design would prioritise the use of existing road reserves and publicly owned land to minimise displacement. Where land take is unavoidable, the government will follow national guidelines for compensation, ensuring all affected persons are treated fairly.

The consultants also elaborated on the potential benefits of the project, including improved access to clean water, enhanced agricultural productivity, job creation, and economic

development. They emphasised the project's long-term sustainability by incorporating gender equality, community ownership, and consideration for local institutions such as schools and health facilities.

5. Discussion and concerns

Male participant: Consider the water project for community consumption rather than the previous power line initiative, primarily focusing on a few locations and large companies.

Response: The Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project aims to provide water for production and domestic use for both commercial and subsistence farmers.

Male participant: Why do you come to us when you are majorly considering big companies/farms? How should we access water?

Response: The project aims to provide water for both production and domestic use for commercial and subsistence farmers. Since the community is the project's primary target and consumer, it is essential to understand your concerns, as well as the socioeconomic conditions and general environment of the project area. This understanding will enable effective planning, implementation, and operation.

Regarding water accessibility, the government plans to extract water from the Nile River while adhering to all quality standards and procedures. A water management system will be established, and/or an existing entity, such as the National Water and Sewerage Corporation, will be responsible for managing the project after construction. Consequently, water accessibility will be provided through this service provider.

Male participant: What will happen to the people whose properties, such as land, houses, and crops, will be affected during project construction?

Response: The project will prioritise minimising damage to crops and trees. The surveyors and planners will aim to align the project within the road reserve as much as possible. However, in cases where this is unavoidable, especially concerning the main transmission line and areas requiring significant land acquisition, such as the locations for the treatment unit and main

reservoir tanks, the government will provide compensation following the national compensation guidelines.

Male Participant: Will the project provide jobs to the community? Will the jobs be for skilled people or even for unskilled people?

Response: If the proposed project receives all necessary approvals and secures funding for construction along with a contractor to carry out the construction phase, the contractor will be encouraged to prioritise local content. This includes providing job opportunities for community members, both skilled and unskilled, in positions that suit their qualifications. Additionally, the contractor will be advised to take gender considerations into account during the recruitment process, ensuring that women also benefit from these job opportunities.

Female participant: Will we women have the opportunity to get jobs on the project? When is the project starting?

Response: If the proposed project obtains all necessary approvals and secures funding for construction, along with hiring a contractor to manage the construction phase, the contractor will be encouraged to focus on utilizing local resources. This means providing job opportunities for community members, both skilled and unskilled, based on their qualifications. Furthermore, the contractor will be advised to take gender into consideration during the hiring process to ensure that women also have access to these job opportunities. The commencement of the project will depend on the approval process and available funding; however, a consultant is currently in the process of conducting feasibility studies.

Female participant: What are the payment procedures for water access and bills? How much will be required for the water bills?

Response: The water service provider will offer clear guidance regarding payment procedures. Water bills are based on the amount of water consumed. The service provider will inform customers of the unit cost rate at the appropriate time after construction and handover for operationalisation. Please note that these rates may change over time.

Female participant: Are you bringing us hard water?

Response: The project will strictly adhere to all quality standards and procedures to ensure the quality of water. A processing unit is proposed to be established in Kitukuza Parish in Masindi Port Sub County, where water will be treated to meet the needs of both human and animal consumption. All national and World Health Organisation (WHO) standards will be followed. As a result, this project will provide safe water suitable for all purposes, including production and domestic use.

6. Summary of Community Feedback

Topic	Feedback Summary
Project Focus	Community members expressed a desire for the project to prioritise their needs over large companies.
Water Accessibility	Concerns about equitable access to water for all community members.
Property Impact	Questions regarding compensation for affected properties during construction.
Employment Opportunities	Interest in job opportunities for both skilled and unskilled labour, with emphasis on gender inclusivity.
Project Timeline	Inquiries about the project's commencement and duration.
Payment Procedures	Questions about water billing procedures and costs.
Water Quality	Concerns about the quality of water to be supplied.

7. Closeting remarks by LC III Chairperson

The meeting concluded with a call from the Sub-County Chairperson for the community to fully support and welcome the project. He urged the government to expedite the project's approval and implementation processes. The community expressed readiness to utilise the water once available and indicated their capacity to afford the water bills, although they requested government assistance in subsidising the rates to ensure broader access to clean water.

B. MYEBA – MYEBA PARISH CONSULTATION MEETING MINUTES – KIMENGO SUB COUNTY

8. Meeting details

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date of Meeting: 30th November, 2024

Venue: Along Myeba Road, Kimengo Sub-County

Client: Ministry of Water and Environment (MWE), Uganda

Funder: African Development Bank (AfDB)

Participants: [37 Total] (29 Male and 8 Female from Myeba village)

Beneficiaries: Myeba Village, Kimengo Sub-County, Masindi District

9. Purpose of the Meeting

The meeting aimed to consult the residents of Myeba village, particularly those living along the road from Myeba to Masindi Port, about the proposed Masindi Port Bulk Water Transfer and Irrigation Infrastructure project. The engagement sought to introduce the project, clarify its goals, and collect community input regarding expected impacts, concerns, and opportunities.

10. Opening Session

The LCI Vice Chairperson welcomed the community and highlighted the purpose of the meeting—to prepare for a feasibility study aimed at improving access to clean water for domestic use and reliable water for agricultural production (irrigation). He encouraged community participation to ensure local needs are considered.

11. Project Presentation by Consultant team

The consultant team provided an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure project. They explained that the project aims to deliver a reliable and multi-purpose water transfer system serving four sub-counties: Kimengo and Miirya in Masindi District, and Masindi Port and Kigumba in Kiryandongo District.

The core objective of the project is to provide bulk water for irrigation and domestic use in rural communities. The project will benefit smallholder and commercial farmers alike by providing consistent water access, especially during dry seasons, and will boost agricultural productivity, food security, and rural livelihoods.

It was noted that the feasibility study is funded by a grant from the African Development Bank, while the Ministry of Water and Environment is leading efforts to secure funding for full project

implementation. The consultant emphasized the importance of engaging the community early to ensure the design reflects local needs, priorities, and environmental and social considerations.

The team also explained that issues such as land acquisition, compensation, employment opportunities, affordability of water services, and gender inclusion are being assessed as part of the feasibility study.

12. Community Questions and Consultant Responses

During the discussion session, the following questions and concerns were raised by community members:

Male Participant: Water scarcity is a big problem in our village. We welcome this project. When is the construction starting?

Response: The consultant team thanked the participant for the warm reception and explained that the current phase is the feasibility study. Once the study is completed and approved, the Ministry of Water and Environment will work on securing implementation funding. If all progresses well, construction could begin in the near future, but a specific start date will be communicated after final approvals and procurement processes.

Male Participant: Will people with small farms be allowed to use water from the project, or will it be limited to large commercial farms?

Response: The project is designed to benefit both smallholder and commercial farmers. The consultant assured the community that equitable access is a core principle of the project, and distribution mechanisms will be put in place to allow even small-scale farmers to access water for production.

Male Participant: What will happen to people whose property—land, houses, or crops—is affected during construction?

Response: The consultant assured the community that in any cases where land, crops, or property are affected by the project, compensation will be provided following Uganda's national compensation guidelines. Detailed assessments will be done to ensure fairness and transparency.

Male Participant: Will the project provide jobs for the local community? Will these jobs be available for both skilled and unskilled workers?

Response: Yes, the project will offer employment opportunities. Both skilled and unskilled labor will be needed, and priority will be given to local residents during recruitment for construction and related activities.

Female Participant: Will women also have the opportunity to be employed under this project?

Response: Absolutely. The project is committed to promoting gender inclusion. Women will be encouraged and supported to take part in both skilled and unskilled roles, including administrative, construction support, and community mobilization activities.

Female Participant: When exactly is the project starting?

Response: As previously noted, the project is still in the feasibility study stage. Once the study is completed, approved, and funding secured, the implementation phase will begin. The Ministry will communicate exact timelines when confirmed.

Female Participant: How will we be paying for water? What procedures will be followed and how much will we pay?

Response: The exact tariffs and payment procedures will be developed by the Ministry of Water and Environment in consultation with communities. The aim is to ensure affordability. Likely, households will have metered access and payment will be based on consumption, but arrangements for communal access points may also be considered for low-income users.

Female Participant: We are concerned about water quality. Are you bringing us hard water?

Response: The consultants clarified that water quality is a top priority. The project will include water treatment facilities to ensure the water meets national standards for domestic use. The issue of hardness will be addressed in the treatment process to ensure the water is safe and suitable for all household uses.

13. Summary of Community Feedback

Feedback Area	Community Feedback
General Support for Project	The community expressed strong support for the project, particularly due to persistent water scarcity in the area.
Project Timeline	Many residents asked about when construction would begin, eager for improvements to water access.
Equity in Access	Residents emphasized the importance of including smallholder farmers in the distribution of water for production.
Compensation for Affected Persons	Concerns were raised about how people whose land or property is affected would be compensated, seeking fairness and transparency.
Employment Opportunities	Community members asked whether the project would provide local jobs for both skilled and unskilled individuals.
Gender Inclusion	Women expressed interest in employment opportunities and requested assurance of inclusion.

Affordability and Payment Mechanisms	Participants were concerned about how much they would pay for water and how payments would be managed.
Water Quality	Some community members expressed concern about whether the supplied water would be hard, and requested assurance of quality treatment.

14. Next Steps

Completion of the feasibility study and submission to the Ministry of Water and Environment.

Community feedback to be incorporated into the design and planning.

Further consultations to be conducted as the project moves toward implementation

C. KINUMI VILLAGE COMMUNITY CONSULTATION MEETING MINUTES – MIIRYA SUB COUNTY

1. Project details:

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date of Meeting: 6th December 2024

Venue: Kinumi Centre, Miirya Sub-County, Masindi District

Client: Ministry of Water and Environment

Funder: African Development Bank (AfDB)

Total Participants: 27 (22 males, 5 females)

2. Meeting Objectives

The primary objectives of the consultation meeting were to inform the residents of Kinumi Village about the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project, gather community feedback, and address any concerns. This engagement aligns with the Ministry of Water and Environment's commitment to ensuring that all environmental and social safeguards are adequately addressed, as outlined in the Environmental and Social Safeguards (ESS) Policy.

3. Opening Remarks

The meeting commenced with a welcome address from the area (LCI Chairman), who expressed gratitude to the consulting team for their presence and acknowledged the importance of the project for the community. He emphasised the need for improved water services in the area and encouraged active participation from all attendees.

4. Consultant's Presentation

The consultancy team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The team explained that the primary goal of the project is to establish a multi-purpose, large-scale water transfer system. This system is expected to provide safe and reliable water for domestic use and irrigation. The project targets four sub-counties: Miirya and Kimengo in Masindi District, and Masindi Port and Kigumba in Kiryandongo District. Within Miirya Sub-County, the villages of Bishenyi, Kitwetwe, and Kinumi have been identified as direct beneficiaries for the first phase. The consultants emphasised that the feasibility study is being funded through a grant from the African Development Bank (AfDB), with the Ministry of Water and Environment (MWE) leading the implementation process.

In explaining the scope of the feasibility study, the team noted that the assessment includes technical, environmental, and socioeconomic analyses. This includes understanding local land use patterns, current water sources, economic activities such as farming and livestock rearing, environmental conditions, and population demographics. They also outlined the importance of understanding any anticipated challenges or barriers to implementation. The consultants highlighted that community engagement is vital to ensure the project is socially inclusive, environmentally sound, and technically feasible.

An important component discussed was land acquisition. The team acknowledged that implementing such infrastructure projects may result in temporary or permanent land use changes. However, they assured participants that the project design would prioritise the use of existing road reserves and publicly owned land to minimise displacement. Where land take is unavoidable, the government will follow national guidelines for compensation, ensuring all affected persons are treated fairly.

The consultants also elaborated on the potential benefits of the project, including improved access to clean water, enhanced agricultural productivity, job creation, and economic development. They emphasised the project's long-term sustainability by incorporating gender equality, community ownership, and consideration for local institutions such as schools and health facilities.

5. Community Questions and Concerns

During the open forum, several questions and concerns were raised by the community members:

Male Participant: How do we know that you're coming from the Ministry of Water and Environment?

Response: The consultants provided identification and explained their affiliation with the Ministry, assuring the community of their legitimacy.

Female Participant: What is the time frame for the water supply to reach our area?

Response: The consultants outlined the project timeline, indicating that the water supply would be extended to Kinumi Village within the project's implementation phase.

Male Participant: If I am far from the proposed pipeline route, how will I access water?

Response: The consultants explained that the project includes provisions for extending water access to areas not directly on the pipeline route, ensuring broader community coverage.

Male Participant: Where is your office located?

Response: The consultants provided the location of their office and contact details, encouraging community members to reach out with any further questions or concerns.

Male Participant: Some people came to this village promising to provide agricultural products and services, but disappeared. How can we trust this project?

Response: The consultants acknowledged past experiences and emphasised the project's backing by the Ministry of Water and Environment and the African Development Bank, assuring the community of its credibility and commitment.

Female Participant: Will compensation be provided for any damaged crops during the project's implementation?

Response: The consultants confirmed that compensation would be provided for any affected crops, in line with national policies and the project's Environmental and Social Management Framework.

Female Participant: Can we access water for irrigation purposes?

Response: The consultants assured that the project includes provisions for irrigation, aiming to support agricultural activities in the community.

Female Participant: We request the government to provide a grace period before the project commences.

Response: The consultants acknowledged the request and assured the community that the project timeline would consider such concerns.

6. Summary of Community Feedback

Topic	Feedback Summary
Project Legitimacy	Community members sought assurance of the consultants' affiliation with the Ministry.
Project Timeline	Inquiries about the time frame for water supply to reach the area.

Water Access	Concerns about accessing water if located far from the pipeline route.
Office Location	Requests for the location and contact details of the consulting team.
Trust in the Project	Skepticism due to past unfulfilled promises by other entities.
Compensation	Questions regarding compensation for damaged crops.
Irrigation Access	Interest in accessing water for irrigation purposes.
Grace Period Request	Request for a grace period before project commencement.

7. Closing Remarks

The meeting concluded with a vote of thanks from the Chairman, who expressed appreciation for the information shared and the opportunity for community engagement. He reiterated the importance of the project for the development of Kinumi Village and encouraged continued collaboration between the community, the Ministry of Water and Environment, and the consulting team to ensure the project's success.

D. KITWETWE VILLAGE COMMUNITY CONSULTATION MEETING MINUTES – MIIRYA SUB COUNTY

1. Project details:

Project Title: Feasibility Study for the Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date of Meeting: 2nd December 2024

Venue: Kitwetwe Village, Miirya Sub-County, Masindi District

Client: Ministry of Water and Environment

Funder: African Development Bank (AfDB)

Total Participants: 98 (46 males, 52 females)

2. Purpose of the Meeting

The purpose of the consultation meeting was to inform the community of Kitwetwe Village about the proposed Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The meeting served as a platform for dialogue, where the project team presented an overview of the feasibility study and collected input from the local population to shape the project's design in line with community needs and expectations.

3. Opening Remarks

The LCI Chairman opened the meeting by welcoming the consulting team and expressing appreciation to the Government of Uganda and the Ministry of Water and Environment for initiating the project. He emphasised the community's need for a sustainable water supply and encouraged full participation and honest engagement.

Following this, the SAS (Sub-Chief) addressed the gathering. He noted that the proposed project would bring benefits to the local population through improved water access for domestic use and agriculture. He called on community members to support the project and to take ownership of its outcomes for long-term sustainability.

4. Consultant's Presentation

The team presented an overview of the project, explaining that it is a government-led initiative funded by the African Development Bank (AfDB). The primary objective is to establish a multi-purpose water transfer system that will supply piped water for domestic use and irrigation across four sub-counties in Masindi and Kiryandongo districts.

The consultants emphasised that the project is being conducted in compliance with both Uganda's national regulations and the Environmental and Social (E&S) Safeguards of the AfDB. These standards require the project to:

Conduct a comprehensive Environmental and Social Impact Assessment (ESIA) to identify and mitigate potential impacts.

Promote gender equality and social inclusion, ensuring women and vulnerable groups benefit equally.

Follow national land acquisition and compensation laws in cases where private property is affected.

Ensure labour standards, including fair recruitment, protection against child labour, and ethical conduct of contractors.

Maintain community engagement through continuous dialogue, feedback mechanisms, and grievance redress systems.

The team also clarified that the feasibility study includes gathering information about land use, water needs, population trends, and environmental concerns to guide proper planning. They highlighted that while the government aims to use public land (especially road reserves), in cases where private assets are affected, compensation will be guided by Uganda's laws and AfDB's involuntary resettlement policy.

5. Community Questions and Consultant Responses

Male Participant: Will the project provide jobs for casual workers in our community?

Response: Yes, the project will create temporary and long-term employment opportunities, including for unskilled labour. Priority will be given to local residents.

Female Participant: What if the pipeline goes through my house? Will I be compensated?

Response: If any part of your home or structure is affected, compensation will be provided according to Uganda's national resettlement and compensation policy and AfDB safeguards.

Male Participant: Will we be getting water from existing wells, or will there be new piped water?
Response: The project is designed to supply treated piped water from the Nile River, not from existing wells.

Male Participant: How will we be charged for the water – is it based on quantity or a flat fee?

Response: Water usage will be metered and billed based on the amount consumed. The Ministry will ensure affordability for rural users.

Male Participant: Will we be paying monthly for water?

Response: Billing schedules (e.g., monthly or bi-monthly) will be determined during implementation. Prepaid options may also be considered.

Female Participant: Will every household have a tap installed at the door?

Response: The project may include individual household connections (bring the service line near to households) and/or communal water points. The final design will depend on affordability and community preference.

Female Participant: If the pipe passes through my latrine area, what happens?

Response: If any sanitation facility is affected, it will be either protected or relocated, and compensation will be provided.

Female Participant: Is this a government project or a private one?

Response: It is a government project, fully owned and managed by the Government of Uganda through the Ministry of Water and Environment, with funding from the AfDB.

Male Participant: How deep will the trench be for laying the pipeline?

Response: The pipeline trench will typically be dug between 1 to 1.5 meters deep, depending on terrain and safety standards.

6. Summary of Community Feedback

Issue/Concern	Community Feedback

Job Opportunities	Strong support for hiring local workers for both skilled and unskilled roles.
Compensation	The community wants assurance of compensation for any affected houses, crops, or latrines.
Water Access	Preference for piped water; questions on whether connections will be individual or communal.
Tariff and Billing	Concerns about how water usage will be billed and the affordability of tariffs.
Project Ownership	Clarification requested on whether it's a public or private initiative.
Trench Construction	Questions on depth and implications for land and property.

E. CONSULTATION MEETING AT BISENYI VILLAGE – KIGULYA PARISH – MIIRYA SUB COUNTY

1. Meeting Details

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date of Meeting: 2nd December, 2024

Venue: Bishenyi Village, Kiguulya Parish, Miirya Sub-County, Masindi District

Client: Ministry of Water and Environment (MWE), Uganda

Funder: African Development Bank (AfDB)

Participants: 50 (33 males, 17 females)

Beneficiaries: Miirya & Kimengo (Masindi District); Masindi Port & Kigumba (Kiryandongo District)

2. Purpose of the Meeting

The consultation meeting was organised to engage community members in Bishenyi Village on the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project. This session formed part of the feasibility study, which aims to determine the viability of establishing a large-scale water transfer system to support both irrigation and domestic water needs across selected sub-counties in Masindi and Kiryandongo Districts. The meeting sought to raise awareness about

the project, gather critical community insights, and ensure that the voices of local stakeholders are captured early in the project planning process.

3. Opening Session

The meeting began with a prayer offered voluntarily by a female community member. This was followed by a welcome and introduction session facilitated by the LCI Chairperson. He introduced the consultancy team, the Sub-County Chief, and the Parish Councillor. Because the community members knew one another well, individual self-introductions were deemed unnecessary.

In their opening remarks, the LCI Chairman and the Parish Councillor expressed appreciation for the government's initiative, noting that the proposed water infrastructure would greatly benefit the area. They encouraged the community to cooperate fully with the consultants and to share accurate and useful information. The Sub-County Chief also emphasised the importance of water infrastructure to local development and called upon the residents to prepare themselves socially and economically for the opportunities the project may bring.

4. Project Presentation by Consultant

The consultancy team from presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The team explained that the primary goal of the project is to establish a multi-purpose, large-scale water transfer system. This system is expected to provide safe and reliable water for domestic use and irrigation. The project targets four sub-counties: Miirya and Kimengo in Masindi District, and Masindi Port and Kigumba in Kiryandongo District. Within Miirya Sub-County, the villages of Bishenyi, Kitwetwe, and Kinumi have been identified as direct beneficiaries. The consultants emphasised that the feasibility study is being funded through a grant from the African Development Bank (AfDB), with the Ministry of Water and Environment (MWE) leading the implementation process.

In explaining the scope of the feasibility study, the team noted that the assessment includes technical, environmental, and socioeconomic analyses. This includes understanding local land use patterns, current water sources, economic activities such as farming and livestock rearing, environmental conditions, and population demographics. They also outlined the importance of understanding any anticipated challenges or barriers to implementation. The consultants highlighted that community engagement is vital to ensure the project is socially inclusive, environmentally sound, and technically feasible.

An important component discussed was land acquisition. The team acknowledged that implementing such infrastructure projects may result in temporary or permanent land use changes. However, they assured participants that the project design would prioritise the use of existing road reserves and publicly owned land to minimise displacement. Where land take is

unavoidable, the government will follow national guidelines for compensation, ensuring all affected persons are treated fairly.

The consultants also elaborated on the potential benefits of the project, including improved access to clean water, enhanced agricultural productivity, job creation, and economic development. They emphasised the project's long-term sustainability by incorporating gender equality, community ownership, and consideration for local institutions such as schools and health facilities.

5. Community Questions and Consultant Responses

Following the presentation, several community members raised concerns and inquiries, which were addressed by the consulting team. These interactions are summarised below:

Male (Representative from Birch Investment Ltd): As a sugar plantation with more than 12,000 workers, will our company be considered in the water supply design?

***Response*:** The consulting team confirmed that commercial enterprises such as Birch Investment Ltd would be considered during the stakeholder engagement and infrastructure planning phase. The project seeks to serve both community and industrial water needs, as long as resource availability and sustainability are maintained.

Male Participant: How much will it cost for my household to be connected to this new water system?
Response: The consultants explained that connection fees and tariffs will be developed in alignment with national rural water pricing guidelines. These rates will be set with sensitivity to household income levels to ensure affordability and access for all, particularly vulnerable populations.

Male Participant: What will happen if the construction affects my crops or land? Will I receive compensation?
Response: Yes. Any loss of land, crops, or property resulting from project construction will be compensated following Uganda's laws and compensation framework. Detailed asset valuation will be conducted before any construction activity, and affected persons will be duly informed and compensated.

Male Youth Participant: Can we use the water from this project to start fish pond projects in our area?

Response: The consulting team acknowledged aquaculture as a potential secondary benefit of the project. If environmental impact assessments indicate that such use will not affect the sustainability of water supply or interfere with priority uses, community-based fish farming could be promoted as a livelihood enhancement initiative.

Female Participant: Will individuals be allowed to sell water from this project to earn income?
Response: Yes, under regulated circumstances. Water vending may be supported where direct connections are not available. Local water user committees will oversee such activities to ensure fair pricing and protect community interests.

Male Participant: Will people who do not have latrines be allowed to access water from this project?
Response: Yes. Access to water will not be denied based on sanitation conditions. However, the consultants stressed that the project will promote hygiene education and sanitation improvements alongside water provision to encourage healthier practices.

6. Summary of Community Feedback

Feedback Area	**Community Feedback**
General Support	The community expressed strong enthusiasm for the project, recognising its potential to improve local livelihoods, water access, and agricultural productivity.
Commercial Engagement	Local businesses, including Birch Investment Ltd, expressed a desire to participate in the water supply design and benefit from the water infrastructure.
Land and Compensation Concerns	Participants raised concerns about the potential impact of construction on their land and crops, with requests for fair compensation in case of displacement or land take.
Livelihood Opportunities	Community members are interested in diversifying their livelihoods through activities such as fish farming and water vending as part of the project's economic benefits.
Water Accessibility and Affordability	The community emphasised the need for affordable and accessible water services, especially for low-income households and those without access to sanitation facilities.
Gender Inclusion	Female participants highlighted the importance of ensuring equal access to the water project and expressed interest in roles such as water vending or small-scale farming.
Sanitation Needs	There was concern regarding access to water for those without latrines, but the community appreciated the project's commitment to hygiene and sanitation improvements.

7. Closing Remarks

The Sub-County Chief concluded the meeting by thanking the consulting team and the residents for their constructive engagement. He reiterated the importance of community readiness and support in ensuring the success of government-led development programs. He encouraged the residents to remain informed, organised, and cooperative as the project progresses toward its implementation phase.

8. Next Steps

The consulting team will proceed with site-specific technical assessments, community profiling, and environmental evaluations. Feedback gathered from this consultation will directly inform the feasibility report. Additional community engagements and validations will be held during the environmental and social impact assessment (ESIA) phase.

F. WAIBANGO PARISH COMMUNITY CONSULTATION MEETING MINUTES – MASINDI PORT SUB COUNTY

1. Project details

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date: 4th December 2024

Venue: Masindi Port Sub-County Headquarters

Client: Ministry of Water and Environment

Funder: African Development Bank (AfDB)

Participants: 33 (16 males, 17 females)

2. Introduction and Purpose of the Meeting

This community consultation meeting was held to engage residents of Waibango Parish in the ongoing feasibility study for the Masindi Port Bulk Water Supply and Irrigation Infrastructure project. The purpose of the meeting was to inform the community about the project objectives, collect their views, and address any concerns they might have. This consultation is part of a broader stakeholder engagement process that ensures local communities are actively involved from the planning stage through implementation.

3. Opening Remarks

The Sub-County Chief opened the meeting by welcoming the consulting team and the community. He thanked the Ministry of Water and Environment and expressed gratitude for bringing such a

development project to the area. He informed participants that many people in Waibango Parish depend on small dams and rainwater for water, which are often unreliable, especially during dry seasons. He urged the community to embrace the project, emphasising that infrastructure placed along road reserves does not warrant compensation, as such land is considered government property.

4. Consultant's Presentation

The consulting team gave an overview of the proposed bulk water transfer and irrigation infrastructure project. The team explained that the project is part of the Ugandan government's efforts to address water scarcity in rural areas and promote agricultural productivity. The project will extract water from the Nile River, treat it, and distribute it through a piped system for domestic and productive use in four sub-counties: Masindi Port and Kigumba in Kiryandongo District, and Kimengo and Miirya in Masindi District.

The consultant's team highlighted that the project is being implemented in accordance with both Uganda's national policies (standards) and the Environmental and Social (E&S) Standards of the African Development Bank. These standards require comprehensive Environmental and Social Impact Assessments (ESIAs), clear stakeholder engagement processes, and attention to gender and social inclusion, particularly ensuring that women, youth, and vulnerable groups benefit equally from the project.

In line with AfDB's E&S standards, the team committed to minimising involuntary resettlement by using road reserves as much as possible. Where land acquisition is unavoidable, compensation will follow national guidelines. The consultants also emphasised the project's focus on sustainable water use, affordable service delivery, and local employment opportunities, including both skilled and unskilled labour.

5. Community Questions, Concerns, and Responses

During the open forum, several concerns were raised, especially regarding past infrastructure projects like the Karuma–Kawanda high-voltage transmission line, which reportedly excluded local residents from employment opportunities. Below are the key concerns raised:

Chairman, Kitaleba (Male): He welcomed the project and acknowledged that most of the land along the road reserves belongs to the government, encouraging the community to cooperate. Response: The consultants agreed, noting that the project would prioritise government land to minimise displacement.

LC III Chairman (Male): He asked for clarification on the width of the road reserve that the project intends to use.

Response: It was explained that road reserves generally range from 15 to 30 meters, depending on road classification. Detailed technical assessments will guide the final routing.

Male Participant: He expressed frustration that past projects like Karuma–Kawanda and the Masindi Port Road did not hire local workers and asked if this project would be any different.
Response: The consultants assured that local labour, both skilled and unskilled, will be prioritised during the project construction and maintenance phases.

Male Participant: He raised concerns over abusive behaviour from some workers in previous projects.
Response: The consulting team emphasised that all workers will be required to follow strict codes of conduct as part of the project's labour and social safeguards. A grievance mechanism will be established for the community to report misconduct.

Male Participant: He requested the inclusion of Corporate Social Responsibility (CSR) activities such as water kiosks or support to local schools and health centres.
Response: The team confirmed that CSR measures will be considered, depending on needs and resources during implementation.

Male Participant: He expressed concern about high water bills.

Response: The Ministry of Water and Environment will regulate tariffs to ensure affordability. Options such as communal taps may be implemented to increase access for low-income households.

Male Participant: He warned against potential social issues arising from external workers, especially concerning child safety and gender-based exploitation.
Response: The consultant responded that contractors will be briefed on child protection policies, and workers found violating them will be held accountable. Sensitisation programs will also be conducted in the community.

6. Summary of Community Feedback

Topic	Feedback Summary
Employment	The community asked for fair employment opportunities, citing exclusion in past projects.
Social Behaviour	The community demanded strict behavioural conduct among project workers.
CSR Contributions	Requests were made for CSR interventions such as community water points or schools.
Water Affordability	Residents emphasised the need for affordable tariffs and installation costs.

Land and Road Reserve Use	The community acknowledged road reserves as public land but wanted clarity on width.
Child Protection & Social Safety	Concern was raised over exploitation risks from external workers.
Engagement	Residents requested ongoing updates through regular meetings.

7. Closing Remarks

In his closing remarks, the LC III Chairman thanked the consulting team for involving the community from the beginning. He noted that people in Waibango had long awaited such a water project and were pleased to finally see progress. He cautioned contractors against overlooking community leaders and advised that local concerns must be fully addressed. He acknowledged the fears raised from past project experiences and encouraged the project implementers to ensure transparency, accountability, and community benefit.

He concluded by encouraging the government and the community to maintain regular engagement and warned that no individual should be allowed to sabotage the project. He expressed confidence in the community's willingness to cooperate throughout all phases of the project.

8. Next Steps

Finalise community input for incorporation into the feasibility study.

Begin technical and environmental assessments.

Continue consultations during the ESIA process.

Establish community liaison systems for regular updates and grievance redress.

G. KADUKU – MASINDI PORT COMMUNITY CONSULTATION MEETING MINUTES – MASINDI PORT SUB COUNTY

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

1. Date of Meeting: 4th December, 2024

Venue: Kaduku II, Masindi Port

Client: Ministry of Water and Environment (MWE), Uganda

Funder: African Development Bank (AfDB)

Participants: 66 (42 males, 24 females)

Beneficiaries: Kaduku II (Masindi District)

2. Purpose of the Meeting

The purpose of the meeting was to engage with the community in Kaduku Parish (Kaduku I, and Kaduku II) regarding the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure project. The objective was to gather feedback, raise awareness, and address concerns from the community about the potential impacts and benefits of the project.

3. Opening Session

The meeting began with a warm welcome from the LC I Chairperson, who introduced the consulting team to the community. The LC I Chairperson also thanked the attendees for taking the time to participate in the meeting.

The opening remarks were given by the Kaduku Parish Chief, who represented the Sub-County Chief. The Parish Chief emphasized the importance of the water supply project for Kaduku II and surrounding villages, stressing that the community's participation and feedback were crucial for the success of the project. He encouraged the community to express any concerns or suggestions during the meeting.

4. Project Presentation by the consultant

The consultancy team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The team explained that the primary goal of the project is to establish a multi-purpose, large-scale water transfer system. This system is expected to provide safe and reliable water for domestic use and irrigation. The project targets four sub-counties Miirya and Kimengo in Masindi District, and Masindi Port and Kigumba in Kiryandongo District. Within Miirya Sub-County, the villages of Bishenyi, Kitwetwe, and Kinumi have been identified as direct beneficiaries. The consultants emphasized that the feasibility study is being funded through a grant from the African Development Bank (AfDB), with the Ministry of Water and Environment (MWE) leading the implementation process.

In explaining the scope of the feasibility study, the team noted that the assessment includes technical, environmental, and socioeconomic analyses. This includes understanding local land use patterns, current water sources, economic activities such as farming and livestock rearing, environmental conditions, and population demographics. They also outlined the importance of understanding any anticipated challenges or barriers to implementation. The consultants highlighted that community engagement is vital to ensure the project is socially inclusive, environmentally sound, and technically feasible.

An important component discussed was land acquisition. The team acknowledged that implementing such infrastructure projects may result in temporary or permanent land use

changes. However, they assured participants that the project design will prioritize the use of existing road reserves and publicly owned land to minimize displacement. Where land take is unavoidable, the government will follow national guidelines for compensation, ensuring all affected persons are treated fairly.

The consultants also elaborated on the potential benefits of the project, including improved access to clean water, enhanced agricultural productivity, job creation, and economic development. They emphasized the project's long-term sustainability by incorporating gender equality, community ownership, and consideration for local institutions such as schools and health facilities.

5. Community Questions and Consultant Responses

During the consultation, several community members raised important questions and concerns. Below are the main questions and the consultants' responses:

Male Participant: How deep will you excavate and bury the water pipeline? Will we be allowed to cultivate and grow crops on top?

Response: The consultants explained that the pipelines will be buried at a depth that ensures their protection from damage. In general, it will be safe for the community to cultivate crops on top of the pipelines, provided the soil structure is not disturbed. However, the final decisions on land use along the pipeline route will be made in consultation with landowners.

Male Participant: Will the government extend the water supply to our village, Kaduku II?

Response: Yes, the project plans to extend the water supply to Kaduku II, along with other villages in the surrounding areas. Details of the water access points and coverage will be clarified in the final project design.

Male Participant: Will the project provide jobs to the community? Will the jobs be for skilled people or even for unskilled people?

Response: The consultants confirmed that the project will create both skilled and unskilled employment opportunities. Local labor will be prioritized for tasks such as construction, maintenance, and other project-related work. Job details will be made available in the implementation phase.

Male Participant: We request that the government regulate and subsidize the water bill rates and installation fees to encourage the entire community to utilize the proposed project.

Response: The consultants acknowledged the importance of affordable water access and assured the community that the Ministry of Water and Environment (MWE) is working on a tariff structure that will make water affordable for all households, including low-income families.

Female Participant: We are concerned about the high-water bills and installation fees. Response: The consultants assured the community that the fee structure would be designed to be affordable and equitable. Consideration would be given to the needs of low-income households and renters, ensuring that water access remains financially accessible to all.

Female Participant: During the dry season, which lasts from December to February, accessing water becomes difficult. Are there any arrangements that allow tenants to install piped water in rented houses or to have separate water meters?

Response: The consultants explained that the project would help address water scarcity by increasing the supply and capacity of the water system. Regarding renters, the government is considering options for installing individual meters to ensure fair distribution and payment, allowing tenants to access water directly from the system.

Male Participant: There are disparities in the compensation of the PAPs (Project-Affected Persons). What criteria will you use to minimise these inequalities during compensation?

Response: The consultants clarified that the compensation process would follow national guidelines to ensure fairness and transparency. All affected properties will be evaluated based on accurate assessments, and any inequalities will be addressed through a transparent compensation process.

Male participants: In Kaduku, we have piped water managed by NWSC, but accessing it is difficult due to low pressure. What actions will be taken to improve both the quantity and quality of water services in this area?

Response: The consultants acknowledged the low water pressure and explained that the new project would create a more reliable water distribution system. The aim is to improve both the quantity and quality of water supply, ensuring that the community has consistent and adequate water access.

6. Summary of Community Feedback

Feedback Area	Community Feedback
General Support	The community expressed full support for the project, committing to embrace it through all phases: planning, construction, and operation.
Water Supply to Kaduku	The community was pleased to learn that Kaduku will be included in the water supply coverage and appreciated the plan to extend services to the area.

Employment Opportunities	There was interest in the job creation potential of the project, with local residents hoping to access both skilled and unskilled employment.
Cost of Water Services	Concerns were raised about the affordability of water bills and installation fees, with requests for subsidies and regulations to make water accessible to all.
Water Access During Dry Seasons	The community emphasized the difficulty of accessing water during the dry season, particularly for renters, and sought assurances that the project would help.
Compensation for Project-Affected Persons (PAPs)	Questions were raised about compensation for displaced persons, with concerns about minimizing disparities during the compensation process.
Water Supply Pressure Issues	Community members expressed frustration with the current low water pressure from the NWSC system and sought improvements in both water quality and supply.

7. Closing Remarks

The LC III Chairperson closed the meeting by thanking the community for their active participation and valuable feedback. He emphasised the importance of continued community involvement throughout the project's planning and implementation stages. He also urged the government to consider extending the project to Kaduku I village, highlighting the need for better water access across the entire sub-county.

8. Next Steps

The consultants will continue with the feasibility study, integrating the feedback gathered from the community into the project design. Further consultations will take place to ensure that all community concerns are addressed before implementation.

H. KITUKUZA PARISH COMMUNITY CONSULTATION MEETING MINUTES – MASINDI PORT SUB COUNTY

1. Project details:

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date of Meeting: 4th December 2024

Venue: Rwempondo Village, Kitukuza Parish

Client: Ministry of Water and Environment (MWE), Uganda

Funder: African Development Bank (AfDB)

Participants: 32 (23 males, 9 females)

Beneficiaries: Kisenyi, Kimyoika, Rwempondo, Kyeria, Kibiran, Kitukuza, and Barkweyo Villages

2. Purpose of the Meeting

The purpose of this community consultation meeting was to inform and engage residents of Kitukuza Parish about the proposed Masindi Port Bulk Water Transfer and Irrigation Infrastructure project. The meeting aimed to provide detailed project information, clarify the community's role in the project, and gather concerns, suggestions, and expectations from residents of the seven villages in Kitukuza Parish.

3. Opening Session

The meeting was held in Rwempondo Village and attended by representatives from all seven villages of Kitukuza Parish. The opening remarks were delivered by local leaders and representatives of the consultant. The consulting team appreciated the community's turnout and emphasised the critical role that local input plays in shaping the feasibility study and ensuring the successful implementation of the project.

4. Project Presentation by the consultant

The consultancy team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The team explained that the primary goal of the project is to establish a multi-purpose, large-scale water transfer system. This system is expected to provide safe and reliable water for domestic use and irrigation. The project targets four sub-counties Miirya and Kimengo in Masindi District, and Masindi Port and Kigumba in Kiryandongo District. Within Miirya Sub-County, the villages of Bishenyi, Kitwetwe, and Kinumi have been identified as direct beneficiaries. The consultants emphasized that the feasibility study is being funded through a grant from the African Development Bank (AfDB), with the Ministry of Water and Environment (MWE) leading the implementation process.

In explaining the scope of the feasibility study, the team noted that the assessment includes technical, environmental, and socioeconomic analyses. This includes understanding local land use patterns, current water sources, economic activities such as farming and livestock rearing, environmental conditions, and population demographics. They also outlined the importance of understanding any anticipated challenges or barriers to implementation. The consultants highlighted that community engagement is vital to ensure the project is socially inclusive, environmentally sound, and technically feasible.

An important component discussed was land acquisition. The team acknowledged that implementing such infrastructure projects may result in temporary or permanent land use changes. However, they assured participants that the project design will prioritize the use of existing road reserves and publicly owned land to minimize displacement. Where land take is unavoidable, the government will follow national guidelines for compensation, ensuring all affected persons are treated fairly.

The consultants also elaborated on the potential benefits of the project, including improved access to clean water, enhanced agricultural productivity, job creation, and economic development. They emphasized the project's long-term sustainability by incorporating gender equality, community ownership, and consideration for local institutions such as schools and health facilities.

5. Community Questions and Consultant Responses

During the interactive session, participants raised the following questions and comments:

Male Participant: How will water installation and billing be managed in our community?

Response: Water services will be metered and priced affordably, with payment structures to be finalised in collaboration with the Ministry of Water and Environment. Community water points may also be set up for shared access in low-income areas.

Male Participant: Based on the information you've shared; I believe everyone here will support this project.

Response: The consulting team thanked the participant for this show of support and reaffirmed their commitment to delivering a sustainable and inclusive water supply system that benefits all community members.

Male Participant: What land size is required to benefit from irrigation water? Will people with small plots also benefit?

Response: Yes, smallholders will benefit. The irrigation component will include provisions for both large and small-scale farmers. Access points will be distributed to support all land sizes.

Male Participant: How will the government benefit from the project? Will residents have to pay for the water they use?

Response: The government benefits by improving livelihoods and increasing agricultural productivity, which boosts local economies. Yes, water use will involve a cost, but it will be kept affordable, and the revenue helps maintain the system.

Male Participant: When will the construction and operation of the project begin? When will we start receiving water?

Response: The project is currently at the feasibility study stage. After this phase, detailed engineering designs will be developed, followed by procurement and construction. The timeline depends on approvals and funding availability. Updates will be shared with the community.

Male Participant: The water is drawn from the Nile, treated at Kitukuza near our health centre, then sent to Kaduku Hill. Why don't you provide a small tank to serve nearby places first, before sending water to Kaduku?

Response: A water tank is indeed proposed near the treatment point in Kitukuza to serve nearby communities, including the sub-county headquarters. Your concern is valid, and the system design will include such provisions.

Female Participant: We're concerned that this is just a trick to say water will go to Kaduku, and not benefit us here in Kitukuza.

Response: The project includes a local distribution tank near Kitukuza Health Centre III, ensuring the surrounding communities are directly served before the water is transmitted to distant areas. Your community is a priority.

Male Participant: My home is far from the road where the pipeline will pass. Will I still be able to access water?

Response: The main transmission lines will follow road reserves, but service lines and secondary distribution lines will be extended to reach households away from the main road. Efforts will be made to include all areas within the parish.

6. Summary of Community Feedback

Feedback Area	Community Feedback Summary
General Support for the Project	Community members, especially men, expressed unanimous support and readiness to participate in the project's implementation.
Water Access for Smallholders	Community sought assurance that those with small land sizes would benefit from the irrigation component, which was confirmed.
Timeline of Implementation	Residents are eager to know when construction will begin and when water services will be operational.
Water Billing and Affordability	Questions were raised regarding installation fees and billing systems. Residents requested a fair and affordable payment system.

Concern Over Water Route	Some residents questioned the logic of pumping water to Kaduku before serving nearby areas. This concern was clarified by the consultants.
Doubt About Benefit to Kitukuza Residents	A few residents expressed skepticism about whether the project would truly benefit their villages. Reassurance was provided.
Request for Inclusive Coverage	Villages far from the main road, such as Kaliro and Kikaito, requested to be included in the project coverage.

7. Closing Remarks

In closing, the LC II Chairperson encouraged residents to welcome the project and treat it as a major opportunity for improving clean and safe water access. He urged them not to worry about property impacts, as efforts would be made to use road reserves, and compensation would be provided where necessary. He also echoed the request to ensure all villages in Kitukuza Parish—including remote ones like Kaliro and Kikaito—are considered in the final project design.

8. Next Steps

Feasibility findings will be compiled and submitted to the Ministry of Water and Environment.

Community feedback will be used to refine the project's design.

Further consultations will be conducted as the project moves into the engineering and implementation phases.

I. WAKISANYI PARISH COMMUNITY CONSULTATION MEETING MINUTES – MASINDI PORT SUB COUNTY

1. Project details:

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Date of Meeting: 5th December 2024

Venue: Nyakalongo/Wakisanyi

Client: Ministry of Water and Environment (MWE), Uganda

Funder: African Development Bank (AfDB)

Participants: 38 (29 Males, 9 Females)

Beneficiaries: Villages of Myeba, Wakisanyi, Katugo, Kemiyambi, and Nyakalongo

2. Purpose of the Meeting

The consultation was held to introduce the proposed Masindi Port Bulk Water Transfer and Irrigation Infrastructure project to residents of Wakisanyi Parish and to obtain community input on the design, implementation, and potential impacts of the project. The engagement aimed to ensure inclusive participation by gathering perspectives from the community, especially regarding water accessibility, compensation concerns, and expectations about the delivery of water services.

3. Opening Session

The meeting took place at Nyakalongo/Wakisanyi and brought together residents from the five villages in the parish. The consulting team introduced the purpose of the feasibility study, shared the project's scope, and emphasized that local participation was essential to ensure the infrastructure addresses actual community needs. Community members were warmly welcomed and encouraged to speak freely.

4. Project Overview by the consultant

The consultants explained that the proposed project, funded by the African Development Bank and implemented by the Ministry of Water and Environment, seeks to construct a large-scale bulk water system to supply both irrigation and domestic water to four sub-counties in Masindi and Kiryandongo Districts. The project is currently in the feasibility stage, with consultations ongoing to gather community insights.

Water will be drawn from the River Nile, treated at a centralized facility, and distributed through a network of main and secondary pipelines. Residents were informed that the system will cater to both household needs and agricultural production. The project includes measures to ensure environmental sustainability, fairness in land acquisition, gender inclusion, and affordability in water access. Where land or crops may be affected during construction, the consultants emphasized that compensation will follow national guidelines.

5. Community Questions and Consultant Responses

The following are the key questions and comments raised by the community during the consultation, along with responses from the consulting team:

Female Participant: I come from Kafu in Kimengo sub-county. Do I have a chance of benefiting from this proposed project?

Response: Yes, Kimengo is one of the sub-counties directly targeted by the project. Kafu and surrounding areas will be considered during the design of service lines and water distribution infrastructure.

Female Participant: Will the government compensate for crops likely to be destroyed during construction?

Response: Yes, any crops or properties affected by the project will be assessed, and fair compensation will be provided according to Uganda's national resettlement and compensation policies.

Male Participant: Will the water bills for this project (water for production) be the same as the water bills from National Water and Sewerage Corporation (NWSC)?

Response: The billing rates for the new system may differ from NWSC rates and will be determined based on affordability and sustainability. Tariffs will be communicated clearly before the system is operational.

Male Participant: What happens if a Project Affected Person (PAP) refuses to vacate land needed for the pipeline?

Response: Every effort will be made to use public land and road reserves. If private land must be acquired, compensation and negotiations will be handled transparently. Refusal to vacate will be resolved in accordance with national procedures involving local leaders and legal guidelines.

Male Participant: Will water for domestic use and water for production be billed at the same rate?

Response: Different uses may attract different tariffs. Typically, water for production (such as irrigation or livestock) is priced differently from domestic use. Specific rates will be announced during implementation.

Male Participant: I have a borehole. Can the Ministry help me upgrade it for better supply?

Response: The current project focuses on bulk water infrastructure, but such individual needs will be documented and shared with the Ministry for potential integration with other rural water programs.

Male Participant: If my neighbor has water access, can I connect from their point?

Response: Yes, water sharing from one connection point to another is allowed, subject to agreement between households. However, it's recommended that each household installs its own meter for accountability and fairness.

Male Participant: When is construction starting?

Response:
The project is currently in the feasibility stage. Once the study is approved, the Ministry will proceed with detailed design, budgeting, and procurement. Construction timelines will be communicated as soon as funding and plans are finalized.

Male Participant: How will water be supplied? Through house taps or boreholes?

Response: The project will supply piped water via a centralized system, with options for household taps, communal points, and potential extensions depending on location. It is different from borehole systems.

Female Participant: Is the water going to be free or do we pay for it?

Response: Water will not be free. Users will pay based on consumption, but the costs will be affordable and regulated by the Ministry of Water and Environment to ensure accessibility.

Female Participant: Will the government supply water to every household?

Response: The goal is to reach as many households as possible, either through direct connections or communal access points. The final coverage will depend on design and available resources.

Male Participant: Can someone get water for both domestic and production use?

Response: Yes, the system is designed to support both uses. Users can apply for service lines that allow for irrigation, livestock, and home use, depending on their needs.

Male Participant: We thank the government for providing us with information at this early stage. Sometimes we only hear about projects when they're nearly complete.

Response: The consulting team appreciated the remark and emphasized that early engagement is essential for a successful, inclusive project.

6. Summary of Community Feedback

Feedback Area	Summary of Community Feedback
General Project Support	Participants appreciated early involvement and welcomed the project as a solution to ongoing water scarcity.
Geographic Coverage	Residents from Kimengo, including Kafu, sought clarity on their inclusion.
Compensation for Affected Property	The community requested fair compensation for crops and land, which the project guarantees under national policy.
Water Billing and Affordability	Questions were raised about billing systems and whether they would align with NWSC rates. Residents stressed the need for affordability.
Access and Distribution Strategy	Participants wanted to know if every household would receive piped water or if communal points would be installed.

Equity of Access and Sharing	Residents asked if neighbours could share water points—this was confirmed as possible.
Gender Inclusion and Employment	Female participants asked about access, fairness, and inclusion, assured by the consultant team.
Borehole Integration	Some requested support for upgrading existing boreholes, a matter to be considered separately by the Ministry.
Project Timeline	The community requested updates on when construction would begin.

7. Closing Remarks

The parish chief, representing the sub-county leadership, gave closing remarks, expressing gratitude to the consulting team for offering clear and detailed information. He also thanked the community members for attending and sharing their views. He urged residents to fully embrace the project as a life-changing opportunity for safe and accessible water. He affirmed the sub-county's commitment to work closely with the Ministry and consultants throughout the process.

8. Next Steps

Finalisation of feasibility study with community feedback integrated.

Detailed engineering designs and implementation plans to follow.

Continued engagement with local leaders and residents.

J. KADUKU COMMUNITY CONSULTATION MEETING REPORT – KIGUMBA SUB COUNTY

1. Project details:

Project Title: Feasibility Study for Masindi Port Bulk Water Supply and Irrigation Infrastructure

Meeting Venue: Kaduku II, Kigumba Sub-County

Meeting Date: 6th December 2024

Client: Ministry of Water and Environment (MWE)

Funder: African Development Bank (AfDB)

Participants: 20 (14 Males, 6 Females)

2. Opening Remarks

The meeting began with welcoming remarks from the Kaduku II LCI Chairperson, who introduced the project team and members of the village leadership. He highlighted that the community faces significant water challenges, including poor access and reliance on unsafe water sources. He noted that many children fetch water before going to school, negatively impacting their academic performance. The LCI appreciated the effort by Excellence Farm, a local agricultural business, in advocating to the government for the extension of water services to the area. The Chairperson emphasised the community's need for water, not only for domestic use but also for agricultural purposes to boost productivity.

3. Consultant's Presentation

The consultancy team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The team explained that the primary goal of the project is to establish a multi-purpose, large-scale water transfer system. This system is expected to provide safe and reliable water for domestic use and irrigation. The project targets four sub-counties: Miirya and Kimengo in Masindi District, and Masindi Port and Kigumba in Kiryandongo District. Within Miirya Sub-County, the villages of Bishenyi, Kitwetwe, and Kinumi have been identified as direct beneficiaries. The consultants emphasised that the feasibility study is being funded through a grant from the African Development Bank (AfDB), with the Ministry of Water and Environment (MWE) leading the implementation process.

In explaining the scope of the feasibility study, the team noted that the assessment includes technical, environmental, and socioeconomic analyses. This includes understanding local land use patterns, current water sources, economic activities such as farming and livestock rearing, environmental conditions, and population demographics. They also outlined the importance of understanding any anticipated challenges or barriers to implementation. The consultants highlighted that community engagement is vital to ensure the project is socially inclusive, environmentally sound, and technically feasible.

An important component discussed was land acquisition. The team acknowledged that implementing such infrastructure projects may result in temporary or permanent land use changes. However, they assured participants that the project design would prioritise the use of existing road reserves and publicly owned land to minimise displacement. Where land take is unavoidable, the government will follow national guidelines for compensation, ensuring all affected persons are treated fairly.

The consultants also elaborated on the potential benefits of the project, including improved access to clean water, enhanced agricultural productivity, job creation, and economic development. They emphasised the project's long-term sustainability by incorporating gender equality, community ownership, and consideration for local institutions such as schools and health facilities.

4. Community Questions and Concerns

VHT Male: This is a dry place. We appreciate the project. It will improve the yields. We are also thankful for government projects like this and for electricity. However, electricity (Umeme) didn't reach my home. I am worried this project might be the same.

Response: The consultants reassured the community that unlike the electricity project, this water supply project is being designed specifically with community inclusion in mind. Public access points such as standpipes or communal taps will be installed to ensure that all residents can benefit, even if they are unable to afford private connections.

Male Participant: Is water for paying?

Response: Yes, the water will be provided as a paid service to support sustainability. However, tariffs will be regulated by the service provider following government policies. Public taps may offer subsidised or lower-cost water access, especially for vulnerable households.

Female Participant: How shall we access water? Some of us cannot afford to install water in our houses. Are there any arrangements? I heard you mentioned public taps.

Response: The consultant confirmed that part of the project plan includes installing public water access points (taps or kiosks) in strategic locations to ensure that even households unable to afford individual connections can access safe and reliable water.

5. Summary of Community Feedback

Issue Raised	Community Feedback/Concern
Access to water	The area is extremely dry; access to clean water is a priority.
Affordability of private connections	Many residents may not afford house connections; they requested public access points.
Payment concerns	The community asked whether the water would be paid for and how fees would be structured.
Skepticism from past experiences	Concerns were raised that past projects (e.g., electricity) did not reach all homes.
Appreciation for the project	The project is welcomed and seen as a timely and necessary intervention for farming and health.

6. Closing Remarks

The meeting ended with words of encouragement from the LCI Chairperson, who urged the community to remain engaged and supportive of the project. He noted that this is a major opportunity to transform water access in Kaduku II. The consultant reiterated the importance of

community input in guiding the planning and implementation phases and committed to continued dialogue with stakeholders.

K. COMMUNITY CONSULTATION - KIGUMBA MEETINGS HELD AT THE SUB-COUNTY HEADQUARTERS

1. Project details

Project Title: Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

Meeting Date: 16 April 2025

Venue: Kigumba Sub-County Headquarters

Facilitators: Ministry of Water and Environment (MWE), [Insert Consultant's Name]

Attendees: 46 (28 males, 18 females)

Represented Parishes: Kigumba I, Buhoomozi, Kiigya, Mpumwe

2. Presentation by the Sub-County Agriculture Officer

The Sub-County Agriculture Officer emphasised the importance of community participation in the project. He urged attendees to provide information on:

- Water Needs: Specific areas requiring water for domestic and agricultural purposes.
- Agricultural Activities: Types of crops and livestock currently being cultivated or raised.
- Group Farming Practices: Existing farmer groups and how they collaborate to support each other.

This information will assist in tailoring the project to meet the community's specific needs and enhance its effectiveness.

3. Consultant's Presentation

The consultancy team presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. The team explained that the primary goal of the project is to establish a multi-purpose, large-scale water transfer system. This system is expected to provide safe and reliable water for domestic use and irrigation. The project targets four sub-counties: Miirya and Kimengo in Masindi District, and Masindi Port and Kigumba in Kiryandongo District. Within Miirya Sub-County, the villages of Bishenyi, Kitwetwe, and Kinumi have been identified as direct beneficiaries. The consultants emphasised that the feasibility study is being funded through a grant from the African Development Bank (AfDB), with the Ministry of Water and Environment (MWE) leading the implementation process.

In explaining the scope of the feasibility study, the team noted that the assessment includes technical, environmental, and socioeconomic analyses. This includes understanding local land use patterns, current water sources, economic activities such as farming and livestock rearing, environmental conditions, and population demographics. They also outlined the importance of understanding any anticipated challenges or barriers to implementation. The consultants highlighted that community engagement is vital to ensure the project is socially inclusive, environmentally sound, and technically feasible.

An important component discussed was land acquisition. The team acknowledged that implementing such infrastructure projects may result in temporary or permanent land use changes. However, they assured participants that the project design would prioritise the use of existing road reserves and publicly owned land to minimise displacement. Where land take is unavoidable, the government will follow national guidelines for compensation, ensuring all affected persons are treated fairly.

The consultants also elaborated on the potential benefits of the project, including improved access to clean water, enhanced agricultural productivity, job creation, and economic development. They emphasised the project's long-term sustainability by incorporating gender equality, community ownership, and consideration for local institutions such as schools and health facilities.

4. Community Concerns and Feedback

Concern: Attendees expressed the need for the water infrastructure to reach all areas within the sub-county, including remote villages.

Response: The project will be implemented in phases due to budget constraints, with the initial focus on high-need areas. Future expansions will aim to cover additional regions.

Concern: Farmers inquired about compensation for any crops, homes, or properties that might be impacted during construction.

Response: Efforts will be made to minimise property destruction by following existing road reserves. Where impacts are unavoidable, compensation will be provided according to national guidelines.

Concern: Participants sought clarity on who would be responsible for maintaining and repairing the water infrastructure.

Response: Funds collected from water bills will be used for the general operation and maintenance of the system. A clear operational framework will be established and shared with the community.

Concern: Farmers requested a reduction in the proposed water tariff from UGX 100,000 to UGX 50,000 per 2.5 acres per season, especially during the initial stages of the project.

Response: This input will be presented in the feasibility report for further scrutiny, discussion, and benchmarking with similar irrigation schemes to determine reasonable tariffs.

Concern: The community expressed urgency regarding the project's commencement due to the adverse effects of prolonged dry spells on their farming activities.

Response: The project is still in the feasibility stage. After the completion of technical studies and approval processes, implementation will follow. The community will be kept informed at every stage through local leadership.

5. Summary of Feedback

The community's feedback highlighted the following key areas:

Equitable Water Access: Ensuring that all areas, including remote villages, have access to the water infrastructure.

Fair Compensation: Providing transparent and fair compensation for any properties affected during construction.

Sustainable Management: Establishing a clear operational framework for the maintenance and management of the water system.

Affordable Tariffs: Setting reasonable water tariffs that consider the economic realities of smallholder farmers.

Timely Implementation: Ensuring that the project commences promptly to address the urgent water scarcity issues.

A. FOCUS GROUP DISCUSSIONS (FGDS) WITH SMALLHOLDER FARMERS

1. Focus Group Discussion – Kaduku I A Coffee Development Group

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

Demographic Information

Item	Details
Group Name	Kaduku I A Coffee Development Group
Village	Kaduku I
Parish	Kaduku
Sub-county	Masindi Port
District	Kiryandongo
Main Activity	Crop farming, especially coffee
Number of participants	9 (5 males, 4 females)
Venue	Kaduku I
Date	18/April/ 2025

Discussion Summary

The Kaduku I A Coffee development Group was very happy about the proposed irrigation project. They shared that their village, Kaduku I, is where the government plans to build the main water reservoir (on Kaduku Hill). Because of this, they believe they should be among the first to receive water services when the project starts. They are proud to host such an important part of the project and see it as a big opportunity for their community.

Farmers in the village have already started growing coffee. Some have even begun harvesting. There are more than three coffee farming groups in the village. In addition to coffee, they also

grow maize, sunflower, soybeans, beans, and plantain. Unlike other villages nearby that keep animals, Kaduku I mostly focuses on crops.

But they face serious challenges with water. Without water, it's hard to keep their crops healthy, especially during dry seasons. They said that with water, their crop yields will improve, and incomes will go up.

They are willing to pay for water, but they asked the government to keep the fees affordable. They suggested paying UGX 50,000 or less for 2.5 acres per season, or UGX 50 for every 50 jerrycans (1 cubic meter).

On gender roles, the group said that men usually own the land and control the harvest. Women do much of the work on the farms but have less say when it comes to money or big decisions.

2. Focus Group Discussion Summary – Twefeho Youth Group

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

Location: Masindi Port Sub-County, Kiryandongo District

FGD Demographics

Attribute	**Details**
Group Name	Twefeho Youth Group
Village	Rwenkunye
Parish	Waibango
Sub-county	Masindi Port
District	Kiryandongo
Number of Participants	4 (4 males)
Venue	Rwenkunye
Date	18/April/ 2025

Discussion Summary

The Twefeho Youth Group highlighted significant challenges in their farming and livestock activities, primarily due to water scarcity and limited irrigation options. The group is actively engaged in both crop cultivation and animal rearing but faces substantial difficulties during prolonged dry seasons. They rely on valley dams for water, but these sources dry up during dry spells, leaving their livestock without water. Additionally, feed for the animals becomes scarce, leading to poor meat and milk production, which adversely affects their income and overall well-being.

While the group has access to land for farming, the dry conditions make it challenging to produce reliable yields. Crops often dry up before harvest, resulting in repeated losses. Some members expressed a desire to grow perishable crops like tomatoes, which have good market value, but the lack of irrigation water limits them to fewer crop choices. Currently, they utilize a solar-powered irrigation system; however, its reliability is compromised during cloudy weather, making it an unreliable solution.

Despite these limitations, the group expressed a willingness to pay for water access if provided through a reliable system. They proposed paying UGX 50,000 per season for every 2.5 acres of land for irrigation and animal use. For domestic water use, they consider UGX 100 per cubic meter affordable, especially compared to the UGX 500 per jerrycan that some currently pay.

Regarding gender roles, the group noted that cattle rearing is predominantly done by men, with fewer women involved, despite their large numbers in the community. However, in matters of decision-making, especially related to finances, planting, and marketing, both men and women participate equally. Decisions like taking loans or choosing what to plant and sell are made jointly within households and the group.

3. Focus Group Discussion Summary – Nyama II Group

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

Location: Nyama II Village, Buhomoozi Parish, Kigumba Sub-County, Kiryandongo District

FGD Demographics

Attribute	Details
Group Name	Nyama II Group
Village	Nyama II
Parish	Buhomoozi
Sub-county	Kigumba
District	Kiryandongo
Number of Participants	6 (4 males, 2 females)
Venue	Nyama II Village
Date	18th April, 2025

Discussion Summary

Participants described farming without sufficient water or rain as extremely difficult. One community member explained that since January, only two instances of rainfall had occurred, leading to widespread crop failure. Because of these conditions, most group members refrain from planting during the first growing season, focusing instead on the second season, which offers slightly better rainfall. During the dry period, they resort to buying food to sustain their families, increasing household expenses.

With the anticipated implementation of the bulk water supply project, participants expressed optimism about the positive changes it could bring. They highlighted that reliable access to water would enable them to grow crops, particularly horticultural produce, throughout the year, boosting food security and increasing income from agriculture. The potential for improved production was seen as one of the most significant benefits of the project.

In terms of willingness to pay, participants stated a preference for government-managed services, arguing that government programs tend to have more affordable rates compared to private operators. There was some variation in acceptable fee levels. One participant proposed a

seasonal charge of UGX 50,000 for 3 acres over three months, stating this would be affordable. Another was willing to pay up to UGX 300,000 for the same area and duration if the service was reliable. Collectively, the group agreed that a flat rate of UGX 150 for 50 jerrycans of water would be acceptable and sustainable for regular agricultural use.

Gender-related issues featured prominently in the discussion. The women explained that they are often more involved in direct agricultural labor than men. They noted that women carry the responsibility of feeding their families and ensuring household food security, while many men are less engaged in farm work. Typically, men access loans, purchase inputs, and attend agricultural trainings. They also control the sale and use of farm proceeds, often making financial decisions without consulting their spouses. One participant recounted how men sometimes sell produce, spend the earnings, and return home with none of the profits. Moreover, decisions about what crops to grow and how money should be spent are often made exclusively by men, reflecting entrenched gender roles and inequalities in household and farming dynamics.

In conclusion, the Nyama II Group voiced strong support for the proposed irrigation infrastructure, seeing it as a vital tool for transforming their agricultural practices and livelihoods. However, they emphasised the need for affordability, community ownership, and gender inclusiveness in the design and implementation of the project.

4. Focus Group Discussion Summary – Kugonza Coffee Growers

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

Demographic Information

Attribute	**Details**
Group Name	Kugonza Coffee Growers
Village	Kaduku III
Parish	Buhoomozi
Sub-county	Kigumba

District	Kiryandongo
Number of participants	7 (4male,3female)
Proximity to Reservoir	2 km from Kaduku Hill (proposed reservoir site)
Venue	Kaduku III
Date	18/April/ 2025

The group shared that Kaduku Hill, where the proposed water reservoir will be constructed, is only about 2 kilometres from their village. Because of this proximity, they strongly hoped that Kugonza coffee group and the entire parish would be among the first to benefit from the project. They expressed that their coffee trees are mature and ready to produce more, but due to the lack of reliable water, yields remain low.

Members noted that it's not just coffee that's affected. Fruit trees, especially mangoes, also suffer during the dry seasons. The trees bear fruit, but the quality and quantity could be much better if water were available for irrigation. They emphasised that with consistent access to water, both their coffee and fruit production would greatly improve, leading to better incomes and food security.

The group explained that most people in the village are engaged in crop farming rather than livestock rearing. In addition to coffee and mangoes, they grow maize, cassava, groundnuts, and beans. However, many of these crops dry up when the rains are delayed or stop entirely. This has made farming unpredictable and sometimes discouraging.

On the issue of payment, the group said they are willing to pay for water if the pricing is affordable. They proposed a rate of UGX 50,000 or less per 2.5 acres per season, or UGX 50 per cubic meter. These rates, they felt, would make water accessible to more farmers without becoming a financial burden.

The discussion also touched on gender roles in farming. Land ownership and control over the harvest and money remain largely in the hands of men. While women are heavily involved in

planting and daily farm work, they often have limited say in financial decisions or access to farming inputs.

5. Focus Group Discussion Summary – Asinguza bull fattening Group

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

FGD Demographics

Attribute	**Details**
Group Name	Asinguza bull fattening Group
Village	Karwara
Parish	Kimengo
Sub-county	Kimengo
District	Masindi
Number of Participants	5 (2male,3female)
Venue	Karwara
Date	18/April/ 2025

Discussion Summary

The Asinguza bull fattening Group emphasized a critical need for reliable water access in their sub-county. Participants noted that water is central not only for household needs but also for sustaining commercial agriculture. Currently, the community relies on dam water harvested during the rainy season, which is shared between humans and animals. This practice leads to high levels of contamination, exposing people to health risks. Furthermore, the group explained that the geological conditions in Kimengo complicate groundwater access—boreholes often dry up quickly due to the porous bedrock that causes water to sink deep underground.

The group expressed hope that the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure Project would significantly transform their lives. They believe the project will enhance agricultural productivity, improve public health, and reduce the prevalence of waterborne diseases such as bilharzia and diarrhoea. In addition, participants noted that improved water access would elevate the general standard of living and contribute to increased household incomes.

Regarding willingness to pay, the group members indicated readiness to contribute financially to the project. They proposed UGX 100,000 per season per household as a reasonable fee for water access. They see the water infrastructure as a shared community asset that will benefit both farmers and pastoralists and expressed the hope that the entire sub-county would be included in the coverage area.

In discussing gender dynamics, the group pointed out that women are more engaged in everyday agricultural activities and bear the burden of family-related responsibilities such as paying school fees. However, they face financial constraints because their savings are sometimes misappropriated by their male counterparts. It was noted that while women are actively involved in digging and managing farms, men typically step in only at harvest time or when key decisions about income and resource allocation are being made.

6. Focus Group Discussion Summary – Twekambe karagwe bull fattening group

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

FGD Demographics

Attribute	**Details**
Group Name	Twekambe karagwe bull fattening group
Village	Karagwe
Parish	Kimengo
Sub-county	Kimengo

District	Kiryandongo
Number of Participants	8 (4male,4female)
Venue	Karagwe
Date	18/April/ 2025

Discussion Summary

The Twekambe karagwe bull fattening group highlighted an acute need for water in their community, especially for livestock and irrigation. Members explained that during dry seasons, water becomes scarce, and boreholes often dry up. As a result, community members are forced to share stagnant dam water with livestock, which contributes to the spread of waterborne diseases such as bilharzia and diarrhoea. The group specifically emphasised the burden on women and girls, who walk long distances to fetch water, exposing them to safety risks and consuming valuable time that could be spent on productive or educational activities.

The water shortage significantly impacts meat production, which drops drastically during the dry season due to dehydration and poor pasture. In some cases, animals succumb to the harsh conditions. Members noted that if water were extended closer to their homes and farms, they would expect improvements in animal health, a boost in meat yields, and better productivity for key cash crops like maize. These changes could enable them to invest in agricultural tools and essential inputs, improving both income and food security.

Currently, the group has no alternative water sources apart from unreliable boreholes and seasonal dam water. They expressed a willingness to pay for a consistent water supply, provided that fees are fair and based on actual consumption. For context, they mentioned that during the dry season the bulls lose weight while buyers tend to look for healthy animals . As a result of this, they lack market for their animals even after being forced to sell at a lower price.

The group also reported security concerns, such as the frequent theft of animals and poultry, further threatening their livelihood. Improved access to water and infrastructure could indirectly enhance security through community development and increased economic stability.

From a gender perspective, traditional roles remain dominant in Kimengo. Men are typically the landowners and make most of the key decisions regarding farming and sales. Women, although active in small-scale gardening, are generally excluded from participating in farming on a commercial scale. Sales of agricultural produce are largely controlled by men, limiting women's ability to influence household income or invest in farming improvements.

7. Focus Group Discussion Summary – Kijogoro mukama talemwa saving and Loan Association

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

FGD Demographics

Attribute	Details
Group Name	Kijogoro mukama talemwa saving and Loan Association
Village	Kijogoro
Parish	Kigulya
Sub-county	Miirya
District	Masindi
Number of Participants	11 (11 men)
Venue	Kijogoro
Date	18th April, 2025

Summary of the discussion

Concerning Water Scarcity and Agricultural Challenges, one of the group members began, *"Farming without water here is nearly impossible. Since January, we've only seen one real rain, and our crops dried up before they even had a chance to grow." Another farmer added, "Because of that, most of us skip the first planting season and only grow during the second season when there's a bit more rain."*

Others nodded in agreement, with one saying, *"During the dry season, we spend so much on buying food, yet we have land lying idle."*

When it came to having Hope in the Upcoming Water Project, the group expressed strong support for the proposed irrigation project. One participant stated, *"If this water project comes through, things will change for the better. We'll be able to plant even during dry months, especially vegetables and fruits that need regular watering."* Another echoed, *"We could make money all year round instead of just relying on one short rainy season."* A younger farmer added, "It would also help with feeding our families without spending extra to buy food."

Affordability and Willingness to Pay

When asked about paying for the service, one man said, *"As long as the water is reliable and it reaches our farms, I'm okay with paying a small fee. But not more than UGX 50,000 for 2.5 acres each season."* A woman agreed, saying, *"Yes, and we should also have the option to pay based on how much water we use. UGX 50 for 50 jerrycans is fair. That way, even those with small gardens can benefit."* The group generally preferred a government-led model, with one participant noting, *"When the government runs it, we at least know they won't overcharge us. Private companies might bring high prices."*

Gender Roles and Family Dynamics

Gender concerns were voiced. One woman said, *"We do the digging, planting, and even harvesting, but when it comes to selling, the men take over."* Another added, *"Sometimes my husband sells everything and comes home with nothing. Then it's up to me to find food for the children."* Men in the group acknowledged this imbalance, with one saying, *"We need to do better. I have seen families where women are part of every decision, and those homes are doing well."*

8. Focus Group Discussion Summary – Kisomoro Kitoka United Farmers

Masindi Port Bulk Water Supply and Irrigation Infrastructure Project

Demographic Information

Attribute	Details

Group Name	Kisomoro Kitoka United Farmers
Village	Kyabaswa
Parish	Isimba
Sub-county	Miirya
District	Masindi
Main Activity	Beans farming
Land Ownership	Primarily male-dominated
Water Access	Scarcity of water; reliance on rain
Number of Participants	10 (4 males, 6 females)
Venue	Kyabaswa
Date	18/April/ 2025

Discussion Summary

Challenges with Water and Farming

One male participant shared, *"Beans are our main crop, but with the changing weather patterns, we can't count on the rain anymore. Some seasons we plant, and then the rain stops before the crop matures. Yields are really low because of this."* Another added, *"This year, most of us had to leave our fields fallow during the dry season because without water, nothing grows. We lost a lot."*

Hopes for the Water Project

A woman spoke up, saying, *"Having access to water all year round would change everything. We could grow beans in the dry season too, which means more food and more money."* A male participant nodded and said, *"It would make us more reliable in terms of production. We could be sure that we have something to sell throughout the year."*

Willingness to Pay for Water

When it came to paying for water, a participant remarked, *"We know the project will need money to run, and we're ready to pay, but it must be affordable. If we can pay around UGX 50,000 for two acres each season, that would be manageable."* Another farmer suggested, *"Even a small charge, say UGX 50 for each jerrycan, would make a big difference for us. It's something we can afford."*

Gender and Water Use

A female participant expressed concerns about gender roles, stating, *"We women work hard in the garden, but when it comes to decisions about the land, it's mostly the men who decide. We need to be included, especially in something as important as water for farming."* Another woman agreed, adding, "*We need to ensure that the whole household benefits from this water project, not just the men."* A man responded, "*Yes, we can't leave anyone behind. The women are as much a part of this work as the men."*

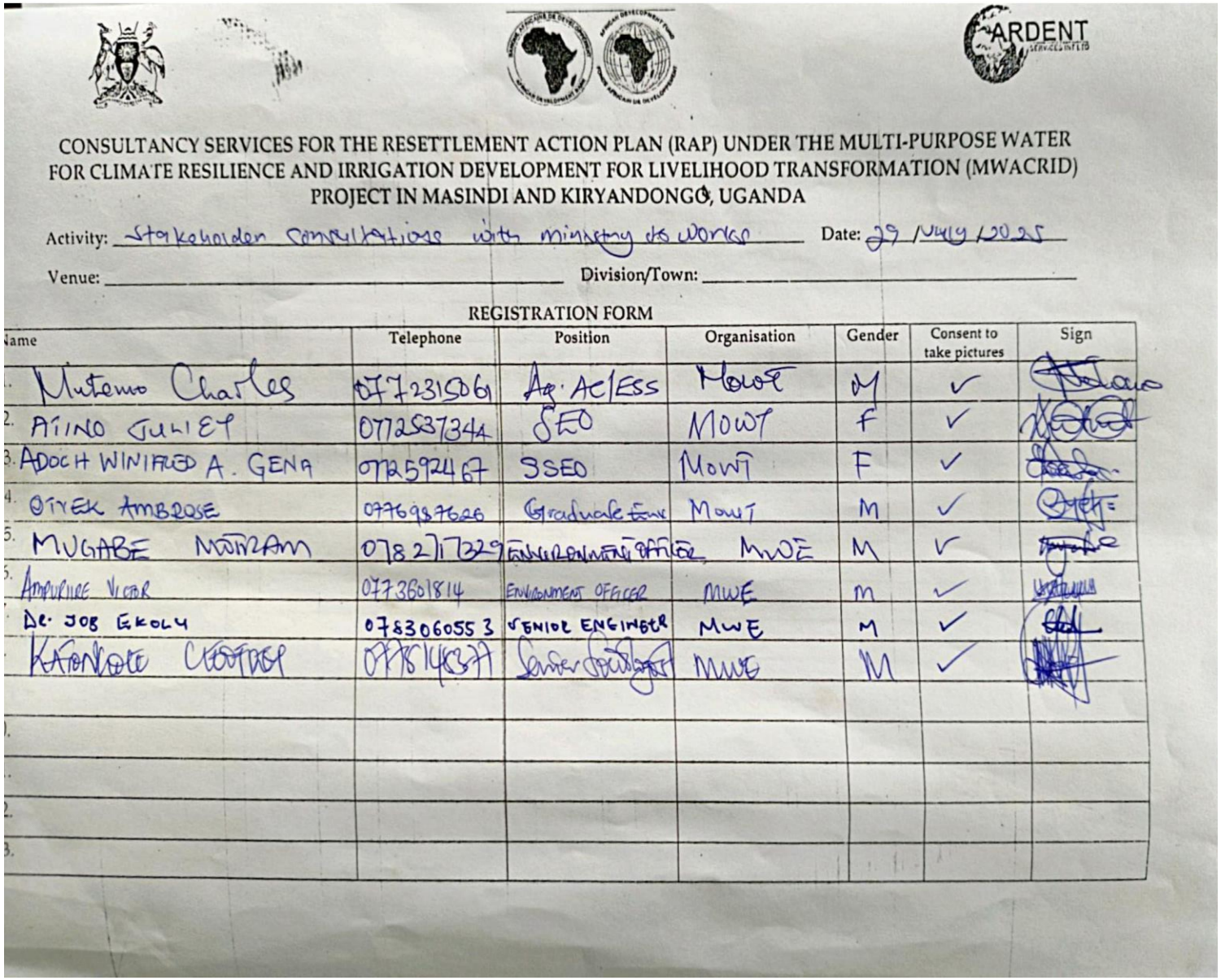
CONSULTANCY SERVICES FOR THE RESETTLEMENT ACTION PLAN (RAP) UNDER THE MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN MASINDI AND KIRYANDONGO, UGANDA

Activity: STAKEHOLDER ENGAGEMENT Date: 24/07/25

Venue: MWE WETLAND DEPARTMENT Division/Town: Na Kaunda

REGISTRATION FORM

Name	Telephone	Position	Organisation	Gender	Consent to take pictures	Sign
Ongol Joseph	0777779934	Asst. Com	MWE, WMD	M	Y	



CONSULTANCY SERVICES FOR THE RESETTLEMENT ACTION PLAN (RAP) UNDER THE MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN MASINDI AND KIRYANDONGO, UGANDA

Activity: Stakeholder consultations with ministry of works Date: 29/July/2025

Venue: Division/Town:

REGISTRATION FORM

Name	Telephone	Position	Organisation	Gender	Consent to take pictures	Sign
1. Mutemo Charles	0772315061	Ag. AC/ESS	MoWT	M	✓	
2. AIINO JULIET	0772537344	SEO	MOWT	F	✓	
3. ADOCH WINIFRED A. GENA	0725924167	SSEO	MoWT	F	✓	
4. OTYEK AMBROSE	0776987626	Graduate Eng	MoWT	M	✓	
5. MUGABE MUNZAM	0782717329	ENVIRONMENT OFFICER	MWE	M	✓	
6. AMPURIRE VICTOR	0773601814	ENVIRONMENT OFFICER	MWE	M	✓	
7. Dr. JOB EKOLU	0783060553	SENIOR ENGINEER	MWE	M	✓	
8. KATONDOKE GEOFFREY	0778142837	Senior Surveyor	MWE	M	✓	
9.						
10.						
12.						
13.						

AFRICAN DEVELOPMENT BANK GROUP

ARDENT

CONSULTANCY SERVICES FOR THE RESETTLEMENT ACTION PLAN (RAP) UNDER THE MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN MASINDI AND KIRYANDONGO, UGANDA

Activity: Consultation Bunyoro Kitara Kingdom Date: 28/07/2025

Venue: Hoima city Division/Town: Kingdom HQ

REGISTRATION FORM

	Name	Telephone	Position	Organisation	Gender	Consent to take pictures	Sign
1	Alex Kabasale	0772860826	Chief Admin' Secretary	Bunyoro Kitara Kingdom	M	Yes	
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							

CONSULTANCY SERVICES FOR THE RESETTLEMENT ACTION PLAN (RAP) UNDER THE MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN MASINDI AND KIRYANDONGO, UGANDA

Activity: STAKEHOLDER CONSULTATIONS Date: 22nd / JULY / 2025

Venue: NFA, MUVE Division/Town:

REGISTRATION FORM

Name	Telephone	Position	Organisation	Gender	Consent to take pictures	Sign
1. Shallon Challenge	0774265636	Env. mgt & Research Officer	NFA	F	✓	
2. John Bosco Acuto	0776211038	Plantation Dept Officer	NFA	M	✓	
3. Bwiruka Brian	0783/7887	Cartography Officer	NFA	M	✓	
4. Edward Ssenyonjo	0772-514932	CGM	NFA	M	✓	
5. Owiny Robert	0782900990	CNFM	NFA	M	✓	
6. Leo. Twinomuhwezi	0782561468	Coordinator Planning	NFA	M	✓	
7. Babirye Agnes Nakandi	0757834803	Intern Environment Office NFA	NFA	F	✓	
8.						
9.						
10.						
11.						
12.						
13.						

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date..4/12/2024.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
1.	MUHUMUZA MARIDO		✓	Katabango	077313594O	
2.	Namubiru Hadijah		✓	Parish chief	0788866542	
3.	JAMILA MUSA		✓	KIABANGO	0784 89077	JAMILA
4.	KATUSABE JANEROSE		✓	WAIBANGO	0765250434	
5	Kusiima JULIET		✓	WAIBANGO	0778611447	
6	ASIIMWE FREDRICK	✓		WAIBANGO	0773430201	
7	ALFRED SUNDAY	✓		WAIBANGO	0788068863	
8	Ladu Michael	✓		Rwekunyi	0743796536	
9.	TUGUME DAN	✓		KIABENGA	0786817004	
10.	BUTARE george.M	✓		Kiabenga LC1	0782425769	GM
11	TABU MAKIDAD	✓		RWENKUNYI	0785451307	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
12.	KUSIIMA BRIGHT	✓		Walbanga	0788067376.	
13.	HABIBA ISHMAEL		✓	Rwekunye	0773 290969	
14	MODONG KADIJA		✓	RWEKUNYE	0773783357	modong
15	MAJI MAGERATE		✓	HAIBANGO	A ——	
16	BAYOWA JOSEPHINE		✓	Rwekunye	0774 074235	
17.	ROSE		✓	HAIBANGO	——	
18.	WANDERA ANNET		✓	RwekunyeTC	0782 7076 40	annet

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
	LOKOLONG JOSEPH	✓		Resident Kwenkanji	0775753182	
	RINGWERO PAUL	✓		Secretary Lei Kanigumbi	0772660163	
	GEORGE NANJA	✓		Resident Nainaga	0775861262	
	AFB Jacini Joseph		✓	Resident Nainaga	—	—

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
1	Buzeneza Jasmin		V	nurse	0775329181	
2	BAZIRI SOLOMON	V		Boy's Dor		
3	Byamukama E.	V		Mayebo	0785850042	
4	Katuramu	V		Doctor	0779021662	
5	MUGISHA	V		ANDREW	0788337331	
6	Sharif	V		Minister		
7	Nuwagaba ANNET		V	Head mgt	0987662979	
8	Twineza Sarah		V	Myeba	0773491063	
9	Asiimwe	V		Myeba		
10	Nzongeyo	V		Myeba	0763249903	
11	Amooti	V		Myeba	0763465739	
					0784606540	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
1	Mugisher.R	V		[redacted]64	0789268254	
	Besime	V		Myeba	0771688263	NYASIIMA WILSON
	Muhimbeza	V		Myeba	07 61777584	
	Tumusime	V		Myeba	0785569305	
	Vuuta	V		Myeba		
	Rebeka		V	Myeba		
	Kasande		V	Myeba	0785468707	
	Agabasingura		V	11 11	0766436662	
	Sibohiyo Jo	V		Myeba	0783600567	
	Niyonize	V		MYEBA	0768867891	
	TWESIGE	V		DMTEBA	0763380414	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
	Katushabe		✓	Myeba	0771866094	
	Namulondo		✓	Sarah Myeba	0785992826	
	Zakaria	✓		Myeba	0781683905	
	ASIIMWE	✓		MYEBA	0789997448	
	GAHINZ	✓		Myeba	0771660133	
	BYAKATONDA	✓		MiyeBA		
	BYARUHANGA	✓		Myebo		
	TWISIME	✓		MYEBA	0777685393	
	MIYETEGEKA J.D	✓		MYEBA	0775180156	
	MUGISA	✓		MYEBA	0787181290	
	Mbaingha	✓		Myeba	07	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
	KWASIRA CHRISTOPHER	V		Mgmtan	0783102380	
	Kiwanuka	V		Mgmtan	0772822 21543	
	Nabwami Nagoya Ann	V		Mgmtan	0772941159172	
	Mpamizi Henry	V		Mgmtan	0782726268	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date 05-DEC-2024

No.	Name	M	F	Designation	Phone number and Email address	Signature
	KAKURU FRANK	✓		NAKALONGO	0781243278	
	MWESIGYE GEORGESILLY	✓		WAKISANYI	0778892718	
	KAMBARADA STEPHEN	✓		C/PERSON LC1	0782833335	
	Ruwanufarooq	✓		Nyeba	0758669007	
	KAMUHARA CHARLES SALVER	✓		WAK:SAMY:	0762079917	
	KAYESU GEORGE	✓		Nyakalongo	0778331392	
	KAYONDO SAM	✓		Nyakarongo	0785962926	
	MUHANGUZI STEPHEN	✓		Nyakarongo	0778752750	
	MUHUMUZA MARION		✓	PLCHIEF	0773135740	
	SAMUEL MUZUNWA	✓		Nyakarongo	0785397918	
	Abdumuchi Isam	✓		Nyakarongo	0779936766	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date..05- DEC - 2024.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
	OKELLO MOSES	✓		Wakisanyi	0760336542	
	LUGENDO PETER	✓		Wakisanyi	0751692223	
	Lwanga Abesi	✓		WAKISANYI	0779923078	
	BABONA RICHARD	✓		WAKISANYI	0764304063	
	Salimu Kiganda	✓		Nalcalongo	0751515142	
	AYESIGA DOREEN		✓	NYAKARONGO	0774 386897	
	Najjuma Deliranta		✓	WAKISANYI	0784063697	
	OMUNYONGOLE JAMES	✓		WAKISANYI	0784583367	
	KARANYORO GRACE		✓	WAKISANYI	0783729123	
	Mwesigye Joy		✓	wakisanyi	0781285229	
	Kutesa Jovia		✓	Kazu	0774877620	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....05-DEC-2024.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
	DUMBA COZZINE		✓	Wakisanyi	0770784196	
	Mutu William	✓		Wakisanyi		
	KIIZA MUHAMADI	✓		Area Defence	0782039166	
	KAMUGISHA NAZARIUS	✓		Wakisanyi	0773084485	
	Senyonga Robert	✓		Wakisanyi	0784170529	
	Kivumbi Sharif	✓		Wakisanyi	0764292513	
	Odala Albert	✓		Wakisanyi	0767137966	
	MAJANA GODFREY	✓		Wakisanyi	0763495990	
	YAWE BRIAN	✓		Wakisanyi	0780433116	
	KYARISIMA VASITA	✓		Wakisanyi		
	ISAAC KABUDUNGO	✓		Nyakarongo	0782897408	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date..05-DEC-2024.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
	KIKOBE EDINANSI		V		0783557566	edina
	KANSIIME Godfrey	V		Livestock farmer.	0772299662-0703581681	
	KYAHIGOMBA BEATRICE		V		0787996334	
	KanYesiga Edmund	V		livestock	0764292320	
	OGWANG JANFRANCO	M		Youth c/p	07709362 42 / 0741726627 / 0702280127	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date..2/12/2024.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
1	ABIGABA SILVER	✓		M	0788487298	Silver
2	Biroho Aporeri	✓		MBisheni	0779053253	
3	TOKIVA BOSCO	✓			0766882647	
4	NAKANJWANI FAUZA		✓			
5	Bwamboka Nobert	✓		M	0765134315	
6	ALINITWE SARAH		✓	BISANI	0784 84 72 31	
7	Kabusinge Brijet		✓	Bisenyi	0773806087	
8	KWAGONZA	2	✗	Bisenyi	0779043819	
9	KATUSIIME JACKLINE		✓	BISENYI	078362481 6	
10	AMANYIRE MOLIOUS		✓	BISENYI	0762160787	
11	omunandye Godfrey	✓		BISENYI	0784601548	
12	Owinga Paul	✓		Bisenyi		

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date 02/12/2021

No.	Name	M	F	Designation	Phone number and Email address	Signature
13	Mary yesi		✓	Bisenyi	0787600801	
14	Amary Kereh		✓	Bisenyi		
15	Jalama James	✓		BISENYI	0777359658	
16	OYERAU DAVID	✓		BISENYI	0763582932	
17	Silder everline		✓	Bisenyi		
18	OBUNE RICHARD	✓		Benyi	0766742728	
19	SEMALO PETER	✓		Bisenyi	0772453434	
20	OTEKWUN, Gil	✓		Bisenyi		
21	Tito Leja	✓		Bisenyi		
22	Kiryandongo Sugar Co	✓		Kaduku, Bisenyi, Kinwetwe & Kihumuro Villages	0774 025 919	
23	Bamu Godfrey	✓		Bisenyi	0760465620	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date..02/12/2024.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
24	Fayodar Jenifer		L	Bisenyi		
25	Nabatanazi Fl.		L	Bisenyi	0775630301	
26	Peeee		L	Bisenyi	-	
27	Manuelar		L	Bisenyi	-	
28	Biknence Ikedo		L	Bisenyi	0780824514	
29	Regina Kayikeiey		✓	Bisenyi	-	
30	MUKESIGWA NATHAN	L	M	Bisenyi	0771287159	
31	Kamwamya Williams	L	M	Bisenyi	0772862868	
32	Nanaka dlber		L	Bisenyi	-	
33	KABULETA PIUS	✓		Bisenyi	0770 688 900	
34	PETERO	✓		Bisenyi	0779986324	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
35	BAGONZA DAVID	M		BISENYI	0772476947	
36	Omadi Kasi	M		Bisenyi	0787760431	
37	Masendi Leonard	M		Bisenyi	0783286433	
38	Baguma Edward	M		Bisenyi	0774901680	
39	Byenkya Robert	M		Bisenyi	0783173528	
40	Kiiza Imildor		F	Bisenyi	0770724019	
41	Gofrey WEDUNGA			Bisenyi	0766987736	
42	WAMANI CLINTON	✓		~~BISENYI~~ Bisenyi	0782026039	
43	Onyuni Alex	✓		Bisenyi	0780452552	
44	OMI CHARLES	✓		Bisenyi	0777361222	
45	OKUDI-WILLIAM	M			0776379453	

STAKE HOLDER CONSULTATION LIST

Project Name: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI AND KIRYANDONGO DISTRICT, UGANDA

Date..02/12/2024.....

No.	Name	M	F	Designation	Phone number and Email address	Signature
46	WATHUM. DEVID	✓		Bisanyi		
47	Magoola Steven	✓		11	0772284866	
48	NAMYOJO ANNETH	✗	✓	Bisanyi		
49	KANYORO MARGH	✓		SAS - MIIRYA	0784171980	
50	KIIZA RONALD	✓		for c/person		
				L C III Miinya Sk	0779247497	

Appendix B-6: Meeting with National Forestry Authority (NFA)

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA **MINUTES OF RAP PREPARATION CONSULTATION MEETING**	
Date of Meeting:	22nd July 2025
Time of Meeting:	10:30 a.m.
Venue of Meeting:	National Forest Authority Head Office Board Room

Agenda

1. Opening Prayer
2. Self-Introductions
3. Remarks from the Chairperson
4. Remarks and presentation from the Consultant (Ardent Services International)
5. Discussion
6. Closure

Minute 1: Opening Prayer

The meeting was opened with a prayer from one of the staff members who was chosen by the chairman of National Forest Authority.

Minute 1: Self-introductions

Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Chairperson

She first of all welcomed all members present in the meeting and continued by applauding the consultant for the punctuality given that the meeting was communicated on a short notice.

She added that they were not involved in the initial stages in that they are even wondering how far the consultant as gone with the ESIA and wondered whether it was approved yet.

Further, she requested for the coordinates of Kaduku and Kitukuza forest where the reservoir, treatment plant and the transmission lines are going to pass. She also notified the Consultant that the EIA should have taken precedence.

She added by requesting for a joint inspection most especially along the hotspots for verifications that is to say Kaduku forest and Kitukuza.

She also inquired whether the NFA field offices in in Kiryandongo and Masindi were engaged respectively.

She concluded by calling upon the Consultant to give remarks and proceed with the presentation to the meeting.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The team expressed appreciation to the NFA for the warm reception and formally introduced the Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation

(MWACRID) Project. The project is targeted for implementation in the sub-counties of Masindi Port and Kigumba in Kiryandongo District, as well as Miirya and Kimengo in Masindi District.

The Consultants presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project. They emphasized that the Ministry of Water and Environment (MWE), as the implementing agency, holds the mandate to ensure environmentally and socially responsible development. In line with this, the consultants highlighted the preparation of a Resettlement Action Plan (RAP) as a key project component, which will guide the fair, lawful, and transparent acquisition of land and compensation of affected persons.

The Consultant explained that RAP process is informed by comprehensive technical and socioeconomic assessments, including land use analysis, livelihood profiling, population dynamics, and mapping of community infrastructure with the aim is to minimize displacement by prioritizing the use of existing road reserves and public land. However, where land acquisition is unavoidable, it will be undertaken in strict compliance with Ugandan legal frameworks and the African Development Bank (AfDB) environmental and social safeguards. The team underscored that stakeholder engagement, including gender-sensitive planning, will be integral to mitigating resettlement impacts and fostering community acceptance.

The Consultant proceeded to demonstrate the alignment of major project components using Google Earth imagery, elaborating on the project's objectives, scope, and key infrastructure elements drawing special attention to environmental considerations, particularly the presence of ecologically sensitive areas along the proposed route in this context, Kaduku Central Forest Reserve (CFR) and Kitukuza Forest Reserve identified as critical ecological zones likely to be significantly impacted by project activities, including the construction of a reservoir and water treatment plant.

These areas are acknowledged as important forest ecosystems requiring the application of rigorous environmental safeguards. The consultant team emphasized the need for technical guidance and collaboration with the National Forestry Authority (NFA) regarding land use in these reserves.

Additionally, the consultants sought clarification from NFA on the status of land within Kaduku and Kitukuza Forest Reserves, where the tank reservoir and treatment plant are proposed to be located, respectively. A request was made for technical guidance regarding the boundaries of a 50-acre area within Kaduku, amid concerns raised by some stakeholders who claimed that the land may belong to the Bunyoro Kitara Kingdom.

The presentation further detailed the proposed route of transmission lines extending from Masindi Port to Kaduku Hill, the designated site for the reservoir. Kaduku was identified as a technically optimal location due to its high elevation and central position within the broader project area, which would enhance water distribution efficiency across the service zones.

Minute 3: Reactions

During reactions, several key concerns and clarifications were raised and addressed as follows:

3.1 Sizes of Transmission and Distribution Corridors:

NFA inquired about the legal right-of-way dimensions for the transmission and distribution lines. It was clarified that the main transmission line requires a 6-meter corridor, while distribution lines require a 3-meter corridor.

3.2 Nature of Line Installation (Underground or Overhead):

There was a query regarding whether the lines would be overhead or subterranean. The team responded that the transmission lines are planned to be installed underground.

3.3 Environmental Considerations:

NFA emphasized the need to minimize environmental impacts, particularly in forested areas. They recommended using a single transmission corridor instead of cutting through multiple sections of the forest to reduce fragmentation and habitat disruption.

3.4 Kaduku CFR Land Ownership Clarification

It was clarified that the Kaduku CFR area falls under the jurisdiction of the NFA, contrary to initial information indicating it belonged to the Bunyoro Kitara Kingdom. Although engagement with the Kingdom remains acceptable, official documentation confirms NFA's ownership of Kaduku Forest.

3.5 Requirement for Comprehensive Assessments:

NFA advised that multiple assessments be conducted prior to determining the land value. These include forest assessments to evaluate the ecological and economic significance of the area and to ensure minimal impact. The assessments should also inform the Resettlement Action Plan (RAP), its associated mitigation measures, and the valuation of opportunity costs related to land use.

3.6 Biodiversity and Offset Planning:

Biodiversity offset measures must be considered, particularly in relation to the Kaduku CFR. The design should be reviewed and revised where necessary to minimize ecological fragmentation.

3.7 Technical Coordination Requirements:

It was requested that project coordinates be shared in .kml format to support spatial planning and environmental analysis.

3.8 Valuation of Affected Natural Resources:

Special attention should be paid to valuating affected pine trees and assessing the presence of flora and fauna within the project footprint, to determine potential environmental impacts.

3.9 Livelihood Considerations:

The team was reminded to consider licensing arrangements related to tree farming in the area. Additionally, livelihood support measures should be aligned with the legal documentation from NFA, confirming government ownership of Kaduku CFR.

3.10 Assessment Timelines:

The meeting concluded with a request for a clear timeline indicating when the recommended assessments environmental, social, ecological, and economic will be undertaken to inform the way forward.

Minute 4: Closure

The meeting was adjourned with a closing prayer from one of the volunteer from NFA.

Appendix B -7: Meeting Minutes with Wetlands Management Department (WMD)- MWE

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 24th July 2025
Time of Meeting: 10:00 a.m.
Venue of Meeting: Assistant Commissioner's Office

Agenda

1. Self-Introductions
2. Remarks from the Consultant (Ardent Services International).
3. Remarks from the Assistant Commissioner Wetlands Management
4. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The Consultant presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project, underscoring the Ministry of Water and Environment's (MWE) role as the implementing agency mandated to ensure environmentally and socially responsible development. A key feature of the project is its reliance on water drawn from the Nile River, with some components designed to traverse the Nile riverine wetland system. In line with MWE's mandate, the preparation of an ESIA and RAP was highlighted as a critical component to guide a fair, lawful, and transparent process of land acquisition and compensation for project-affected persons. The project is planned for implementation in the sub-counties of Masindi Port and Kigumba in Kiryandongo District, and Miirya and Kimengo in Masindi District.

The consultants explained that the RAP is being developed based on detailed technical and socioeconomic assessments, including land use analysis, livelihood profiling, population studies, and mapping of community infrastructure. The approach prioritizes minimizing displacement by utilizing existing road reserves and public land where possible. In cases where land acquisition is unavoidable, the process will strictly adhere to national legal requirements and the African Development Bank's (AfDB) environmental and social safeguards. The team further emphasized that meaningful stakeholder engagement, with a strong focus on gender-sensitive planning, will be essential to mitigating resettlement impacts and ensuring community support for the project.

Minute 3: Remarks from the Assistant Commissioner

The Assistant Commissioner emphasized that all farming activities should be located outside the designated wetland buffer zones. It is critical that the integrity of wetlands is maintained throughout the project lifecycle.

The Commissioner advised that the project must be mindful of the types of chemicals that will be used by farmers. Proper agro-chemical management practices should be integrated into project planning to minimize potential environmental contamination.

The Commissioner stated that there is no objection to the project proceeding. However, this is conditional upon clarifying specific aspects related to environmental protection and water resource use.

It was noted that it is important to establish what crops or agricultural products farmers will be growing under the project to assess compatibility with wetland conservation objectives.

The Commissioner requested information on the estimated volume of water to be abstracted per day for irrigation and other uses. It was emphasized that the project proponents must apply for and obtain a water abstraction permit from the relevant authority.

All physical infrastructure and project components must be sited outside wetland buffer zones to avoid encroachment and degradation of wetland ecosystems.

Minute 4: Closure

In his closing remarks, the Assistant Commissioner requested that the project team clearly avoids wetland buffer zones in all designs, prepare and submit details on crops to be grown and chemicals to be used by farmers, provide estimated daily water abstraction volumes and initiate the permit application process.

The Assistant Commissioner expressed the need for a field visit to assess the potential impacts of the project, especially in areas where farming will be implemented. This will allow for a better understanding of the on-ground context and inform decision-making.

Appendix B – 8: Meeting with Bunyoro Kitara Kingdom

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN

THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 28th July 2025

Time of Meeting: 10:00 a.m.

Venue of Meeting: Bunyoro Kitara Kingdom Secretary's Office

Agenda

1. Self-Introductions
2. Remarks from the Consultant (Ardent Services International).
3. Remarks from the Bunyoro Kitara Kingdom Secretary
4. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Consultant (Ardent Services International Ltd).

The Consultant presented an overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project, underscoring the Ministry of Water and Environment's (MWE) role as the implementing agency mandated to ensure environmentally and socially responsible development. As part of this mandate, the preparation of a Resettlement Action Plan (RAP) was highlighted as a critical component to guide the fair, lawful, and transparent process of land acquisition and compensation for affected persons. The project is planned for implementation in the sub-counties of Masindi Port and Kigumba in Kiryandongo District, and Miirya and Kimengo in Masindi District.

The consultants explained that the RAP is being developed based on detailed technical and socioeconomic assessments, including land use analysis, livelihood profiling, population studies, and mapping of community infrastructure. The approach prioritizes minimizing displacement by utilizing existing road reserves and public land where possible. In cases where land acquisition is unavoidable, the process will strictly adhere to national legal requirements and the African Development Bank's (AfDB) environmental and social safeguards. The team further emphasized that meaningful stakeholder engagement, with a strong focus on gender-sensitive planning, will be essential to mitigating resettlement impacts and ensuring community support for the project.

Additionally, the consultants sought clarification from the Kingdom on the status of land within Kaduku and Kitukuza Forest Reserves, where the tank reservoir and treatment plant are proposed to be located,

respectively. A request was made for technical guidance regarding the boundaries of a 50-acre area within Kaduku, amid concerns raised by NFA who manages the CFR.

Minute 3: Remarks from the Secretary

The Kingdom Secretary clarified that Kaduku Hill, where the Central Forest Reserve (CFR) is located, belongs to the Kingdom. He emphasized that the Kingdom has long-term plans to construct the Kingdom Palace on this hill.

It was noted that the Kingdom currently lacks the capacity to manage some of its properties, including Kaduku Hill. As such, a Memorandum of Understanding (MoU) was signed with the National Forestry Authority (NFA) to manage the area on behalf of the Kingdom.

The Kingdom is open to providing alternative land for the development of the project in the event that Kaduku Hill is not available. However, the Kingdom formally requested that boundary opening and valuation assessments be carried out to ascertain the value of the land, and that the Kingdom's interest in Kaduku Hill be duly compensated if the project takes place there.

The Kingdom Secretary highlighted that the Kingdom owns over 49 acres of land where the proposed treatment plant is to be located. However, there are squatters currently occupying parts of this land, which may need to be addressed during project implementation.

The Kingdom requested that the Ministry of Water and Environment (MWE) officially write to the Kingdom indicating their intentions to develop Kaduku Hill. This formal communication is necessary for transparency and proper coordination moving forward.

Minute 4: Closure

In closing, the Secretary requested for site visit to Kaduku CFR, indicated that MWE has to write officially to the Kingdom regarding Kaduku Hill intentions. Initiate boundary opening and valuation assessments for Kaduku Hill. Discuss potential compensation mechanisms for the Kingdom's interest in the land and assessing the situation regarding squatters on the treatment plant site.

Appendix B – 9: Meeting Minutes with Ministry of Works and Transport (MoWT)

MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN

THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

MINUTES OF RAP PREPARATION CONSULTATION MEETING

Date of Meeting: 29th July 2025
Time of Meeting: 10:00 a.m.
Venue of Meeting: Assistant Commissioner's Office Ministry of Works and Transport

Agenda

1. Self-Introductions
2. Remarks from the Assistant Commissioner Environment and Social Safeguards
3. Remarks from the MWE Team.
4. Remarks from the Consultant (Ardent Services International).
5. Reactions
6. Closure

Minute 1: Self-introductions

1.1 Self-Introductions were made as listed in the attendance list.

Minute 2: Remarks from the Assistant Commissioner/Chairperson

The Assistant Commissioner welcomed the Consultant and the Ministry of Water and Environment (MWE) team to the Ministry. He extended apologies for the limited space, explaining that the Ministry is still undergoing reorganization following the merger of UNRA and MoWT.

He informed the meeting that his office is responsible for overseeing all Environmental and Social (E&S) issues related to national roads. Upon receipt of the project introduction letter, it was promptly assigned to his department for attention.

The Assistant Commissioner expressed appreciation to MWE for proactively engaging stakeholders, emphasizing that this is the appropriate and preferred approach for ensuring sustainable project implementation.

He noted that he had a brief overview of the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project and expressed confidence that more detailed information would be shared by MWE and the Consultants during the meeting.

The Assistant Commissioner stated that MoWT has no objection to the implementation of the project, provided that all anticipated impacts are effectively managed and the necessary approvals, particularly from the Road Engineering Department, are secured especially in relation to road crossings.

He cautioned the project team against duplicating compensation along the Rwenkunye–Masindi Port road corridor, where road construction is already underway and compensation had previously been undertaken.

He concluded his remarks by inviting the Ministry of Water and Environment to present their official statements and continue with the meeting agenda.

Minute 3: Remarks from the MWE Team

The Ministry of Water and Environment (MWE) representative welcomed all participants to the meeting and expressed appreciation to the Ministry of Works and Transport (MoWT) for their attendance, and to Ardent for organizing the session. The MWE team emphasized that the Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project is a transformative initiative covering the districts of Masindi and Kiryandongo.

The project aligns with the objectives of Uganda's National Development Plan IV (NDP IV), particularly in improving livelihoods and enhancing climate change resilience. Key project outputs include the irrigation of approximately 4,000 hectares of land, provision of water to large-scale farmers including those under the Uganda Investment Authority (UIA), and the supply of clean water across both districts. Given the project's scope, particularly the extensive pipe distribution network that may cross national roads, MWE stressed the importance of close consultation and coordination with MoWT.

Minute 4: Remarks from the Consultant (Ardent Services International).

The Consultant welcomed all participants to the meeting and clarified that the purpose of the consultative engagement was to seek guidance on the procedures and requirements for crossing national roads, particularly the Gulu-Kampala Highway. This is intended to ensure the smooth implementation of the project and inform the Environmental and Social Impact Assessment (ESIA). The consultant further requested input on how potential negative impacts could be mitigated.

Using Google Earth imagery, the consultant presented the locations of key project components, with particular focus on the water abstraction point, which is situated approximately 300 meters from the existing ferry port. Additionally, the consultant highlighted the proposed construction of a bridge connecting Apac and presented the specific sections where the project is expected to cross national roads at five different points.

Minute 5: Reactions

MoWT appreciated the Consultant for the informative presentation and commended the design team for their strategic approach in minimizing the number of road crossings, which reduces potential disruptions. MoWT emphasized the importance of ensuring that the Resettlement Action Plan (RAP) implementation includes thorough community sensitisation to enhance community buy-in and

cooperation. It was noted that the section of the project where the road crosses the Gulu-Kampala Highway is prone to flooding, and this issue should be addressed in the design and implementation.

Additionally, concerns were raised regarding the increased risk of HIV transmission during the construction phase, especially in light of reduced donor funding for HIV-related interventions.

Minute 4: Closure

In his closing remarks, the Assistant Commissioner MoWT concluded by committing to relay the outcomes of the discussion to the Commissioner for National Roads, who will provide further guidance and schedule a follow-up meeting to advise on procedures for crossing national roads.

Appendix B – 10: Meeting minutes with Nile Basin Commission (NBC)

MINUTES OF MEETING WITH NILE BASIN INITIATIVE (NBI), MINISTRY OF WATER AND ENVIRONMENT, AND THE BANK

31 March 2025

1. **ATTENDANCE**

I. **NBI**

II. MINISTRY OF WATER AND ENVIRONMENT –

III. AfDB MISSION

List of participants is attached as an Annex-1

Venue: Virtual

II. AGENDA

1. Introduction of participants
2. Introduction of NBI
3. Introduction of MWaCRID Project
4. Discussion
5. Key agreed action
6. Conclusion

1. Introduction of participants:

Participants of the meeting representing their respective institutions introduced themselves (Refer to attendance List attached).

2. Introduction of NBI:

The representative of NBI, Dr. Micheal Kizza provided highlights of the role of the Nile Basing Initiative (NBI).

He added that NBI had 10 member states including Egypt, Sudan, and South Sudan. The Cooperative Framework Agreement CFA) is in the process of ratification. To date it had been ratified by six (6) countries.

Countries who wished to draw water would have to notify other riparian countries as per the laid-out procedures. All Riparian countries were made aware of the procedure, and some have used and complied in the past.

NBI pledged to provide a platform for prior notification, information exchange, and further discussion between countries. The country interested in withdrawing water would notify the downstream countries along with the necessary documentation such as a project brief.

Environmental and Social Safeguard studies were mentioned as pre-requisites for water resources development.

3. Introduction of Multi-Purpose Water for Climate Resilient Irrigation Development and Agro-Industrialisation Programme (MWaCRID-P) Project:

The Task Manager of MWaCRID Project, Mr. Mekonnen Loulseged provided a brief background of the project. He informed that based on a request from the Government of Uganda, the African Development Bank (AfDB) fielded a multi-disciplinary team to prepare the *MWaCRID Project*.

He added that the proposed project comprised several interconnected components designed to abstract, treat, store, and distribute water from the River Nile. These main components being:

Diversion Canal: A Lined channel from the River Nile at Masindi Port to the offshore water Intake structure, designed to convey raw water.

Water Intake and Raw Water Pump Station: An intake structure at the end of the diversion canal to draw water from the Nile and a raw water pumping station.

Drinking Water Treatment Plant: A comprehensive plant to produce potable water meeting WHO standards.

Irrigation Water Treatment Plant: A treatment plant to ensure water quality suitable for agricultural irrigation, likely involving sedimentation and basic filtration.

Clean Water Reservoir and Pumping Station: A clear water reservoir for storing treated water and a high lift pumping station operating 24/7.

Transmission Mains: Transmission pipelines from the treatment plant to the storage reservoirs.

Storage Tanks: Four (4) large storage reservoirs for irrigation, each with a capacity of 24,000m³ (totalling 96,000m³), and two (2) separate storage tanks for domestic water supply (a primary 3,100m³ reservoir and an emergency 1,000m³ reservoir), all designed to allow for gravity-fed distribution.

Main Distribution Lines: An extensive network of pipelines for irrigation and domestic supply, covering commercial farms, livestock watering points, and villages within the study area.

4. Discussion

The mission informed the NBI that a comprehensive Environmental and Social Impact Assessment (ESIA) was conducted for the project. The primary source of water for the project being the River Nile potential impacts on the water quality and quantity was assessed. The project's maximum water demand is 375,000 m³/day (approximately 4 m³/s). The maximum water demand represents about 0.6% of the 80% dependable flow of the River Nile. This is a very small fraction of the total flow.

NBI informed the mission that the countries in the Nile Basin have established guidelines on water use for downstream countries a Platform for sharing information on the use of the water from River Nile (Prior Notification of Riparian Countries)

With the above background of the proposed project, NBI requested Ministry of Water and Environment (MWE) to share a project brief to trigger discussion with down stream countries that share the Nile (South Sudan, Sudan and Egypt) with Government of Uganda providing assurances on water with specific emphasis on key features of the proposed project and water abstraction methods.

NBI further requested MWE to provide the types of crops to be grown on the proposed project and acreage covered by the proposed project to model the impact of the crop cultivation on the River Nile.

The Transboundary Office in the Ministry of Water also informed the mission that the River Nile being a Transboundary Resource, Prior Notification of Down Stream Countries should be sent out by Government through the Minister of the Ministry Water and Environment (MWE) that should be accompanied with the Detailed Feasibility Study and Environmental and Social Impact Assessment (ESIA) Report of the project for the comfort of the Riparian States on the impacts of the project on water security and associated mitigation measures.

The meeting agreed to proceed with notification and engage with downstream countries, as well as consult internally with Uganda's Ministry of Energy regarding potential impacts on planned hydropower plants downstream.

5. Key agreed actions from the meeting:

Ministry of Water to provide necessary documentation and information to start the notification process for downstream countries.

• Eng Stephen Ogwete to follow up with Eng Ibrahim Jemba and team to gather available project information and data.

• Ministry of Water to engage with the Ministry of Energy regarding potential impacts on planned downstream hydropower plants.

• Uganda to send an initial notification letter to Nile Basin Initiative (NBI) about the project intentions.

• NBI to facilitate the notification process to downstream countries once they receive the letter from the Government of Uganda – Minister of Water and Environment.

• Project team to consider using solar energy instead of electricity to reduce pumping costs at the water treatment plant and pump station.

• Ministry of Water and Environment to prepare a project brief highlighting key components and environmental aspects for sharing with downstream countries.

• Project team to finalize the feasibility study for use in the notification process.

• NBI to share documentation on the prior notification procedure with the project team.

• Uganda to utilize bilateral engagements through the Ministry of Foreign Affairs to supplement the NBI process of notifying Downstream countries.

6. Conclusion:

The meeting observed that given the small percentage of abstraction and minimal impact on water levels, the impact on downstream Impacts and the overall river regime is considered not significant.

Attendance List of meeting Participants

NAME	ORGANISATION
Mr. Evans Kituyi	AfDB
Engineer Steven Ogwete (Transboundary Water Officer)	MWE
Eng. Ronald Katalo (Assistant Commissioner) WSSP	MWE
Eng. Ibrahim Jjemba (Project Coordinator)	MWE
Ms. Atim Racheal (Water Officer) – RWSA	MWE
Mr. Mugabe Motram (Senior Environment Officer)	MWE
Eng. Joseph Wasswa (Water Officer and Project Manager – Central Region) WSSP	MWE
Mr. Mekonnen Loulseged Task Manager (Water and Irrigation Systems Expert)	AfDB
Ms Grace Shittu (Economic and Green Growth Expert)	AfDB
Mr. Emmanuel Nyirinwaya (Fragility Expert)	AfDB
Mr. Siphwo Dlamini (Agri Business Officer)	AfDB
Mr Funso Somorin (Climate Change and Agri Business Officer)	AfDB
Dr. Micheal Kizza (Deputy Executive Director)	NBI
Ms Milly Mbiro (Water Officer)	NBI / NELSAP
Mr. Vincent Sebugwawo (Water Resources Modeler)	NBI
Mr. Richard Bavakure (Environmental and Social Safeguards Officer)	AfDB
Ms. Alice Abuyah Achieng (Environmental and Social Safeguards Officer)	AfDB
Mr. Victor Ampuriire (Environmental Officer)	MWE

APPENDIX B 11: LETTER OF NOTIFICATION TO THE RIPARIAN STATES

NILE-SEC
NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL

P.O. Box 192
Entebbe
Uganda

Telephone: +256 (417) 705000 / 117
Fax: +256 (41) 320 971
E-mail: nbisec@nilebasin.org

10th July, 2025

NBI/1.5/2025/11

To: Nile-COM Members

H.E. IR Prosper DODIKO
Minister of Environment, Agriculture and Livestock
Bujumbura, BURUNDI

H.E. MME EVE BAZAIBA MASUDI
Vice Prime Minister and Minister of Environment, and Sustainable Development
Kinsasha, DEMOCRATIC REPUBLIC OF CONGO

H.E. PROF. HANI SEWILAM
Minister of Water Resources and Irrigation
Cairo, EGPYT

H.E. DR. ENG. HABTAMU ITEFA
Ministry of Water and Energy
Addis Ababa, ETHIOPIA

HON. ENG. ERIC MURITHI MUGAA
Cabinet Secretary, Ministry of Water, Sanitation and Irrigation
Nairobi, KENYA

HON. DR. VALENTINE UWAMARIYA
Minister of Environment
Kigali, RWANDA

HON. DR JOSEPH GENG AKECH
Minister,Ministry of Youth and Sports
Ag. Minister, Ministry of Water Resources and Irrigation/Nile-COM Member
Juba, SOUTH SUDAN

H.E. ENG. DAWELBAIT ABDELRAHMAN MANSOUR
Minister of Irrigation and Water Resources
Khartoum, SUDAN

HON. JUMAA HAMIDU AWESO
Minister of Water
Dodoma, TANZANIA

Your Excellencies/Honourable Ministers,

Subject: **Notification Regarding the Proposed *Multipurpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation Project* – Uganda**

The Government of the Republic of Uganda has requested the support of the Nile Basin Initiative (NBI) in facilitating notification to Nile riparian states regarding the proposed *Multipurpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation Project* (hereinafter referred to as "the Project"). This notification is being made in accordance with the African Development Bank's Operational Policy on Projects in International Waterways and its Integrated Safeguards System.

The Project, to be funded by the African Development Bank (AfDB), is aimed at enhancing food security, improving climate resilience, and increasing household incomes in Kiryandongo and Masindi Districts of Uganda. It proposes an abstraction of up to 4 cubic meters per second (m^3/s) from the White Nile, which accounts for approximately 0.6% of the dependable flow (Q80) at the proposed intake site, located 18 kilometres downstream of the Lake Kyoga outlet.
The intended abstraction will serve multiple purposes, including:

(i) Provision of potable water to approximately 87,000 people;
(ii) Development of irrigation infrastructure covering approximately 13,000 hectares;
(iii) Support to industrial activities; and
(iv) Provision of water for an estimated 10,000 livestock.

The total capital investment for the Project is estimated at USD 210 million. All physical investments will be located within Uganda's territory in the Nile Basin. According to assessments carried out by the Government of Uganda and the African Development Bank, the anticipated impacts of the Project are considered modest and are not expected to cause appreciable harm to other riparian countries.

These conclusions are drawn from a detailed review of the Project's key infrastructure components, including:

(i) Water abstraction infrastructure;
(ii) Two water treatment plants (for drinking and irrigation purposes);
(iii) Conveyance and transmission systems;
(iv) Six storage facilities;
(v) Distribution networks; and
(vi) Ancillary infrastructure such as access roads and power supply.

The assessment concludes that the Project will have a negligible impact on cross-border water flows and a likely positive effect on water quality. Kindly review the attached information sheet, which provides further technical and environmental details.

We would appreciate receiving any comments your Government may have on the proposed Project by 16th August 2025, to enable us to transmit them to the Government of Uganda for its consideration.

We thank you for your continued cooperation in promoting equitable and sustainable management of the Nile Basin's shared water resources.

Accept Your Excellencies/Nile-COM Members, the assurances of my highest consideration and esteem.

Dr. Florence Grace Adongo
EXECUTIVE DIRECTOR

NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL
SECRETARIAT
P. O. BOX 192 ENTEBBE

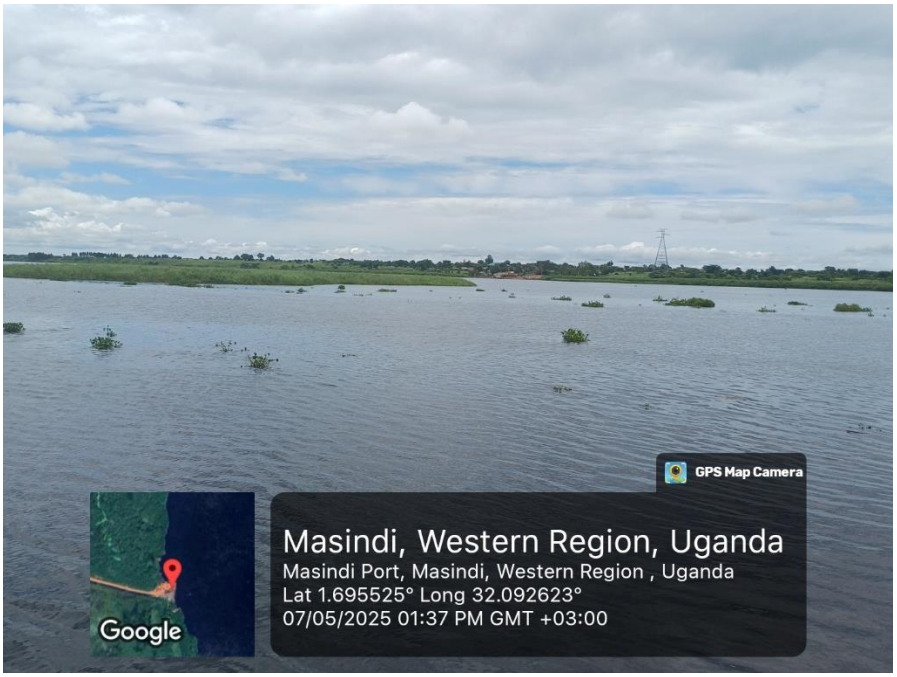
Copy: Hon. Sam Cheptoris, Nile-COM Chair
Nile-TAC Members

Attachments:
1. Summary of the Multipurpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation Project

APPENDIX C: BIODIVERSITY SURVEY REPORT

THE REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT

Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project in the Sub-Counties of Masindi-Port and Kigumba in Kiryandongo District; Mirya and Kimengo In Masindi District, Uganda



(Photo taken showing the intake area- left background)

Biodiversity (Ecological) Survey Report

May 2025

Table of Contents

Table of Contents 398
List of Tables 399
List of Figures 400
1. Background 400
1.1. Introduction 400
1.2. Justification of Biodiversity Surveys 400
2. Study Area 401
2.1. General Project Area 401
3. Methodology 402
3.1. Literature review 402
3.2. Consultations 402
3.3. Field surveys 402
3.3.1. Sampling strategy 402
3.3.2. Methods 403
3.3.3. Flora 404
3.3.4. Fauna 405
3.4. Impact analysis 410
4. Findings 412
4.1. Flora and vegetation 412
4.1.1. Vegetation Characteristics of the project area 412
4.1.2. Vegetation communities 422
4.1.3. Vegetation community structure 422
4.1.4. Species of ecological and Conservation importance 422
4.1.5. Protected Trees and Reserved Species of Uganda 423
4.1.6. Invasive species 424
4.2. Fauna 426
4.2.1. Birds 426
4.2.2. Mammals 428
4.2.3. Herpetofauna 430

4.3. Aquatic Biodiversity and Fisheries 435
4.3.1. Phytoplankton: 435
4.3.2. Zooplankton 435
4.3.3. Macro-invertebrates (benthic) fauna 436
4.3.4. Fish species composition and conservation status 437
4.4. Ecologically Sensitive Areas within the Project Area 439
5. Predicted Impacts 439
5.1. Impact Analysis 441
6. Conclusion and Recommendations 449
References 449
Appendix 1: Plant Species List 451
Appendix 2: Bird Species List 455

List of Tables

Table 1: Sampling points for amphibians 405
Table 2: Definition of significance criteria in the expert survey 410
Table 3: Rating scales for the criteria assessment in the expert survey 411
Table 4: Significance levels and scores for the expert survey 411
Table 5: Site Specific vegetation characterization of the project area 414
Table 6: Protected Trees and Reserved Species with the project area 423
Table 7: Mammal Species Recorded within and around the project area 428
Table 8: Amphibian species recorded 432
Table 9: Reptile species recorded within and around the project area 433
Table 10: Species composition and relative abundance of phytoplankton in water samples from selected sampling sites 435
Table 11: Species composition and relative abundance of zooplankton in water samples from selected sampling sites 436
Table 12: Diversity of Macro-invertebrates 436
Table 13: Relative abundance of fish species recorded during the Audit (P= Present and R= reported to exist during interviews) 437
Table 14: Photographic Representation of the Fish Species 438
Table 15: Predict impacts and mitigation measures 441

List of Figures

Figure 1: Location of the proposed MWACRID Project 402
Figure 2: Google image showing transects used and sampling points 403
Figure 3: Aquatic sampling points 409
Figure 4: Plant-Life Composition of the Project Area 422
Figure 5: Bird species per habitat type 426
Figure 6: Victoria Nile surrounded by riparian vegetation (wetland) 427
Figure 7: Bird species per project site 428
Figure 8: Species per genera 430
Figure 9: Reptile species richness within the different project components 431

Background

Introduction

The proposed Multi-Purpose Water for Climate Resilience and Irrigation Development for Livelihood Transformation (MWACRID) Project in the Sub-Counties of Masindi-Port and Kigumba (Kiryandongo District) and Mirya and Kimengo (Masindi District) are part of the Government of Uganda's effort to respond to the challenges caused by the overdependence on rain-fed agriculture. This is through the Ministry of Water and Environment (MWE), with funding from the African Development Bank (AfDB). The project also aims to provide treated water for domestic use in the project area, improving the public health, hygiene and livelihoods.

The project involves construction of various components such as the intake, treatment unit, reservoir and kilometers of transmission and distribution lines, that require land take and a suit of construction activities (clearing, excavations and levelling; compaction works, materials sourcing, civil works, concrete works etc). Some of these components and activities are in sensitive habitats such riverbank (for the intake) and Kaduku forest reserve (for the reservoir). Therefore, although several socioeconomic impacts are perceived from the project, it is important that the potential ecological impacts are carefully studied right from project planning and design so that proposals are made for managing ecological impacts and risks and ensure enhancement of positive ecological impacts.

Justification of Biodiversity Surveys

Flora and fauna are major indicators of both short- and long-term effects of environmental changes by observation of species composition and vegetation structure. Both flora and fauna have for long been used as environmental indicators due to their sensitivity and reactions to different environmental changes hence the need for their survey to gather baseline data before undertaking projects that are potentially impactful to the environment.

The general objective of the study was to contribute to informed decision-making by taking into consideration the possible ecological impacts and risks due to the proposed project.

The specific objectives of the surveys include to;

- Determine the diversity and distribution of flora and fauna within and around the project area
- Assess the conservation concern of encountered species regarding IUCN Redlist of species.
- Identify ecologically sensitive sites/hotspots, altered habitats and provide a quick review of flora assemblages at the proposed sites
- Identify and predict potential impacts and possible mitigation measures of various project activities on the biodiversity and ecosystems.
- Develop an ESMP for managing and monitoring biodiversity within and around the project area especially during construction and operation/maintenance phases of the project.

Study Area

General Project Area

The project area spans both Masindi and Kiryandongo Districts in Uganda. Masindi District, located in the mid-western region, covers approximately 4,200 square kilometers and is bordered by Kiryandongo to the east, Nwoya to the north, and several other districts. Kiryandongo District, also in western Uganda, covers around 3,600 square kilometers and shares borders with Nwoya, Masindi, and other neighboring districts. Masindi Port, the project's proposed water source catchment area, lies along the western banks of the Nile River, about 194 km northwest of Kampala and 49 km from Masindi town. Known for attracting tourists for various leisure, religious, and business purposes, Masindi Port is strategically located near the Nile River, which serves as the primary water source for the project. Its coordinates are 1°41'54.0" N, 32°04'40.0" E.

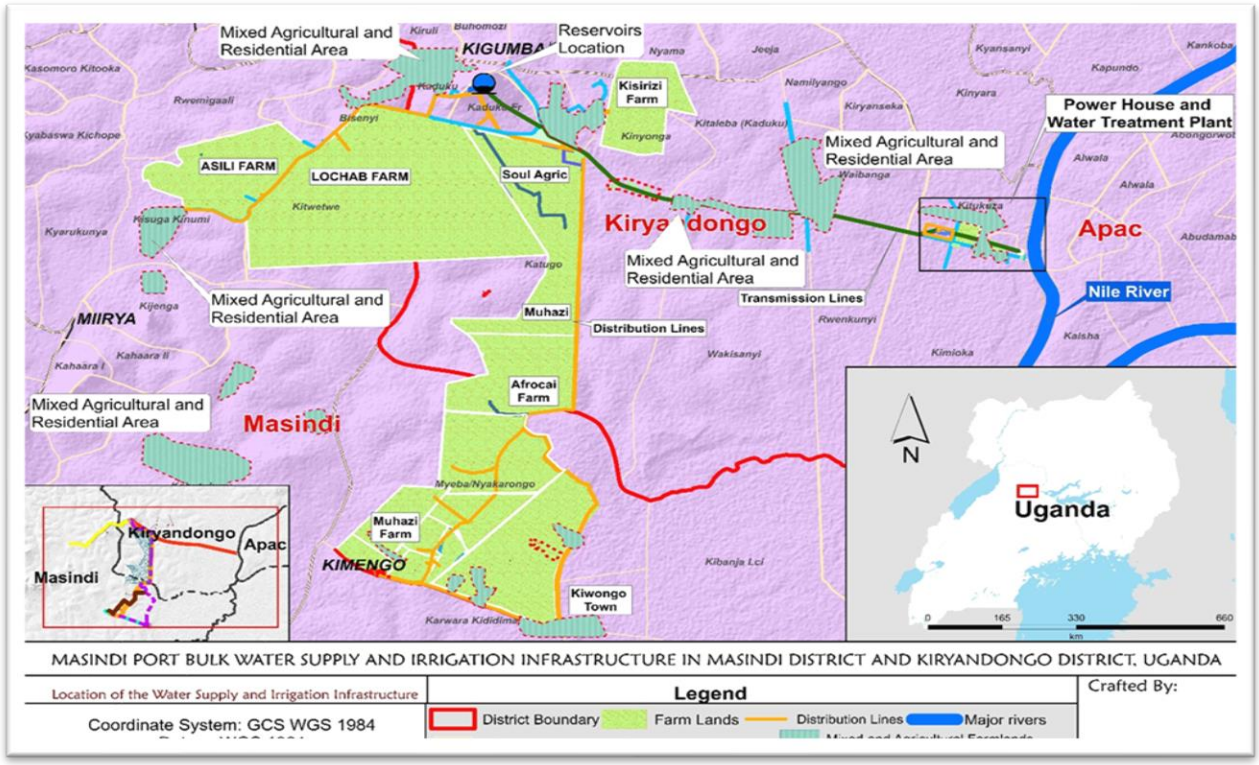


Figure 10-1: Location of the proposed MWACRID Project

Methodology

To ably collect data and assess impacts of the project activities on biodiversity within the project area, a mixture of methods was deployed including literature review, consultation (authorities and residents) and field surveys.

Literature review

Review of literature involved project related documentation, project scoping report and terms of reference, district development plans, biodiversity related information published within the project area including previous ESIA for projects within the project area.

Consultations

Consultations involved both local authorities and residents. It is understood that residents have a high understanding of the area as they interact with the environment daily and therefore have valuable information regarding biodiversity in the area.

Field surveys

Sampling strategy

Field surveys were conducted in May 2025 to collect site specific data and ground proof information gathered through literature review and consultation. Data for the various survey sites were captured using a GPS Garmin 64s" in World Geodetic System 1984 (WGS 84), and the coordinates displayed in Universal Transverse Mercator (UTM) projection.

Since the project comprises different components such as intake, powerhouse, treatment area, reservoir, transmission and distribution lines, the project area of influence for biodiversity surveys was determined differently for flora and fauna given the fact that one is immobile and the other is highly mobile, respectively. For fauna, an area of 1km radius from the project component was considered to accommodate for opportunistic encounters. On the other hand, survey for flora was restricted within the project site footprint. For habitats, a landscape approach was adopted mainly to appreciate the different habitats that the project traverses especially for the linear components.

At site level, transect method was used, setting sampling points at given interval depending on the project component. For the transmission and distribution lines, sampling points were set at intervals of 250 meters, although short sections were considered in pristine and natural habitats, yet longer intervals considered for highly disturbed/modified habitats such as settlements and cultivation lands. For nonlinear components transects were established across the project components, the length depending on the size of the project component (Figure 2).

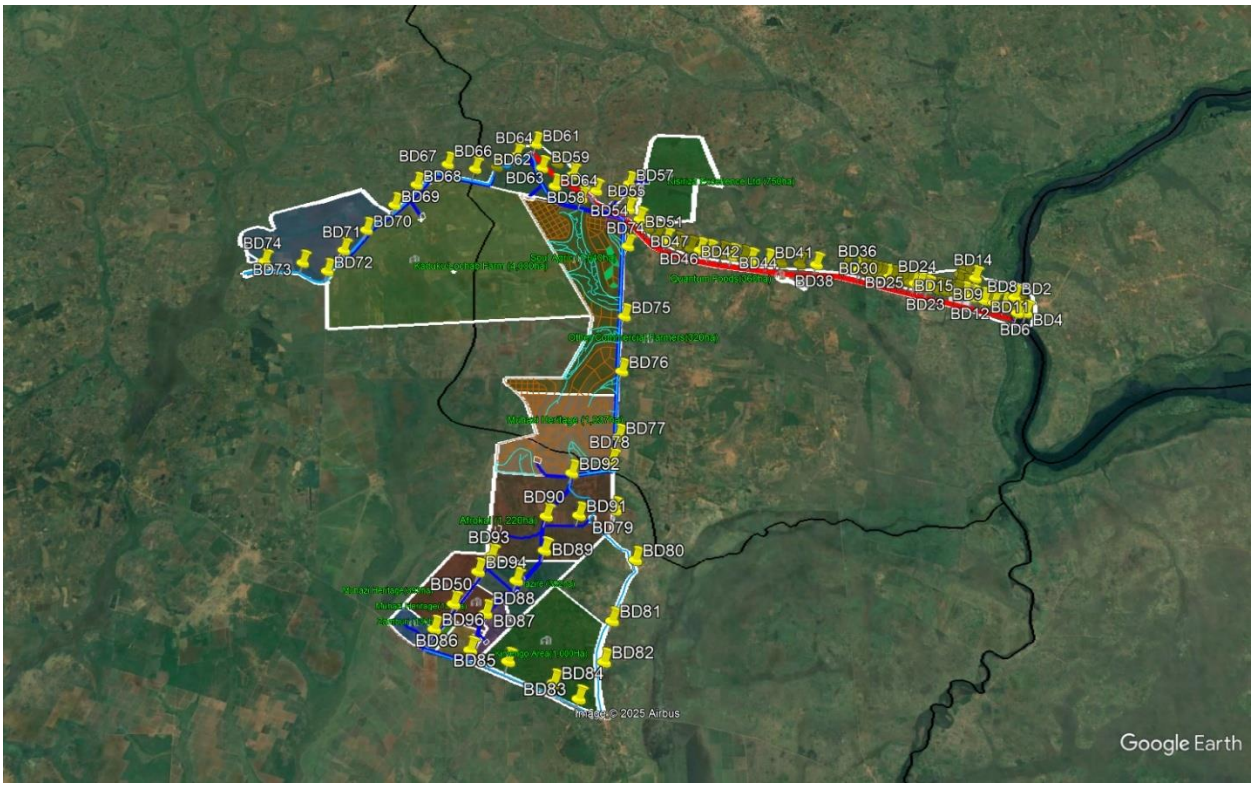


Figure 10-2: Google image showing transects used and sampling points

Methods

Different methods were adopted for the different taxa i.e., flora and fauna as described in the following sections.

Flora

Habitat classification:

Langdale-Brown et al (1964) mapped the vegetation of Uganda, which identified 22 plant communities. Langdale-Brown (L-B) classification determined the Potential Natural Vegetation (PNV) in areas that have undergone modification, presumably under the influence of man. The L-B classification is based on plant community composition rather than just plant biomass, which is more relevant to the goal of characterizing vegetation and identifying sensitive habitats. Secondly, although much of Uganda's vegetation has been extensively altered over the past three-four decades, the L-B classification can still be considered to epitomize the potential of an area to support an ecosystem type (Kalema, et al., 2010; Pomeroy, et al., 2002). Finally, the L-B classification provides 22 vegetative categories opposed to 13 categories adopted by the National Biomass System (USAID 2014). This greater level of resolution allows us to assess the potential impacts of development activities on ecosystems at a finer scale.

Floral characteristics of the project area

To study the floral structure and diversity of, and within the project area, field observations were employed with use of GPS machine to lay plots along the right of way of the proposed road upgrade. The project area being situated mainly along modified habitats (farmlands and road network) to built-up landscape, a few encountered trees were measured for DBH at 1.3m breast height, while height was determined by help of hypso-clinometer, estimates, and Diameter tapes. Floral keys and guidance books were used (see; Kalema and Hamilton, 2020; and Namaganda et al., 2004).

Sampling

A field Survey Walk of the proposed project components was conducted in May 2025, to identify potential areas that could be of ecological concern and need attention during the construction phase if avoidance is hard. The choice of sampling sites was rather purposive based on ecological knowledge, habitats such as wetland and river crossings, species of conservation concern among others. Sites were also identified considering their naturalness, ecological sensitivity and habitat variability. All efforts, however, were made to get the points where most disturbances are expected. All sample sites were geo-referenced, and characterization was based on the floristic and landscape features observed at different sites.

The Botanist considered the proposed transmission and distribution lines as a general transect line and traversed it making points of interest (250 meters intervals) although short or longer sections were considered depending on the nature of the habitats.

A plant species list (richness) was generated and analyzed based on presence, and against the IUCN Redlist of threatened species and ecosystems.

Species and habitat sensitivity, and conservation status

Species richness, abundance, invasive, and sensitive habitat were also investigated. Sensitivity of habitats was assessed from presence of i) threatened taxa in accordance with IUCN and WCS conservation assessment protocol, ii) rarity, iii) endemism; presence of iv) fragile watersheds, v) steep slopes, and vi) riparian areas.

The conservation status of each species was obtained from the 2020 published IUCN redlist data and the National redlist of Uganda's threatened species (Wildlife Conservation Society, 2016). Through examining published distribution records and literature, assessments of the limits of distribution range of the different species, new records, and lack of records of expected species, was undertaken.

Fauna

Herpetiles:

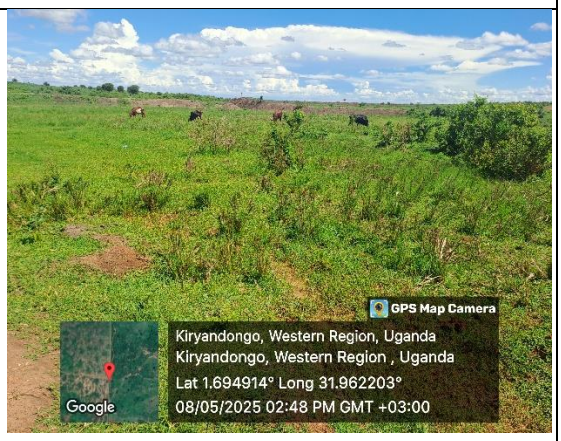
Herpetofauna (reptiles and amphibians) were surveyed using a combination of scientifically tested methods as described by Heyer et al, (1994); Fellers and Freel, (1995); Halliday, (1996); and Olson, et al, (1997). The methods included the following:

i. Visual Encounter Surveys (VES): The method involved moving through a habitat watching out for and recording surface-active herpetofauna species. VES was complimented by visual searches, by examining under logs, leaf litter, in vegetation and crevices. Species encountered were recorded and where possible photographed.
ii. Audio Encounter Surveys (AES): This method uses species-specific calls / vocalizations / sounds / advertising calls made by breeding males. The identity of the amphibian species heard calling, and their numbers were counted and recorded.
iii. Dip netting: Using a dip net, ponds, pools, and streams and other water collection points were dip netted. Adult amphibians and tadpoles encountered were recorded.
iv. Opportunistic Encounters: Herpetofauna species encountered opportunistically while moving in the project area were also recorded.

The methods were used within 200metre radius around the sampling points chosen based on the different types of habitats represented in the project area including wetlands, woodlands and farmlands / gardens.

Table 1 shows the sampling areas (aquatic habitats) for amphibians.

Table 10-1: Sampling points for amphibians

Sampling Point	Coordinates (UTM 36N)		Photos
	Eastings	Northings	
Intake (Victoria Nile)-Papyrus dominated riparian vegetaion	399079	187375	
Wetland along the distribution line through Soul-agric farm. Seasonal wetland ponded with water at the time of survey	384487	184860	
Transmission/distribution line. Seasonal wetland under serious stress from grazzing	384672	191243	

Reptiles were identified using (Schiøtz, 1975, 1999; Stewart, 1967) while amphibians were identified using Channing and Howell (2006). Data was analyzed by 1) compiling Species checklist, 2) determining the

species conservation status using IUCN 2019 published Red List of threatened species as well as using the National Red List for Uganda published by Wildlife Conservation Society in 2016.

Mammals:

The mammals were surveyed using three main methods:

i. Direct observation/opportunistic encounters: This entailed the collection of direct evidence of fauna activity (e.g. sightings, vocalizations). All mammals that were seen or opportunistically sighted or heard vocalizing while moving in and around the project area were identified, counted and recorded;
ii. Use of Signs e.g. footprints and/or dung or calls: This entailed the collection of indirect evidence (e.g. faeces or dung, footprints). Mammal species whose signs / indirect evidence were recognized were recorded for their presence; and;
iii. Local consultations: The fauna specialist held discussions with residents in and around sampling points about the availability of mammal species in the project area.

Nocturnal mammals were excluded since the survey was conducted during daylight hours. Mammal identification was based on Kingdon (1974), Delany (1975) and Kingdon et al. (2013). However, these were recorded through literature survey and consultation.

The conservation status of the encountered mammal species was ascertained using the 2020 version of the IUCN Red List of Threatened Species.

Birds:

A combination of Timed Species Counts (TSCs), transect walks and opportunistic observations was used to survey bird fauna diversity within the project area (Bibby et al., 2000 and Voříšek et al., 2008). The survey targeted the different habitats identified in project locations.

The ecologist walked along the transect searching for the presence of birds. Each TSC lasted one hour, during which time all bird species seen or heard were recorded in order of detection. The Timed Species Counts (TSCs) and transect walks were supplemented with opportunistic observations by recording species found present within the project area outside the time of the count. Species identified through visual observations and species identified by their vocalizations were also recorded. The fauna ecologists' eye was aided by a 10 x 40 binocular. Efforts were made to sample the different habitats represented in the project area. Sampling was conducted in the early morning and towards the evening. All identifications were made to species level. Birds that were recorded during the survey were ecologically characterized using the following criteria:

Main Category	Sub-Category		Descriptions
Forest Birds	FF	Forest Specialist	Forest interior birds

Main Category	Sub-Category		Descriptions
	F	Forest generalists	Normally breed in the forest or fragments but may occur outside the forest
	f	Forest visitors	Non-forest birds
Aerial	AA	Aerial feeders	Species feeding on the wing
Water Birds	W	Water specialist	Restricted to wetlands or open water
	w	Water generalist	Often found near water
Grassland	G	Grassland specialist	Characteristic of open grasslands
	g	Grassland generalist	May be found in grassland habitats but also able to utilise woodland and forested habitats.
Migrants	A	Afrotropical	Species migrating within Africa
	P	Palaearctic	Species breeding in Europe or Asia
	Ap	Afro-Palaearctic	Species with both Palaearctic and Afrotropical populations

Data analysis was done by 1) compiling Species checklist, 2) determining the species conservation status using IUCN 2020 published Red List of threatened species as well as use of the National Red List for Uganda published by Wildlife Conservation Society in 2016.

Aquatic biodiversity and Fisheries

An aquatic biodiversity and fish survey was carried out on the River Nile at the pier because that is going to be the water source for the project. All the other planned stations like Treatment point, reservoir, transmission and distribution lines did not have water. There were no other wet/ flowing waterbodies within the project area during the survey time.

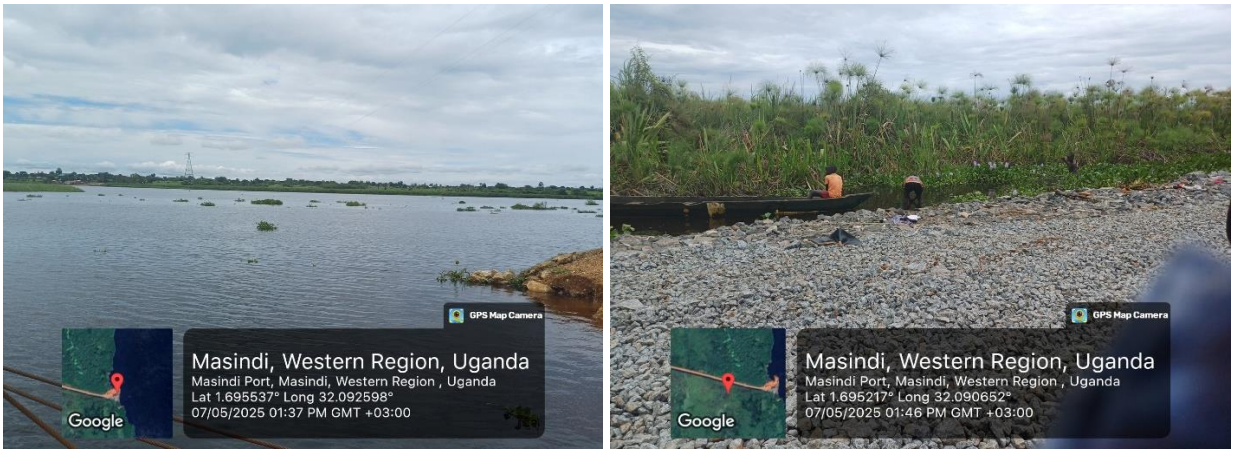


Figure 10-3: Aquatic sampling points

Materials and Methods:

Phytoplankton sample preparation and identification:

Water samples for phytoplankton species identification were collected using a water sampler. A small portion of twenty (20) ml was separated and preserved using Lugol's solution in brown glass bottles for further analysis in the laboratory. Using an inverted microscope, the phytoplankton was identified up to species level into blue-green algae, green algae, diatoms and flagellates by means of standard techniques (APHA, 1998).

Zooplankton sample preparation and identification:

Water samples were collected using a water sampler. A sample of 1000 ml was filtered using cellulose acetate membrane filters (pore size 0.45µm) and preserved in labelled sample bottles with ethanol (50 %). Total counts (all individuals in the sample) of zooplankton were made for each sample using a Sedgwick rafter cell on a stereo microscope. Identification was done up to species level for rotifers and for micro crustaceans using standard identification keys (Fernando, 2002).

Benthic /macro invertebrate fauna sample preparation and identification:

The Ekman-Birge-grab 15x15x15cm was used to get samples for the benthic fauna. The samples were sieved using benthic net of 0.5 mm mesh in order to remove fine sediments and other extraneous materials. The samples were preserved in 50% ethanol for later identification in the laboratory.

Fisheries data collection:

Fisheries data was collected through discussions with the fisher community and the workers at the pier. The fish checklist album guide was used for respondents to identify which fish species they usually encountered in the river. Expert analysis/observation of fish presence at the water surface and fish landed by the fishermen was applied to determine fish species composition.

Impact analysis

The potential impacts likely to arise from implementation of the proposed project were evaluated based on a four-point scale. The scale definitions were adopted to the local level addressed in this study (Table 2). The impacts were evaluated against four criteria intensity, geographic extent, duration and likelihood (Terrapon-Pfaff et al., 2017). *Intensity* refers to the level to which an impact has effects on the livelihood of the local population, G*eographic extent* describes the scale of the area affected, *Duration* defines the time span the impact continues to affect the livelihoods from the time it emerges and onwards and *Likelihood* relates to the probability of the occurrence of an impact.

Table 10-2: Definition of significance criteria in the expert survey

Criteria	Scale	Definition
Magnitude/Intensity	No	No impact / livelihoods not affected
	Minor	Low impact / no substantial effects on livelihoods
	Low	Moderate impact / moderate effects on livelihoods
	Moderate	High impact / substantial effects on livelihoods
	High	Very high impact / very extensive effects on livelihoods
Extent	Within Limited Area	Communities along the proposed water supply system
	Local	Within Buikwe District
	Widespread	Outside Buikwe district
Duration	Momentarily	0-1 year
	Short-term	2-5 years
	Medium-term	5-15 years
	Long-term	20 years
	Irreversible	Permanent
Likelihood/Probability	None	Impact will not occur / has not yet occurred
	unlikely	Impact is unlikely to occur / has not yet occurred
	Likely	Impact is likely to occur / has not yet occurred
	Most Likely	Impact is most likely to occur / has already occurred
	Definite	Impact will definitely occur / impact has occurred

Significance evaluation

Based on the outcomes of the expert survey, the impact significance was determined. To this end, the results for each criterion were translated into scores, which were the aggregated into a final significance score. In the *first step*, the evaluation results were translated into numerical values taking the confidence levels into account. As no commonly accepted method exists for this process It is recommended to divide each level of the scale into three intervals based on the certainty level (Table 3). In this way, the final value for each of the criterion also depends on the certainty of the expert judgments.

Table 10-3: Rating scales for the criteria assessment in the expert survey

Symbol	No	minor	Low	Moderate	Very High
M=Magnitude	0	2	4	6	10
P=Probability	0	1	2	3	5
E= Extent	0	1	2	3	5
Duration	Momentarily (0-1 year); Short-term (2-5 year); Short-term (2-5 years); Medium term (5-15 years); Long term (15-20 years); Irreversible (Permanent)				

In the *second step,* the scores of each criterion and for each impact were aggregated into a final score, which could then be translated into a significance level. Various arguments exist for or against different methods of aggregation, but no commonly accepted aggregation rule exists.

In this study, to aggregate the criteria scores, it was decided to draw on risk assessment research which stresses the importance of the probability of an event followed by the extent of its consequences, applying the following aggregation rule:

Significance= $L_! \times I_! + G_! + D!$, Where;$L!$ =Likelihood of impact *I,* $I!$ =Intensity of impact *I,* $G!$ = Geographic extent of impact *I,* and $D!$ =Duration of impact *i*

The values for intensity (*I*), duration (*D*) and geographic extent (*G*) are added together and then multiplied by the value assigned to the likelihood (*I*) criteria, resulting in a range of scores between 0 and 75. The main weakness of the aggregation function is the risk that an impact rated unlikely to occur, but which could have irreversible consequences, could be overlooked. To avoid this risk, the results must be carefully assessed by the researcher after the aggregation to avoid relying solely on the numerical outputs. Once the final scores for each impact are calculated, they must be translated into impact significance levels. We differentiate between four significance levels (very high/high/moderate/low), which are based on the score ranges listed in Table 4.

Table 10-4: Significance levels and scores for the expert survey

Significance	Scores	Description
Very low	0-15	impact or impact of very low order
Low	16-30	Only very limited effects; social, cultural and economic activities of communities
		continue unchanged

Moderate	31-45	Medium level impact affecting a limited number of people in a small area for a limited time span
High	46-60	Probable impact with high effects on the livelihoods of communities, affecting many people or having a long-term effect
Very High	61-75	High probability and very high level of effects in a widespread area and with long-term effects on the livelihoods of communities

Findings

Flora and vegetation

Vegetation Characteristics of the project area

The natural vegetation of Masind and Kiryandongo district comprises of forest, dry and humid Savannah with Elephant grass prolific throughout the area. This type of vegetation provides a diverse habitat for a variety of birds and animals. The vegetation cover on these hills is dominated by moist medium-altitude forests, while the valleys contain permanent swamps. The hill vegetation provides an excellent watershed system for the drainage southward and south-east into the River Kafu, which in turn flows into the Victoria Nile. The five broad categories of vegetation of Masindi district include: tropical forests, savanna grassland and savanna woodland, swamps (permanent and seasonal) and post cultivation communities and communities where cultivation is taking place. Three vegetation or land cover types describe the project areas – that is farmlands, shrublands and swampy vegetation especially at the intake situated at the shores of Victoria nile.

Most of the vegetation within the farmland area (See Table 5) is predominantly bushlands of Acanthus sp-Flacoutia indica-etc), thickets of shrubs (Bridelia micrantha, Rubus apetalus, Rhamnus prinoides, Gymnathemum amygalinum, Trema orientale etc) and emergents of Erytherina abyssinica, Sambucus canadensis, Vangueria madagascariensis and commercial farmlands of Saccharum officinarum, Persea americana, Anacardium occidentale, Zea mays among others, with most vegetation dominated by weedy-with grass and herbaceous species dominant, even though a remnant tropical tree species, and shrubs were encountered during the survey.

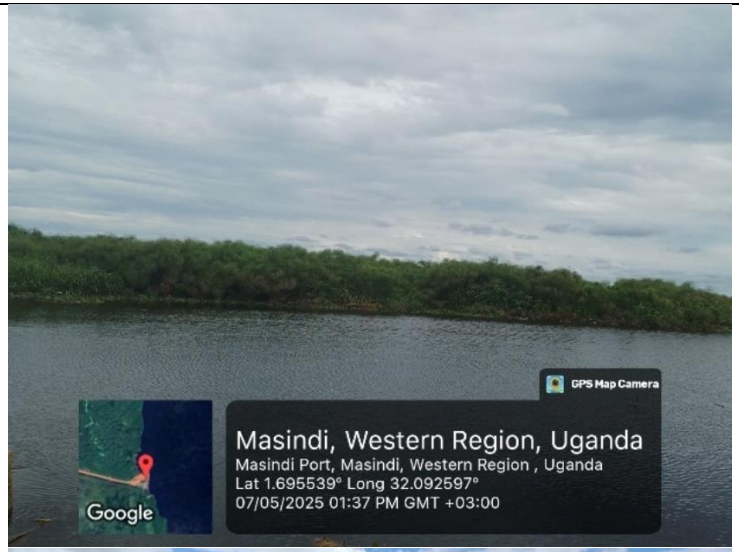
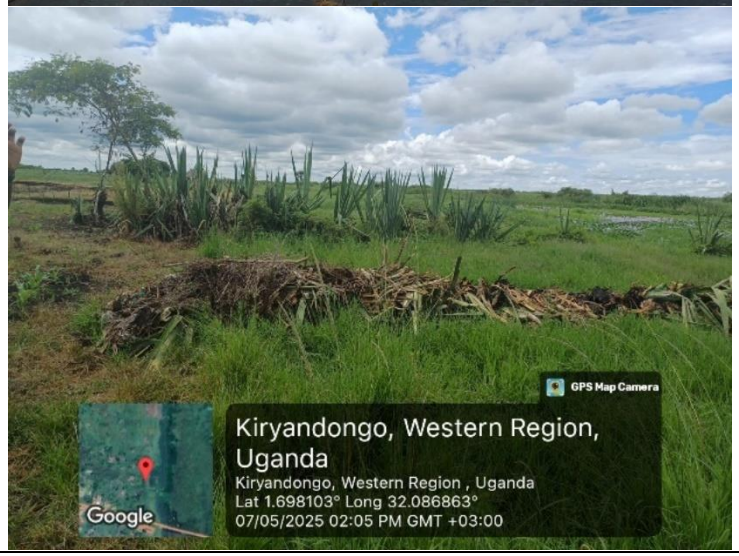
The swamp vegetation is comprised of largely a permanent river (Victoria Nile) at the intake and three seasonal wetlands along the transmission/distribution lines. The river is a continuation of the greater River Nile, defining the boarder of Masindi and the Apac district, here is the intake facing a pure Papyrus wetland shoreline largely dominated by assemblages of Cyperus papyrus, Typha capensis, Agave sisalana, Cyperus latifolia, Leersia hexandra, Cyperus distans however the shoreline is largely infested with invasive

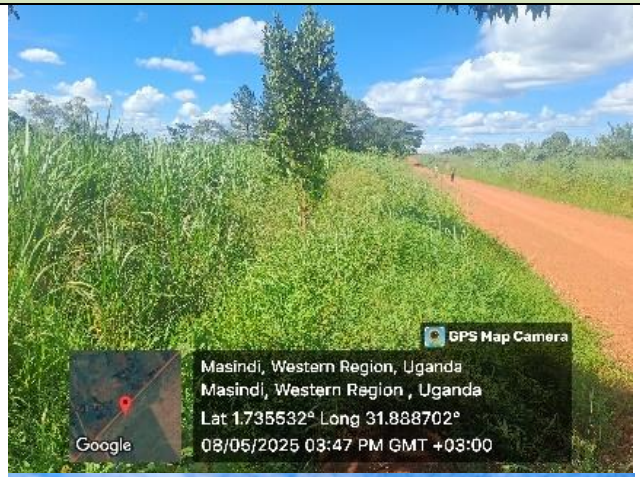
species namely Water hyacinth-Eichhornia crassipes, and Chromolaena odorata were recorded during the survey

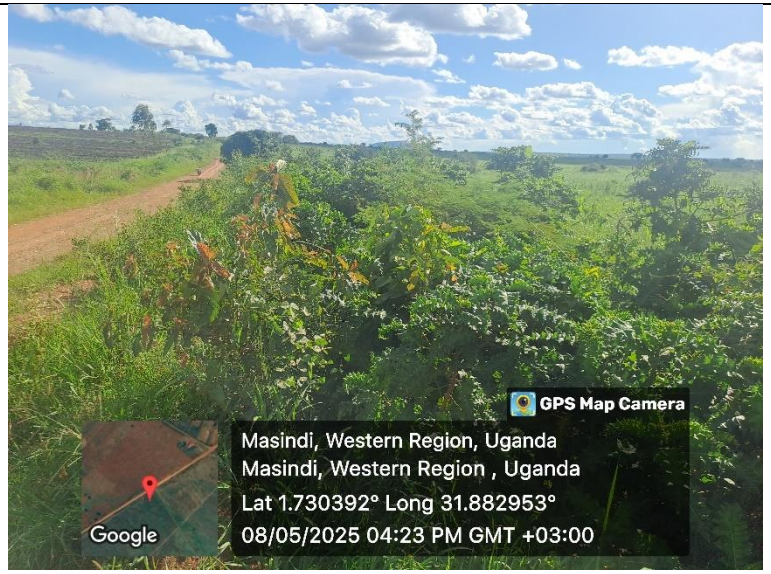
Indirect impact of such developments on these habitats are discussed in this assessment report.

Table 10-5: Site Specific vegetation characterization of the project area

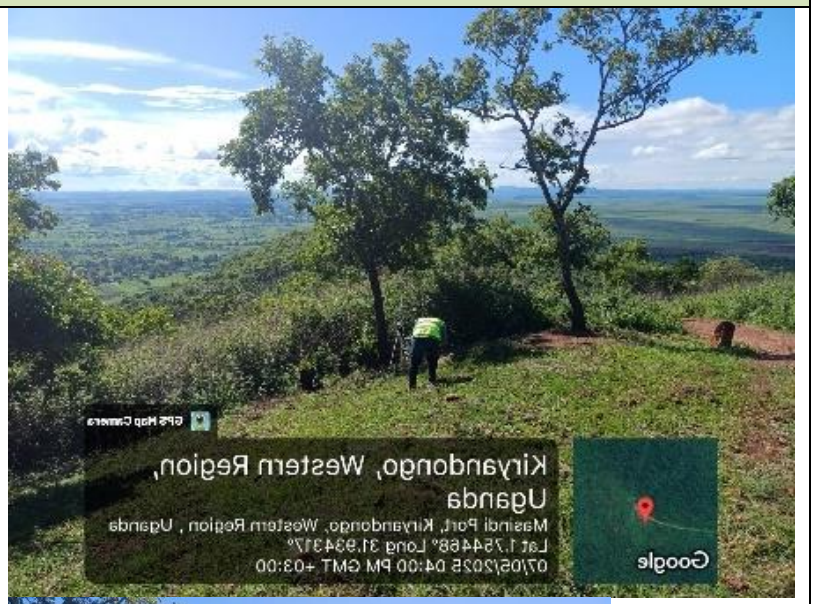
Project component	Description	Photo catalogue

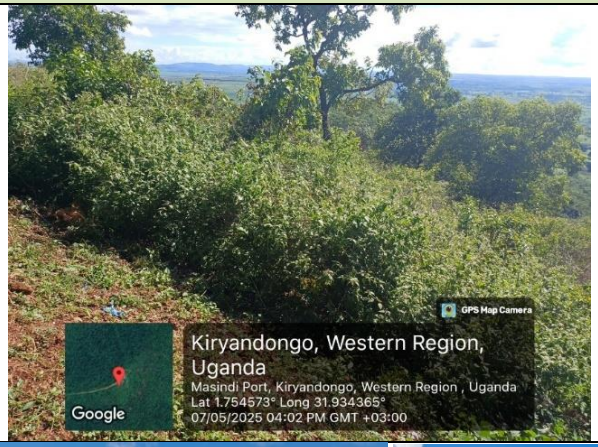
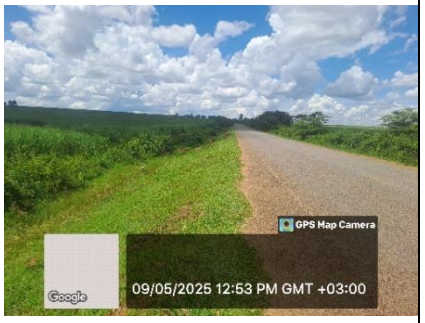
Intake and Powerhouse	The Intake extends towards the Victoria Nile – largely characterized by wetland vegetation with species such as Cyperus *papyrus, Typha capensis, Agave sisalana, Cyperus latifolia, Leersia hexandra, Cyperus distans.* The powerhouse on the other hand is located about 600m away from the intake; here being a modified habitat with farmlands, remnants of shrubland vegetation intertwined with marshland were observed. Key species recorded were *Agave sisalana, Albizia coriaria* – a reserved tree species, and invasive species assemblages of *Lantana camara, Senna spectabilis, Chromolaena odorata, emergents of Ficus sp* and *Combretum spp.*	 

Project component	Description	Photo catalogue
Transmission Main	The transmission line stems from the intake in Masindi port area – marshland area towards the treatment unit in the area under subsistence farms and largely under farrowing. The line continues with Masindi Port Road towards Kaduku forest reserve. The reserve is largely a shrubland dominated by *Combretum molle,* and *C. colllinum, Persia americana, Acacia seyal and Sesbania sesban* are evident along access roads and grass species of *Themeda triandra, Cynodon dactylon* Along the transmission line, reserved and protected trees were recorded that is; - *Mangifera indica* - *Albizia coriaria* - *Albizia zygia* - *Artocarpus heterophyllus*	 

		 GPS Map Camera Masindi, Western Region, Uganda Masindi, Western Region , Uganda Lat 1.730392° Long 31.882953° 08/05/2025 04:23 PM GMT +03:00 Google 

Project component	Description	Photo catalogue
Treatment Unit area	This area is largely under farrow and thus recorded a heavy infestation of *Chromolaena odorata and Senna obstifolia.* Emergents of *Acacia spp, Combretum spp, Croton africana*, *Lovoa swynnertonii* – NT species, *Cordia dichotoma*. These are generally remnants on the farm and thus highly reserved. Other species included annual crops such as *Zea mays, Manihot esculenta*	

Project component	Description	Photo catalogue
Reservoir Unit area	Located past Kaduku forest reserve, it is surrounded by shrubs and thickets of Acacia. It is mostly covered by grass savannah derived from forest wooded savannah with species of Acacia. The Acacia species include Acacia general and *Acacia hocki*. There are also *Combretum molle* and *Erythrina abyssinica, Annona senegalensis* but in the southern part of the area, the woodland dominated by *Acacia seyal* and *Sesbania sesban* is evident. *Chromolaena odorata* was the most abundant invasive species in this area	 

Project component	Description	Photo catalogue
		
Distribution network	This is the large portion of the study area all the way from the reservoir area to the furthest farms of Kimengo, Norman, Kazire among others. The distribution network largely traverses areas under pure stands of *Saccharum officinarum, Zea mays, Anacardium occidentale, Manifera indica* among others. Emergents of Azadirachta indica are noticed within the expanses of Zea mays farmlands	   

Vegetation communities

A full checklist of all species encountered along the project area is presented in Appendix 1. A total of 82 plant species from 81 Genus representing 40 families, majority of which are grassland, weedy species were recorded during the survey. The most dominant species, Herbs, Grass were. *Acanthus sp, Dichrostachys cinera, Biancaea decapetala and Eragrostis sp*. Figure 4 shows the most abundant life form-Grass encountered during the study

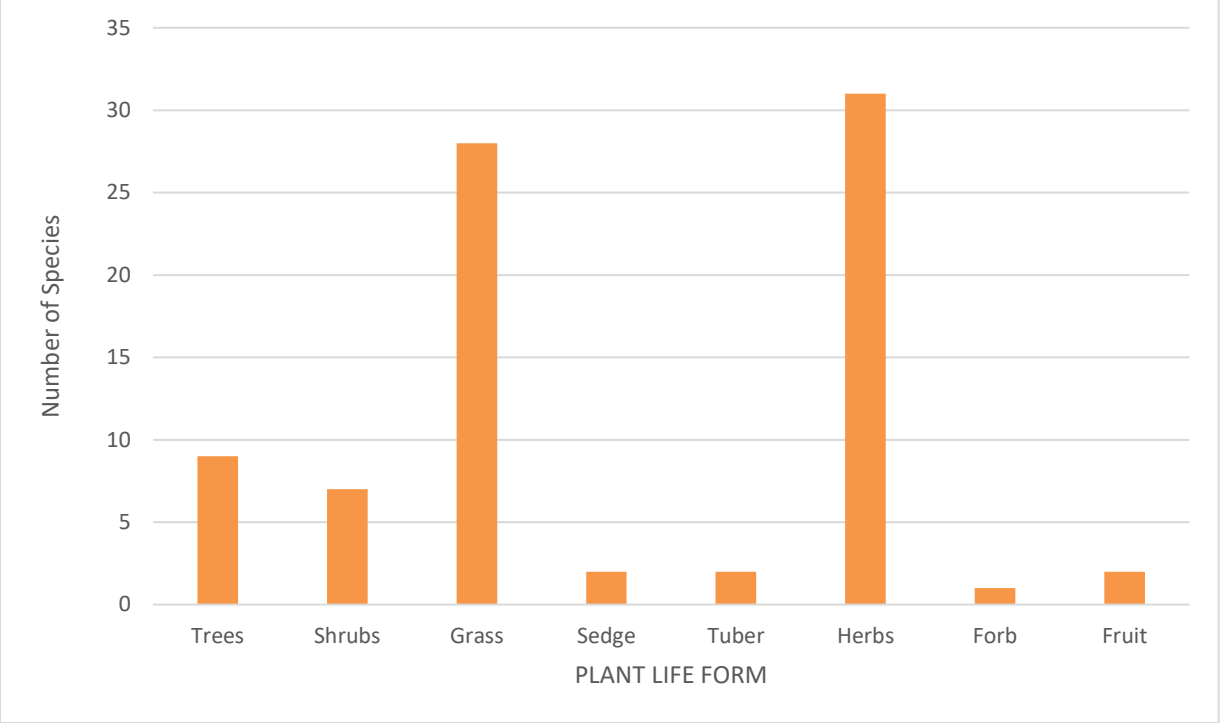


Figure 10-4: Plant-Life Composition of the Project Area

Vegetation community structure

Nearly all survey points within the proposed project area had trees and shrub individuals in the emergent tree layers whose heights were over ranging between 2-5m for trees and shrubs, especially the Eucalyptus grandis, Erytherina abyssinica, and Mangifera indica, fruit trees such as Persia american and Mangifera indica especially within the commercial gardens with Zea mays, Sorghum bicolor. However, many plants in the shrub layer were between 1-2 m and those in the herbaceous and grass layers between 0-0.5 m. Generally, habitat modification within the project area was evident as there was seemingly a homogenous dominance of bushed vegetation of Acanthus sp- Chromolaena -Erytherina bushlands across the surveyed area. Lantana camara, Pontederia crassipes, Senna obstifolia, Ricinus communis, Acanthus sp, Dichrostachys cinera, Chromolaena odorata, and Mimosa pigra were the most evident invasive species across all the project area.

Species of ecological and Conservation importance

While *Lovoa swynnertonii* – NT was the only species of conservation concern encountered during the survey, *Mangifera indica, Albizia spp* were the protected and reserved trees in the project area. It is understood that local ordinances exist for their conservation and will need to be monitored during the construction phase of the project, therefore, the rest of the species encountered during the study were categorized as least concern (LC) as per the IUCN list of threatened species (IUCN, 2021). The details and possible effects of the proposed water transmission and distribution network on vegetation have been provided in Table 5 based on occurrence along the project area.

Protected Trees and Reserved Species of Uganda

The Ugandan government declared that tree species under section 30 (1) and (2) of the National Forestry and Tree Planting Act, 2003 as National List of Reserved Tree Species and the list is specified in Schedule 8, of the National Forestry and Tree Planting Regulations, 2016.

During a botanical survey, it was established that 3 protected and reserved tree species (that is Mangifera indica, Albizia spp) will be affected by the proposed transmission and distribution network developments. Erytherina abyssinica was the dominant and most encountered species largely because it had been used as a boundary plant by farmers details are provided below.

Table 10-6: Protected Trees and Reserved Species with the project area

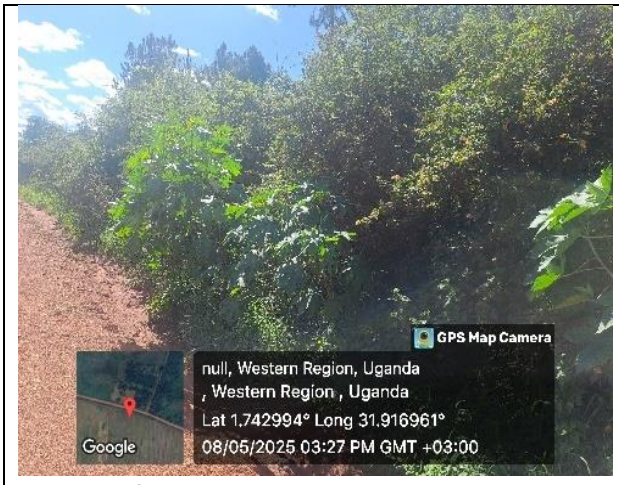
#	Species	Location (GPS Coordinate)
1	*Albizia coriaria*	 Encountered and observed within the farmland at multiple locations but also at the pump house (397405, 187932)

#	Species	Location (GPS Coordinate)
2	*Mangifera indica*	

Most of these species were observed on farmlands and within the road reserves. Schedule 9 of the National Forestry and Tree Planting Regulations, 2016, specify the need for permits to cut protected and reserved trees.

Invasive species

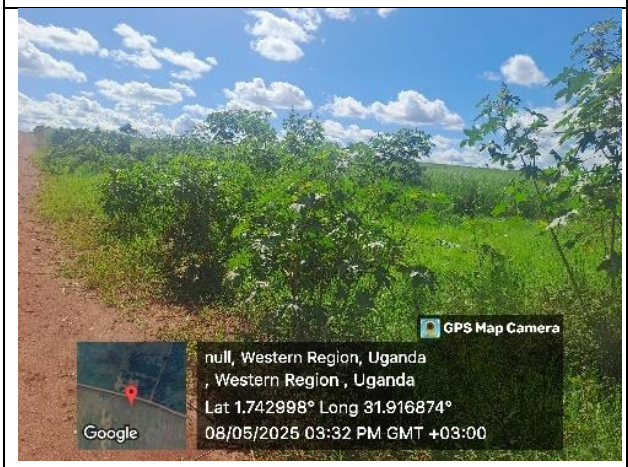
Ten (10) invasive alien species were encountered along and within the project area and these include *Chromolaena odorata (397370, 187903), Lantana camara* (394542, 188555)*, Oxalis latifolia*, *Xanthium strumaium* (393447, 188890), *Bidens Pilosa, Acanthus sp, Dichrostachys cinera, Biancaea decapetala, Senna spectabilis,* (383188, 192298), *Ricinus communis*. These species were reported as invasive under global invasive species list (Cronk & Fuller 2001, Saul et al, 2017) due to their ability to suppress herbaceous plants and their high dispersive power and regenerating potential engineered by any magnitude of disturbance within the community. Unlike others, *Xanthium strumaium,* within cultivated fields and *Oxalis latifolia, was* of particular concern because of their production of poisonous seeds that kill birds, given the rate it occupies extremely disturbed sites in any vegetation community.



Pockets of *Lantana camara*



Chromolaena odorata



Ricinus communis



Acanthus pubescens



Senna obstifolia



Pontederia crassipes

Plate 1: Invasive Species Encountered in the Project area

These species require careful management and monitoring to restore and protect the integrity of the remnant natural vegetation within the project area.

Fauna

Owing to habitat degradation and modification, the fauna of the project area is generally low compared to what the Pearl of Africa is known to harbour. The existing fauna mainly occurs in the Victoria Nile riparian vegetation and Kaduku Forest reserve. The ones in the bushes are the common species that have evolved to survive alongside anthropogenic disturbances. The occurrence of the different species of fauna has been presented separately for the different taxa i.e., birds, mammals and herpetiles.

Birds

A full checklist of all bird species encountered along the project area is presented in Appendix 2. 161 species of birds were positively identified and recorded.

The project area generally has relatively high bird diversity represented by species with different habitat requirements. This is attributed to the habitat heterogeneity of the area as the encountered birds belong to Forest Visitors, Forest Generalists, Forest Specialists, Grasslands, Open Woodland, Water Specialists and Water Generalists.

Forest Visitors were the most common birds represented by 43 species, followed By Open Woodland (36), Water Specialists (32), Grassland Specialists (25), Forest Generalists (11), Forest Specialists (08). The least common bird category was the Afrotropical Migrants and Water Generalists, both represented by 03 species respectively (Figure 5).

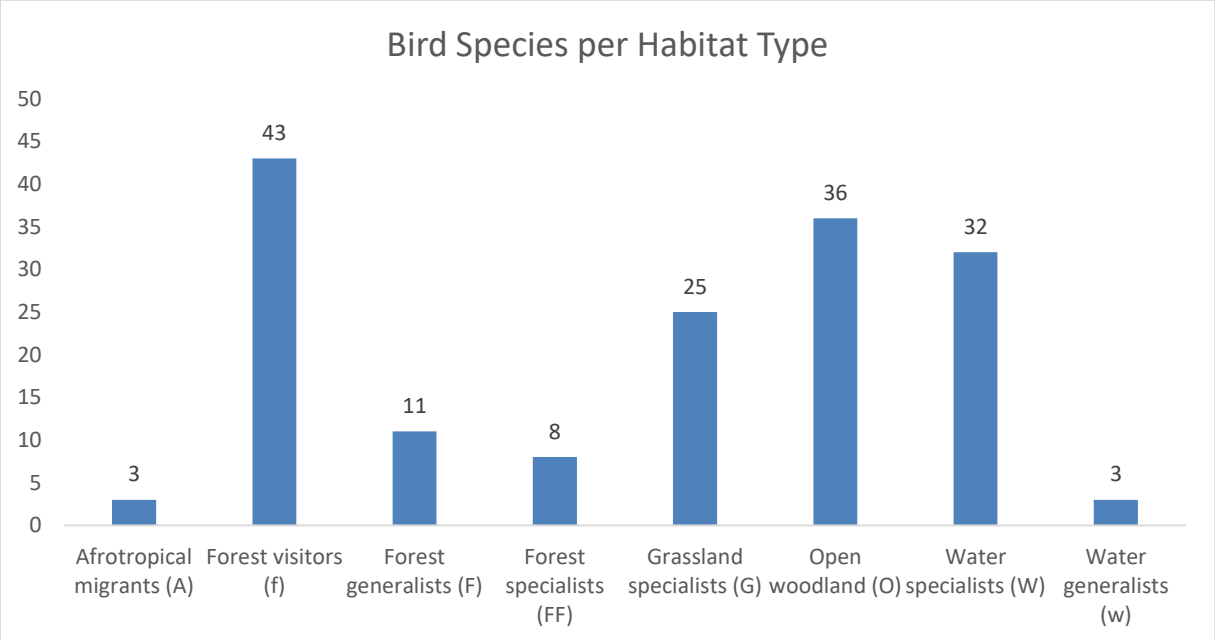


Figure 10-5: Bird species per habitat type

The dominance of the forest visitors and birds of open woodlands could be explained by the fact that the area has undergone modification, leaving areas of scattered trees and open woodlands sandwiched in cultivation lands and human settlements. Forest generalists are also high in numbers because of their

adaptability and ability to thrive in a variety of habitats, including urbanized areas. They can adjust their diet, nesting sites, and other behaviors to utilize available resources and tolerate changes in the environment. In contrast, specialist birds are highly adapted to specific ecosystems and may struggle in altered landscapes.

The high number of water specialists is attributed to the presence of an open water habitat (Victoria Nile) at the intake, surrounded by a rich riparian vegetation (Figure 6) (characteristic of wetland) providing both foraging and breeding grounds for water birds.



Figure 10-6: Victoria Nile surrounded by riparian vegetation (wetland)

Transmission and distribution lines had the highest bird species (132) diversity (Figure 7) given their long stretch, traversing different habitat types. The intake also had significantly high species diversity (49). This is due to the presence of an open water body (Victoria Nile). The Reservoir's relatively high species diversity (46) is attributed to its location which is within Kaduku Forest reserve which is still relatively pristine compared to the surrounding habitats.

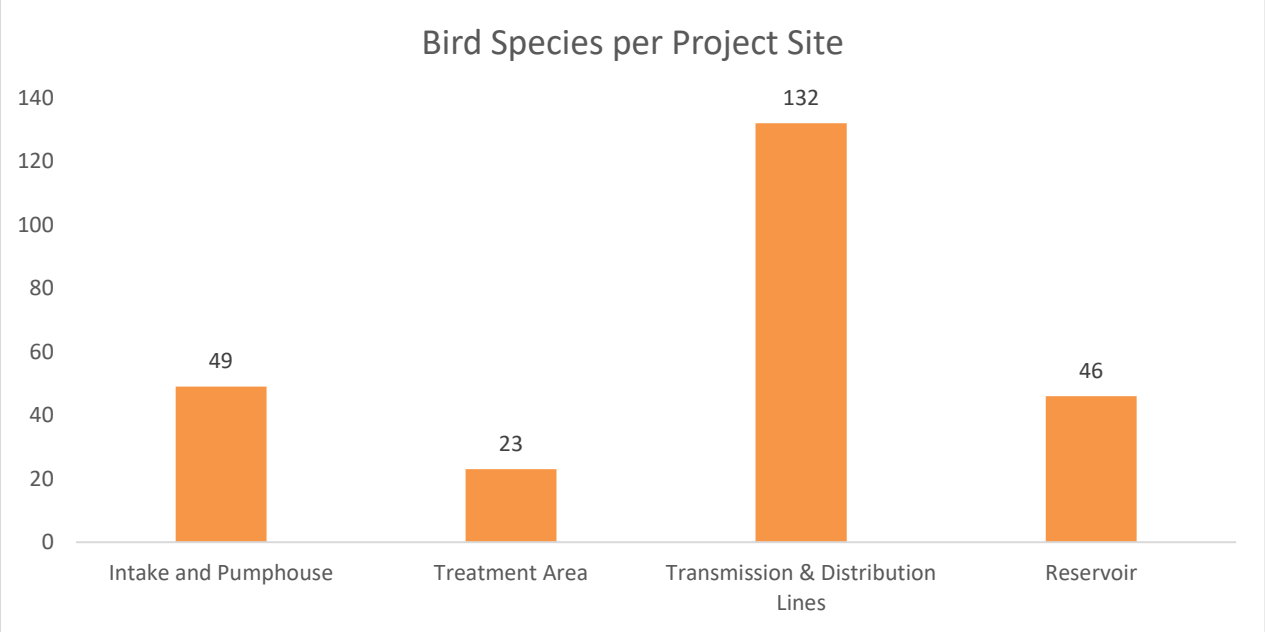


Figure 10-7: Bird species per project site

According to IUCN 2024 red list of threatened species, no species of conservation significance was recorded during the survey. However, three (03) species of migratory birds were encountered at the intake. As much as the bird species encountered generally have stable populations and spread across the country, it is important that construction of the project takes precaution to protect the birds and their habitats, given the ecological roles they play. They are important seed dispersers, pollinators, pest controllers, and scavengers, which contribute to ecosystem health and biodiversity. They also help with nutrient cycling and serve as indicators of environmental changes, making them valuable for understanding and protecting our natural world.

Mammals

Sixteen (16) mammal species were recorded within and around the project area, some through physical observation, while the majority through literature review and consultation with the residents (Table 7). Most of the species were small mammals of the Rodentia family, known to tolerate anthropogenic disturbances. The medium mammals were mainly encountered along the transmission line through Kaduku forest reserve which provides ecological requirements for mammals such antelopes, given its relatively pristine nature.

Table 10-7: Mammal Species Recorded within and around the project area

#	Common Name	Scientific Name	IUCN Red list Status	Record Type	Site			
					Intake & Pumphouse	Treatment Area	Transmission and distribution lines	Reservoir
	Small Mammals							
1	Black Rat	Rattus rattus	LC	Ob		✓	✓	✓
2	African grass rat	Arvicanthis niloticus	LC	Ob	✓	✓	✓	✓
3	Bush Rat	Aethomys hindei	LC	Ob		✓	✓	
4	Stripped Grass Mouse	Lemniscomys striatus	LC	Ob	✓	✓	✓	
5	Stripped Ground Squirrel	Xerus erythropus	LC	Ob			✓	
6	Unstripped Ground Squirrel	Xerus rutilus	LC	Ob			✓	
7	African Giant Pouched Rat	Cricetomys gambianus	LC	Li			✓	
8	African Black Shrew	Crocidura nigrofusca	LC	Li		✓	✓	
9	Crested porcupine	Hystrix cristata	LC	Con		✓	✓	
	Medium Mammals							
10	Common slender mongoose	Herpestes sanguineus	LC	Ob	✓		✓	
11	Marsh mongoose	Atilax paludinosus						
12	Bunyoro Rabbit	Poelagus marjorita	LC	Li			✓	✓
13	Bushbuck	Tragelaphus scriptus	LC	Con			✓	
14	Common duiker	Sylvicapra grimma	LC	Con			✓	
15	Oribi	Ourebia ourebi	LC	Con		✓	✓	
16	Vervet Monkey	Chlorocebus pygerythrus	LC	Ob			✓	✓

Key: Ob = Recorded through observation; Li = Recorded through literature review; Con = Recorded through consultation.

As indicated in table 7 above, the transmission and distribution lines registered the highest species richness, followed by the treatment area, reservoir and intake in that order. The transmission and distribution lines traverse different habitat types including cultivation lands, open woodlands, shrubland etc that host an array of species.

None of the species recorded are of conservation concern, all categorized least concern according to IUCN red list 2020 due to their high level of occurrence across the country. However, the presence of antelope species signifies the importance of Kaduku forest reserve in the area as a lifeline habitat and therefore, construction activities in the reserve should be well planned in consultation with the National Forest Authority to ensure that such and more species are protected.

Herpetofauna

Amphibians

Five amphibian species belonging to three families and three genera were recorded during the survey (Table 8). Two were toads and three frogs. The registered species are very adaptable to modified environment, and they do not suffer much from habitat loss. All other species apart from the toads were registered at the riparian vegetation and riverbank waters of the Victoria Nile, with many individuals, signifying the importance of the riparian vegetation surrounding Victoria Nile.

None of the species recorded is of conservation concern as all belong to Least Concern (LC) category following the IUCN Red List suggesting that the occurring species are widespread and abundant and therefore not threatened.

Reptiles

17 reptile species were recorded during the survey (Table 9), representing 11 Families and 14 genera. Majority of the recorded species were in the Agamidae and Scincidae families each with three (03) species (Figure 8).

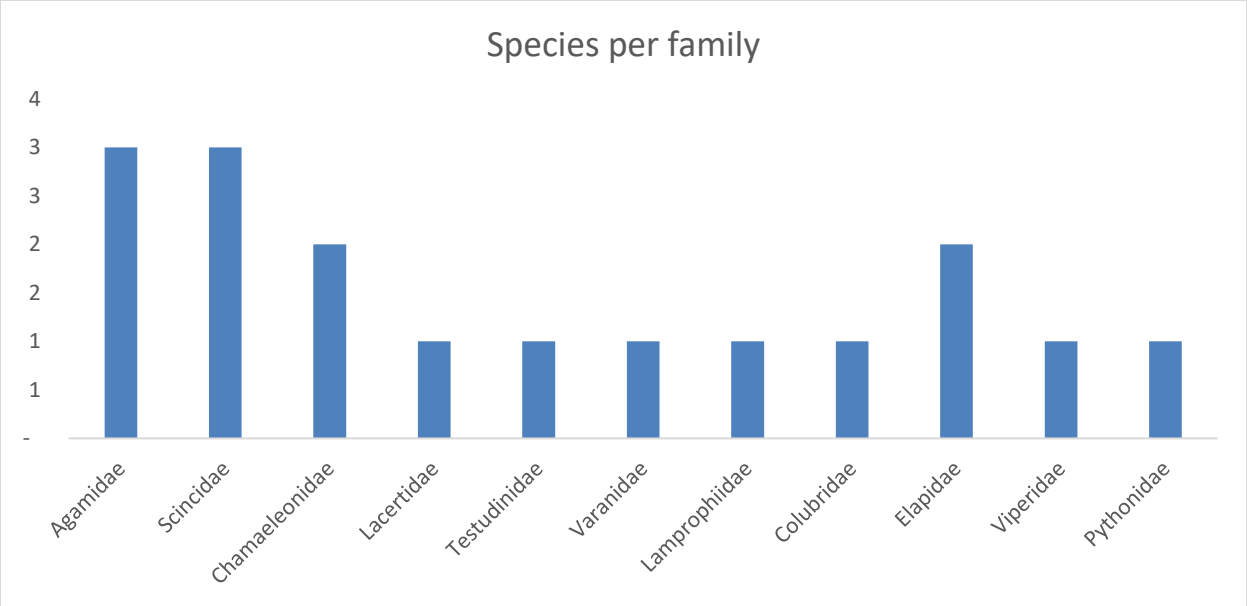


Figure 10-8: Species per genera

The dominance of the Agamidae and Scincidae families within reptiles is primarily due to their high species diversity and adaptability to various ecological niches. Skinks exhibit a wide range of ecological adaptations, including burrowing, arboreal, and terrestrial lifestyles, allowing them to thrive in various habitats. On the other hand, some agamids have adapted to arid environments through mechanisms like rain-harvesting, while others are arboreal, further expanding their ecological reach.

The transmission and distribution lines exhibited the highest species richness (16) followed by the treatment area (11), yet the reservoir and intake had the lowest species richness, each with eight (08) and (03) respectively. The high species richness along the transmission line could be attributed the a bigger sampling point given that it's the longest traversing different habitats. Kaduku forest reserve was a key habitat for the different reptiles given its open woodland, with rock outcrops as you climb Kaduku hill.

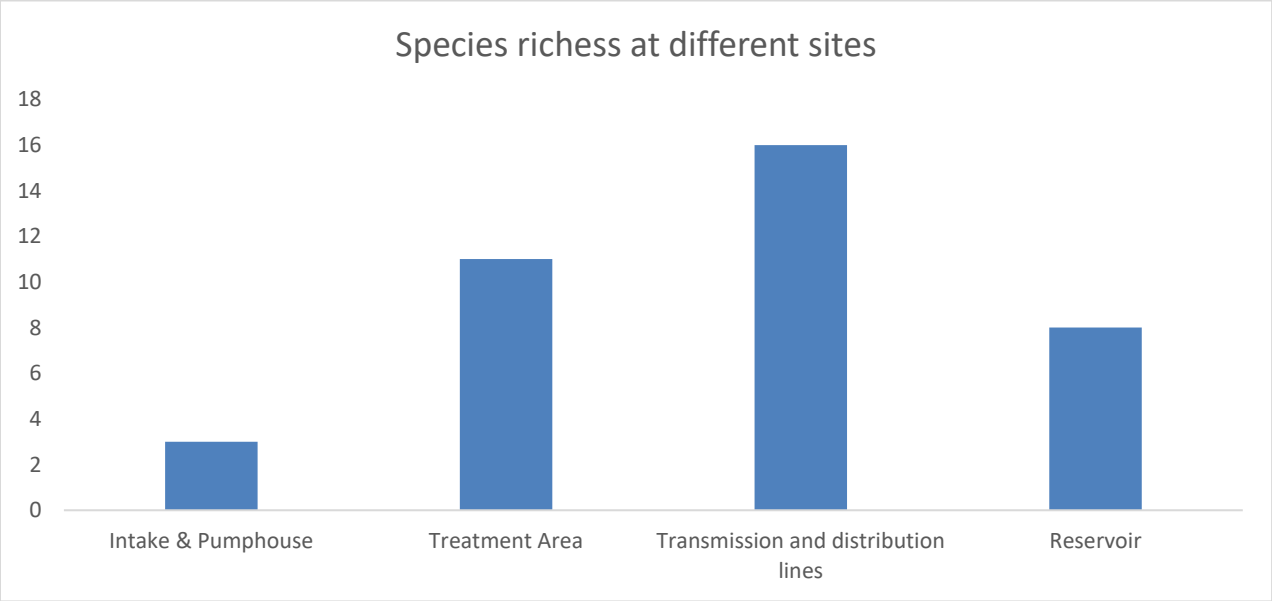


Figure 10-9: Reptile species richness within the different project components

No species of conservation significance was recorded. Also, none of the reptiles encountered and those reported by the community members are of conservation concern. All the species are listed as least concern by IUCN 2020 Red List of threatened species. The Central Africa Rock Python *Python sebae* is listed under the Endangered Species Decree of 1985, which means that international trade of the species is prohibited. The Species is listed under CITES Appendix II (Branch 1998). However, in Uganda the Central Africa Rock Python *Python sebae* was down listed from Appendix II because the species is still abundant and widespread in the Country. However, the species still suffer from habitat destruction and from hunting for its skin, meat and are frequently used in traditional medicines by local people.

Table 10-8: Amphibian species recorded

#	Order	Family	Common Name	Species Name	Record Type	IUCN	Site			
							Intake & Pumphouse	Treatment Area	Transmission and distribution lines	Reservoir
1	Anura	Bufonidae	Guttural Toad	Sclerophrys gutturalis	Ob	LC	☑	☑	☑	☑
2	Anura	Bufonidae	Hallowell's toad	Sclerophrys maculata	Li	LC	☑			
3	Anura	Dicroglossidae	Eastern Groove-crowned Bullfrog	Hoplobatrachus occipitalis	Li	LC	☑			
4	Anura	Ptychadenidae	Anchieta's Rocket Frog	Ptychadena anchietae	Ob	LC	☑		☑	
5	Anura	Ptychadenidae	Mascarene Rocket Frog	Ptychadena mascareniensis	Ob	LC	☑		☑	

Key: Ob = Recorded through observation; Li = Recorded through literature review.

Table 10-9: Reptile species recorded within and around the project area

#	Order	Family	Common Name	Scientific Name	Record Type	IUCN	Site			
							Intake &	Treatment Area	Transmission and	Reservoir
1	Squamata	Agamidae	Blue Headed Tree Agama	Acanthocercus atricolis	Ob	LC		☑	☑	☑
2	Squamata	Agamidae	Red-Headed Rock Agama	Agama agama	Ob	LC		☑	☑	☑
3	Squamata	Agamidae	West Kenya rainbow Agama	Agama finchi	Ob	LC		☑	☑	
4	Squamata	Scincidae	Common Savanna Supple Skink	Mochlus sundevallii	Ob	LC		☑	☑	☑
5	Squamata	Scincidae	Common Speckled-lipped Skink	Trachylepis maculilabris	Ob	LC		☑	☑	☑
6	Squamata	Scincidae	Eastern Striped Skink	Trachylepis striata	Ob	LC		☑	☑	☑
7	Squamata	Chamaeleonidae	Graceful Chameleon	Chamaeleo gracilis	Li	LC			☑	
8	Squamata	Chamaeleonidae	Smooth Chameleon	Chamaeleo laevigatus	Li	LC		☑	☑	
9	Squamata	Lacertidae	Speke's Sand Lizard	Heliobolus spekii	Li	LC			☑	
10	Testudines	Testudinidae	Leopard tortoise	Stigmochelys pardalis	Ob				☑	
11	Squamata	Varanidae	Nile monitor lizard	Varanus niloticus	Li/Con	LC	☑		☑	
12	Squamata	Lamprophiidae	Brown House Snake	Lamprophis fuliginosus	Li/Con	LC		☑	☑	☑
13	Squamata	Colubridae	Olive Marsh Snake	Natriciteres olivacea	Li	LC	☑	☑		

#	Order	Family	Common Name	Scientific Name	Record Type	IUCN	Site			
							Intake &	Treatment Area	Transmission and	Reservoir
14	Squamata	Elapidae	Naja nigricollis	Black-Necked Spitting Cobra	Li/Con	LC	☑	☑	☑	☑
15	Squamata	Elapidae	Black Mamba	Dendroaspis polylepis	Li/Con	LC			☑	
16	Squamata	Viperidae	Common Puff Adder	Bitis arietans	Li/Con	LC			☑	
17	Squamata	Pythonidae	African Rock Python	Python sebae	Ob-remains	LC		☑	☑	☑

Key: Ob = Recorded through observation; Li = Recorded through literature review; Con = Recorded through consultation.

Aquatic Biodiversity and Fisheries

Phytoplankton:

Overall, the green algae were the most abundant by number of species (9) followed by the blue greens (6) and the flagellates (2) were the least (Table 10). This was an indication that the water quality at the source is still pristine. Therefore, it can sustain/support healthy fish population. It is known that the dominance of green algae is an indication of a non-compromised water quality and are good food for fish.

Table 10-10: Species composition and relative abundance of phytoplankton in water samples from selected sampling sites

BLUE-GREENS	**N = 245**
Microcystis sp (%)	29.39
Lyngbya sp (%)	23.67
Zygnema sp (%)	14.29
Desmidium sp (%)	8.98
Oscillatoria sp (%)	17.14
Calothrix sp (%)	6.53
GREENS	**N = 327**
Spirogyra sp (%)	19.57
Hildebradia sp (%)	13.76
Urothrix sp (%)	11.01
Westella sp (%)	0.00
Micrasterias sp (%)	9.17
Chlorella sp (%)	15.90
Nitella sp (%)	11.62
Trichocerca sp (%)	7.34
Cladophora sp (%)	11.62
FLAGELLATES	N = 30
Uroglena sp (%)	53.33
Phacus sp (%)	46.67

Zooplankton

A total of eight species of rotifers and two species of crustaceans were encountered (Table 11). The dominance of rotifers in the proposed project area is an indication that the environment is still favorable for fish because rotifers are a vital food source especially for the young fish (larvae and fry) stages thus their composition and abundance is vital for fish growth and survival at that fragile stage. Again, this conforms to the trends in the above results of the green algae.

Table 10-11: Species composition and relative abundance of zooplankton in water samples from selected sampling sites

ROTIFERS	**N = 317**
Ascomorpha sp (%)	23.97
Brachionus sp (%)	18.30
Proales sp (%)	11.99
Trichocerca sp (%)	14.51
Euchlanis sp (%)	7.57
Polyarthra sp (%)	10.09
Lecane sp (%)	5.68
Keratera sp (%)	7.89
CRUSTACEANS	**N = 24**
***Cyclops sp* (%)**	75.00
Bosmina sp (%)	25.00

Macro-invertebrates (benthic) fauna

In the current study eight different types of benthic organisms were recorded (Table 12). The macroinvertebrates were dominated by water snails and mosquito larvae. This may suggest health threats for the riparian communities such as Bilharzia and malaria.

The diversity of benthic organisms is a very important bio-indicator of the soundness of the aquatic ecosystem. Also, benthic communities, are important components of a stream ecosystem because they form the foundation of the stream's food web. Changes in benthic community composition and productivity can affect higher trophic levels (fish and amphibians) and stream processes (organic matter processing). Frequent disturbance of the benthic community may keep them in early stages of development, thereby affecting the composition and function of this community and impacting fish that depend on a healthy benthic community.

Table 10-12: Diversity of Macro-invertebrates

Macro-invertebrate	**Family**
Black water beetles	Hydrophilius
Chironomid larvae	Chironomidae
Odonata larvae	Libellulidae
Leeches	Nepidae
Water snails	Gastropoda
Earth Worms	Lumbricidae

Corixa Punctata (Water boatman)	Notonectidae
Mosquito larvae	Culicidae

Fish species composition and conservation status

A total of thirteen (13) fish species were recorded overall, belonging to eight (8) families (Table 13). None of the recorded fish species is of serious ecological concern according to the IUCN redlist 2025-1. However, it is important to note that the proposed water source is a spawning and nursery ground for many fish species based on the very many young fishes observed in the area, coupled with the habitat structure of dense rooted papyrus and vossia. Therefore, care must be taken so that the project activities do not destroy the habitat.

Table 10-13: Relative abundance of fish species recorded during the Audit (P= Present and R= reported to exist during interviews)

Fish Family	Species	Seasonality/regularity (generated during interview)	The IUCN Red list 2025-1
Lepidosirenidae	*Protopterus aethiopicus*	Caught during rainy season	Least Concern
Cyprinidae	*Barbus jacksonii*	Caught throughout the year	Least concern
	Rastreneobola argentea	Caught during dark nights especially in rainy seasons	not assessed
Clariidae	*Clarias casonii*	Caught during rainy season	Not assessed
	Clarias gariepinus	Caught during rainy season	Least Concern
Cichlidae	*Oreochromis leucostictus*	Caught during rainy season	Least Concern
	Oreochromis niloticus	Caught throughout the year	Least Concern
	Sarotherodon galilaea	irregular	Near threatened
Momyridae (Elephant-snoutfishes)	*Mormyrus niloticus*	Caught during rainy season	Least Concern
	M.kannume		Least Concern
Morchokidae	*Synodontis afrofisheri*	Caught during rainy season	Least Concern
Centropomidae	*Lates niloticus*	Caught throughout the year	Least Concern
Bagridae	*Bagrus docmac*	seasonally	Least Concern
8	*13*		

Table 10-14: Photographic Representation of the Fish Species



Sarotherodon galilaeus



Fig. 1 Protopterus aethiopicus



Bagrus docmac



Synodontis afrofischeri



Mormyrus niloticus



Oreochromis niloticus



Clarias casonii



Clarias gariepinus

Ecologically Sensitive Areas within the Project Area

The project is generally located in degraded and modified habitats, characteristic of agropastoral communities. Majority of the habitats are farmlands, rangelands, bushlands and shrubland.

The key ecological receptors within the project area were identified as Victoria Nile and Kaduku Forest Reserve.

- Victora Nile: The Victoria Nile and its associated riparian vegetation (to be affected by the intake and powerhouse) is a key aquatic habitat for the various species of birds and fish and therefore deserves key attention during construction and operation of the water project. A Riparian Management Plan is recommended to guide on the conservation of this lifeline habitat for water dependent biodiversity and the ecosystem services that the surrounding communities derive from.
- Kaduku Forest Reserve: Just by its status as a protected forest area, Kaduku FR is an important habitat which will be impacted by a section of the transmission and distribution lines, and the water reservoir. This area was found to harbor several species of birds, mammals and reptiles given its bushed woodland with rock outcrops (Kaduku hill). Engagement with the National Forest Authority will be important in enforcing protection measures during construction and operation of the water project.

Predicted Impacts

Whereas the proposed transmission and distribution network is largely in cultivated areas under Sugarcane, maize, ovacado and subsistence farming, and built-up area, the likely impacts of the

transmission and distribution network on the ecological settings (especially at the intake and Kaduku FR) will be both direct and indirect – incremental overtime.

Direct impacts will include but not limited to loss of vegetation and tree cutting from the RoW, impact on the Victoria Nile riparian vegetation, trampling of seedlings, destruction of fauna habitats and mortality of fauna.

Indirect impacts will include disruption of farming activities, unsustainable, and overexploitation of forest resources, degradation of wetlands and marshlands downstream, proliferation of invasive alien species. Tree loss from salvaging along the RoW for transmission lines, access roads and distribution network, is the only likely residual impact predicted. A re-vegetation plan shall be prepared to mitigate these impacts.

Impact Analysis

Table 10-15: Predict impacts and mitigation measures

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
Negative Impacts									
Loss crops and vegetation	• Vegetation and crops within the project area will be lost during clearing and excavation for the network. However, mostly seasonal crops were found, and these could be removed by the owners before planned developments. • In addition, bushes and grasses characterized the project area While other species remain LC thus affected vegetation will be common species found elsewhere within and outside the project area. •	Construction	farmlands, Vegetation	• Undertake a preclearance survey to correlate with valuation report on trees to be affected. • Compensation of owners especially (in case of perennial crops) and trees that will be damaged and cut during the construction/development phase. • The owners of crops especially seasonal crops shall be given time for their crops to mature and harvest. • Minimise vegetation clearance to only the areas required transmission and distribution network development. • Restoration planting for aesthetics and species restoration. • Timely sensitization about the potential impact on seasonal farmers within seasonal swamps and those encroachers in wetlands	1	1	2	2	8

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
				to vacate the areas before civil works starts. • To mitigate residual impact of tree loss, - Develop a re-vegetation plan with an enrichment plan over the difference transmission and distribution network development phases - Establishment of tree nursery for propagation of native planting material especially the threatened and reserved species reported in this report. • Restore the ecological state of the surrounding sites immediately after portions and/or all project activities in the area have been accomplished.					
Disturbance and degradation of wetlands	• Water intake is at Victoria Nile riparian vegetation which is characteristic of wetland/swamp and crosses couple of areas with seasonal wetland. Construction activities such as clearing and trenching will	Construction	Aquatic flora and fauna	• Plan to construct in wetlands during dry season • Provide specific method statements for wetland crossings • Develop and implement a riparian management plan for the Victoria Nile riparian habitat	2	3	2	2	14

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
	affect this area. Wetlands are known to be homes for various aquatic flora and fauna and provide several ecosystem services to the surrounding communities			• Construction works across wetlands will use existing road corridors for and operational access wherever possible. • All project workers should be sensitized to minimize damage to flora and fauna within the wetlands • Close monitoring and supervision of the construction operations to avoid causing further damage to undesignated project areas.					
Proliferation of alien species	• Constructions may facilitate the introduction of alien species into areas out of the project area and into the project area, brought in by vehicles or site workers. These species if invasive may out-compete the existing plant species and overtake them.	Construction & Operation	Vegetation Farmlands	• Uproot AIS ahead of vegetation clearance to avoid spreading • Contractor shall have an environment officer for the implementation of contractor environment management plan. • Deposition in designated stock pill and collection points • Prepare an AIS management plan to manage AIS during construction and operation stages	1	1	2	2	8
Erosion and sedimentation	• Dislodged soils during construction can cause erosion and sedimentation resulting into siltation of the	Construction & Operation	Vegetation Farmlands	• Remove the excavated soils from the edge of the roads to avoid it being washed by rain during construction.	2	3	2	2	14

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
	receiving aquatic ecosystems and increase turbidity especially in wetland areas.			• Restore the area with native vegetation after construction • Phasing operations and avoiding construction during rainy seasons to minimize erosion and sedimentation • Use silt fences especially during construction in sensitive habitats such as wetlands • Schedule construction activities to dry season in sensitive habitats like wetlands to minimize disturbance • Minimize the disturbance period (period between start and reinstatement) in sensitive habitats (wetlands).					
Loss of habitat for fauna	Vegetation clearance affects and or destroys habitats for wildlife. The impact s likely to be higher at the Victoria Nile Riparian vegetation and Kaduku FR, areas found to be high in aquatic and fauna diversity respectively.	Construction	Vegetation	• Clearance of fauna habitat (vegetation and soils) should be limited only to localities required for development. • Movement of equipment (vehicles, contractors and the entire construction crew) must follow designated pathways or agreed upon access roads. This will avoid unintended damages to fauna.	1	1	2	2	8

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
				• Prepare and implement and revegetation and riparian management plan • Undertake vegetation and tree avoidance plan for trees that are important especially along the transmission/distribution lines and treatment area • The contractor should restore sites where activities will be carried out at all the project sites. The topsoil that will have been removed before pitting the trenches for the pipeline should be put back to cover the trenches so that the mobile fauna is not affected. • All project workers should be sensitized to minimize damage to vegetation and fauna. • If wild animals are encountered, the Contractor shall notify UWA so that it is picked and taken to a secure place. • Trenching, pipework laying as well as well as backfilling will be done concurrently. For any pits dug during construction, the contractor					

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
				shall ensure that every evening, the pits are covered with timber while being secured with a warning tape. • Wetlands along the project alignment should be given due attention during the construction phase to avoid negative impacts by: *o Avoiding intentional spilling of petroleum products.* *o Implementation of the water act and wetlands policy, specifically articles that prohibits pollution and dumping of waste.* *o Scare the fauna before undertaking the activities to minimize injury and burying the hiding fauna* *o Relocate those fauna species that cannot move on their own and this should be done by a trained person.*					
Mortality of fauna	Fauna may be accidently trampled during bush	Construction	All fauna	• Conduct preclearance surveys to identify presence of wildlife and					

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
	clearing and trenching causing death of fauna. Malicious kills by project workers could also happen especially in regard to retiles			propose possible workarounds to avoid killing. • Conduct ecological watch briefs during clearing and trenching to avoid accidental kill of fauna • Sensitive workers regarding the importance of wildlife to avoid or minimize malicious kills • Where possible, relocate entrapped or injured wildlife to safe areas (wildlife reserves) to avoid death. • Monitor and report on all wildlife encounters and report wildlife incidents (injuries and deaths) to the project environment.					
Poaching of wildlife	People working through Kaduku FR may get involved in poaching for the occurring antelope species.	Construction and OM	All fauna	• Sensitize workers about presence of wildlife in these areas and discourage any dealing in wildlife. • Collaborate with NFA to ensure monitoring during construction activities					
Impact on fish	Impact on fish will be through disturbance of the riparian vegetation and impact on water quality through dredging and	Construction and operation	Aquatic biodiversity and fish	• Install fish screen om the horse to avoid sucking fish • Undertake regular monitoring to understand impact of activities on	1	1	1	2	6

Impact/Issue	Description of Impact	Project Phase	Affected Project area/Taxa	Enhancement/Mitigation Measures	Impact Analysis				
					E	D	M	P	S
	installation of the intake pipes. Also, fish could be easily sucked up as raw water is being pumped affecting the diversity and abundance of fish in the area			fish and proposal additional controls • Undertake detailed fish surveys prior to construction activities to update data on fish • Implement erosion and silt control measures to minimize siltation of the water body					

Conclusion and Recommendations

It is apparent that the project area is located within modified habitats with high anthropogenic activities such as large-scale cultivation and human settlements. However, the occurrence of woodlands, tall standing trees along the transmission and distribution lines, and presence of Victoria Nile and Kaduku FR underscores the importance of a section of the project area as vital habitats for the existing fauna. Victoria Nile and its associated habitats were found to harbor significant fauna and fish diversity. Therefore, care should be taken to minimize impacts on this habitat. Generally, we recommend as follows;

- While *Lovoa swynnertonii* – NT was the only species of conservation concern encountered during the survey, *Mangifera indica, Albizia spp* were the protected and reserved trees in the project area. Avoidance and replanting of these species is fundamental to maintaining the green status in the future within the project area.
- Masindi and Kiryandongo districts under the auspices of natural resource departments have passed Environmental/Forest ordinances and these outline species if trees that should not be harvested. The contractor shall be obliged to visit this ordinance in preparation of CEMP to enable monitoring of project activities with respect to these preserved species
- Encountered invasive species in the project area calls for an eradication program of invasive species, especially during the construction phase. *Lantana camara, Chromolaena odorata* and *Pontederia crassipes* were the most dominant species across the survey areas. Construction contractor shall seek services of an environmental specialist to manage these species in their contractor environmental management plan (CEMP)
- As part of Environment and Biodiversity Monitoring, prepare among other plans, Biodiversity and Ecosystem Service management plan, Invasive Alien Species Management Plan, Re-vegetation, and a Restoration Plan.
- Prepare a standalone Riparian management plan for the Victoria Nile riparian vegetation
- Biodiversity monitoring of vegetation changes for species conservation. This shall require seeking and involving the District Forest officer in project implementation and monitoring.
- Work together with NFA to update identified risks and impacts of project activities to biodiversity within Kaduku FR and ensure implementation of controls to safeguard flora and fauna.

References

AmphibiaWeb 2014: Information on amphibian biology and conservation. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/.

Channing. A, (2001). Amphibians of Central and Southern Africa. Cornell University Press, Ithaca, New York

Drewes, R.C., Vindum, J.V., 1994. Amphibians of the Impenetrable Forest, southwest Uganda. Journal of African Zoology 108, 55–70.

Drewes, R.C., Vindum, J.V., 1998. Reptiles of the impenetrable forest (including an addendum and corrigenda to the amphibian fauna). Unpublished Report, California Academy of Sciences, San Francisco.

Drewes, R.C., Vindum, J.V., O'Brien, J.P., 1992. Amphibians of the impenetrable forest, Uganda. Unpublished Report, California Academy of Sciences, San Francisco.

Duellman, W.E. 2005. Cusco Amazónico: The lives of amphibians and reptiles in an Amazonian rainforest. Comstock Publishing, Ithaca and London.

Forest Department, Ministry of Water Lands and Environment, 2003. National Biomass Study. National Biomass Study Technical Report, Kampala.

Gardner, T.A., Fitzherbert, E.B., Drewes, R.C.; Howell, K.M. & Caro, T. 2007.Spatial and temporal patterns of diversity in an East African leaf-litter amphibian fauna.Biotropica 39:105–113.

Goodman J.D. 1992: Checklist of Amphibians and Reptiles of East Africa. (Un Published Manuscript)

Heyer, W.R., Donnelly, M.A., McDiarmid, R.W., Hayek, L.-A.C., & M.S. Foster, (eds.) 1994. Measuring and monitoring biological diversity. Standard methods for amphibians. Washington & London, Smithsonian Institution Press, 364 pp

Kalema, J., & Hamilton, A. (2020). Field guide to the forest trees of Uganda: for identification and conservation. CABI.

Khan, M. S. 1990. The impact of human activities on the status and distribution of amphibians in Pakistan.Hamdryad. 15(1):21-24.

Langdale_Brown, I., Osmaston, H. A. and Wilson, J. G. (1964). The vegetation of Uganda and its bearing on land use. Government of Uganda, Entebbe.

Magurran, A.E., 1988. Ecological diversity and its measurements. Princeton, NJ, Princeton University press. Monitoring Biological Diversity: Standard Methods for Reptiles and Amphibians. Smithsonian Institution

MWE (2022) Environment and Social Impact Assessment (ESIA) for the Proposed Large Solar Powered Piped Water Supply And Sanitation Systems in Gaspa Rural Growth Centre, Kiryandongo District Environmental And Social Impact Statement

Namaganda, M., Phillips, S., Lye, K. A. (2004). The distribution of grass species in Uganda. African Journal of Ecology. https://doi.org/10.1111/j.1365-2028.2004.00460.x

Plumptre A.J., Tim R.B. Davenportb , Mathias Behanganac , Robert Kityoc , Gerald Eiluc , Paul Ssegawac , Corneille Ewangoa , Danny Meirted , Charles Kahindoc , Marc Herremansd,k, Julian KerbisPeterhanse,f, John D. Pilgrimg,l, Malcolm Wilsonh , Marc Languyi , David Moyerj (2007) The biodiversity of the Albertine Rift: BIOLOGICAL CONSERVATION 134 (2007) 178 – 194

Plumptre, A.J., Ayebare, S., Pomeroy, D., Tushabe, H., Nangendo, G., Mugabe, H., Kirunda, B., & Nampindo, S. (2017). Conserving Uganda's Biodiversity: Identifying critical sites for threatened species and habitats. Unpublished report to USAID and Ministry of Tourism, Wildlife and Antiquities.

Terrapon-Pfaff, Julia & Gröne, Marie-Christine & Dienst, Carmen & Ortiz, Willington, 2018. "Productive use of energy – Pathway to development? Reviewing the outcomes and impacts of small-scale energy projects in the global south," Renewable and Sustainable Energy Reviews, Elsevier, vol. 96(C), pages 198-209.

Uetz, P. &JiríHošek (eds.) 2014, The Reptile Database, http://www.reptile-database.org, accessed: 30 May 2014

Uganda Wildlife Authority, 1999, Wildlife Protected Areas System Plan for Uganda, Volumes 1-5, Uganda Wildlife Authority, Kampala, Uganda.

USAID. (2006). Uganda biodiversity and tropical forest assessment

Wildlife Conservation Society (WCS). (2016). Nationally Threatened Species for Uganda. https://www.nationalredlist.org/files/2016/03/National-Redlist-for-Uganda.pdf

Witte, F., Gooudswaad, P. C., Katunzi, E. F. B., Mkumbo, O. C., and Wanink, J. H. (1999). Lake Victoria's ecological changes and their relationships with riparian societies. In: Ancient lakes (eds): Kawanabe, H., Coulter, G. W. and Roosevelt, A. C. pp 189-202. Kenobi Productions, Ghent.

Appendix 1: Plant Species List

Family	Species	Plant form	IUCN Status
Acanthaceae	*Acanthus pubescens*	Herb	LC
Amaranthaceae	*Achyranthes aspera*	Herb	LC
Asteraceae	*Ageratum conyzoides*	Herb	LC
Amaranthaceae	*Amaranthus spinosus*	Herb	LC
Bromeliaceae	*Ananas comosus*	Fruit	LC
Aristolochiaceae	*Aristolochia littoralis*	Herb	LC
Asteraceae	*Aspilia africana*	Herb	LC
Asteraceae	*Bidens pilosa*	Forb	LC
Poaceae	*Bracharia jubata*	Grass	LC
Poaceae	*Brachiaria decumbens*	Grass	LC
Poaceae	*Brassica carinata*	Grass	LC

Family	Species	Plant form	IUCN Status
Poaceae	*Brassica elongate*	Grass	LC
Brassicaceae	*Brassica oleracea*	Grass	LC
Crassulaceae	*Bryophyllum pinnatum*	Herb	LC
Apocynaceae	*Calotropis procera*	Herb	LC
Cannaceae	*Canna indica*	Herb	LC
Caricaceae	*Carica papaya*	Tree	LC
Apocynaceae	*Cascabela thevetia*	Shrub	LC
Apocynaceae	*Catharanthus roseus*	Shrub	LC
Poaceae	*Chloris gayana*	Grass	LC
Poaceae	*Coix lacryma-jobi*	Grass	LC
Commelinaceae	*Commelina benghalensis*	Herb	LC
Commelinaceae	*Commelina diffusa*	Herb	LC
Cucurbitaceae	*Cucurbita maxima*	Forb	LC
Poaceae	*Cynodon dactylon*	Grass	LC
Cyperaceae	*Cyperus rotundus*	Sedge	LC
Fabaceae	*Delonix regia*	Herb	LC
Fabaceae	*Desmodium hirtum*	Herb	LC
Fabaceae	*Desmodium stolzii*	Herb	LC
Fabaceae	*Desmodium triflorum*	Herb	LC
Poaceae	*Digitaria abyssinica*	Grass	LC
Poaceae	*Digitaria longiflora*	Grass	LC
Dioscoreaceae	*Dioscorea cayennensis*	Tuber	LC
Dioscoreaceae	*Dioscorea rotundata*	Sedge	LC
Dracaenaceae	*Dracaena fragrans*	Herb	LC
Dracaenaceae	*Dracaena triasciata*	Herb	LC
Poaceae	*Echinochloa colona*	Grass	LC
Poaceae	*Eleusine coracana*	Grass	LC

Family	Species	Plant form	IUCN Status
Poaceae	*Eleusine indica*	Grass	LC
Poaceae	*Eragrostis aspera*	Grass	LC
Poaceae	*Eragrostis ciliaris*	Grass	LC
Poaceae	*Eragrostis curvula*	Grass	LC
Poaceae	*Eragrostis olivaceae*	Grass	LC
Poaceae	*Eragrostis pilosa*	Grass	LC
Poaceae	*Eragrostis tenuifolia*	Grass	LC
Myrtaceae	*Eucalyptus camadulensis*	Tree	LC
Myrtaceae	*Eucalyptus grandis*	Tree	LC
Convolvulaceae	*Ipomea indica*	Herb	LC
Verbenaceae	*Lantana camara*	Shrub	LC
Poaceae	*Leersia hexandra*	Grass	LC
Lamiaceae	*Leonotis nepetifolia*	Herb	LC
Anacardiaceae	*Mangifera indica*	Tree	LC
Fabaceae	*Mimosa pigra*	Shrub	LC
Apocynaceae	*Mondia whiteii*	Herb	LC
Moringaceae	*Moringa Oleifera*	Tree	LC
Lamiaceae	*Ocimum gratissimum*	Herb	LC
Oxalidaceae	*Oxalis latifolia*	Herb	LC
Polygonaceae	*Oxygonum sinuatum*	Herb	LC
Poaceae	*Panicum brevifolium*	Grass	LC
Poaceae	*Panicum maximum*	Grass	LC
Poaceae	*Panicum trichocladum*	Grass	LC
Poaceae	*Paspalum notatum*	Grass	LC
Poaceae	*Paspalum scrobiculatum*	Grass	LC
Passifloraceae	*Passiflora edulis*	Herb	LC
Poaceae	*Pennisetum purpureum*	Grass	LC

Family	Species	Plant form	IUCN Status
Lauraceae	*Persea americana*	Fruit	LC
Arecaceae	*Phoenix reclinata*	Tree	LC
Euphorbiaceae	*Ricinus communis*	Shrub	LC
Poaceae	*Saccharum officinarum*	Grass	LC
Fabaceae	*Senna alata*	Shrub	LC
Fabaceae	*Senna hirsuta*	Herb	LC
Fabaceae	*Senna spectabilis*	Herb	LC
Malvaceae	*Sida acuta*	Herb	LC
Malvaceae	*Sida cordifolia*	Herb	LC
Malvaceae	*Sida rhombifolia*	Herb	LC
Malvaceae	*Sida ternata*	Herb	LC
Solanaceae	*Solanum lycopersicum*	Herb	LC
Solanaceae	*Solanum nigrum*	Herb	LC
Bignoniaceae	*Spathodea campanulata*	Tree	LC
Verbenaceae	*Stachytarpheta jamaicensis*	Herb	LC
Asteraceae	*Tithonia diversifolia*	Herb	LC
Asteraceae	*Vernonia amygdalina*	Shrub	LC
Poaceae	*Zea mays*	Grass	LC

Appendix 2: Bird Species List

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
1	Common reed warbler	Acrocephalus scirpaceus	W	LC	✓			
2	Rufous-rumped lark	Pinarocorys erythropygia	G	LC		✓	✓	
3	Spur-winged Lapwing	Vanellus sp	W	LC	✓			
4	Greater swamp warbler	Acrocephalus rufescens	W	LC	✓			
5	Common Sandpiper	Actitis hypoleucos	W	LC	✓			
6	African Jacana	Actophilornis africana	W	LC	✓			
7	Pale flycatcher	Agricola pallidus	f	LC		✓	✓	✓
8	Common Kingfisher	Alcedo atthis	W	LC	✓			
9	White-tailed Plover	anellus leucurus	W	LC	✓			
10	Short-tailed pipit	Anthus brachyurus	G	LC			✓	
11	Grey Heron	Ardea cinerea	W	LC	✓			
12	Black-headed heron	Ardea melanocephala	W	LC	✓		✓	
13	Yellow-Throated Greenbul	Atimastillas flavicollis	f	LC		✓	✓	✓
14	Hadada ibis	Bostrychia hagedash	w	LC	✓		✓	
15	Sooty flycatcher,	Bradornis infuscata	f	LC		✓	✓	✓
16	White-winged swamp warbler	Bradypterus carpalis	W	LC	✓			
17	Black-cheeked waxbill,	Brunhilda charmosyna	f	LC		✓	✓	✓
18	Black-faced waxbill,	Brunhilda erythronotos	f	LC		✓	✓	✓
19	Cattle egret	Bubulcus ibis	w	LC	✓		✓	
20	Water thick-knee,	Burhinus vermiculatus	W	LC	✓			
21	Common buzzard	Buteo buteo	F	LC			✓	✓
22	Little Heron	Butorides striatus	w	LC	✓		✓	
23	Gray wren-warbler,	Calamonastes simplex	G	LC			✓	

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
24	Dunlin	Calidris alpina	W	LC	☑			
25	Little Stint	Calidris minuta	W	LC	☑			
26	Grey-Backed Camaroptera	Camaroptera brachyura	f	LC		☑	☑	☑
27	White-Browed Coucal	Centropus superciliosus	O	LC			☑	
28	Pied kingfisher	Ceryle rudis	W	LC	☑	☑		
29	Green-throated sunbird	Chalcomitra rubescens	f	LC			☑	
30	Scarlet-Chested Sunbird	Chalcomitra senegalensis	f	LC			☑	
31	Simple greenbul	Chlorocichla simplex	F	LC			☑	
32	African gray woodpecker,	Chloropicus goertae	FF	LC			☑	☑
33	Purple-banded sunbird,	Cinnyris bifasciatus	f	LC			☑	☑
34	Red-chested sunbird,	Cinnyris erythrocercus	f	LC		☑	☑	☑
35	Tiny sunbird	Cinnyris minullus	f	LC		☑	☑	☑
36	Variable Sunbird	Cinnyris venustus	f	LC			☑	
37	African marsh-harrier	Circus ranivorus	W	LC	☑			
38	Croaking Cisticola	Cisticola natalensis	G	LC			☑	
39	Yellow-bellied waxbill,	Coccopygia quartinia	G	LC			☑	
40	Speckled mousebird,	Colius striatus	f	LC			☑	
41	Speckled Pigeon	Columba guinea	O	LC		☑	☑	
42	Pied crow	Corvus albus	O	LC		☑	☑	
43	Malachite kingfisher	Corythornis cristatus	W	LC	☑			
44	Browed Robin-Chat	Cossypha heuglini	f	LC			☑	
45	Wattled starling,	Creatophora cinerea	f	LC			☑	☑

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
46	Black-throated canary,	Crithagra atrogularis	f	LC		☑	☑	☑
47	White-bellied canary,	Crithagra dorsostriata	f	LC			☑	
48	Papyrus canary,	Crithagra koliensis	f	LC			☑	☑
49	Dusky crimsonwing,	Cryptospiza jacksoni	FF	LC			☑	
50	Temminck's courser,	Cursorius temminckii	G	LC			☑	
51	Olive Sunbird	Cyanomitra olivacea	FF	LC			☑	
52	African Palm Swift	Cypsiurus parvus	O	LC			☑	
53	Gray-headed oliveback,	Delacourella capistrata	G	LC			☑	
54	Great Egret	Egretta alba	W	LC	☑			
55	Little egret	Egretta garzetta	W	LC	☑			
56	Black-Shouldered Kite -	Elanus caeruleus	G	LC			☑	
57	African Blue-Flycatcher	Elminia longicauda	f	LC			☑	
58	Yellow-vented eremomela,	Eremomela flavicrissalis	f	LC			☑	☑
59	Fan-tailed widowbird,	Euplectes axillaris	G	LC			☑	
60	Northern Red Bishop	Euplectes franciscanus	G	LC			☑	
61	Black bishop	Euplectes gierowii	G	LC			☑	
62	Marsh widowbird,	Euplectes hartlaub	G	LC			☑	
63	Black-Winged Bishop	Euplectes hordeaceus	O	LC		☑	☑	
64	Red-cowled widowbird,	Euplectes laticauda	G	LC			☑	
65	Little greenbul,	Eurillas virens	f	LC			☑	
66	Greater kestrel,	Falco rupicoloides (A)	A	LC			☑	☑

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
67	Woodland Kingfisher	Halcyon senegalensis	O	LC			☑	
68	African fish-eagle	Haliaeetus vocifer	W	LC	☑			
69	Black-winged Stilt	Himantopus himantopus	W	LC	☑			
70	White-throated blue swallow,	Hirundo nigrita	FF	LC			☑	☑
71	Barn Swallow	Hirundo rustica	FF	LC			☑	☑
72	Spur-winged Plover	Hoplopterus spinosus	W	LC	☑			
73	Pallid honeyguide	Indicator meliphilus	F	LC			☑	☑
74	African pygmy kingfisher,	Ispidina picta	W	LC	☑			
75	Rufous-necked wryneck,	Jynx ruficollis	f	LC			☑	☑
76	Lizard buzzard	Kaupifalco monogrammicus	f	LC		☑	☑	☑
77	African firefinch	Lagonosticta rubricata	f	LC		☑	☑	
78	Red-billed firefinch,	Lagonosticta senegala	f	LC		☑	☑	☑
79	Lesser blue-eared starling,	Lamprotornis chloropterus	f	LC		☑	☑	
80	Black-Headed Gonolek	Laniarius erythrogaster	f	LC		☑	☑	
81	Slate-coloured boubou,	Laniarius funebris	f	LC			☑	☑
82	Lühder's bushshrike,	Laniarius luehderi	f	LC			☑	☑
83	Tropical boubou	Laniarius major	f	LC			☑	☑
84	Papyrus gonolek	Laniarius mufumbiri	f	LC			☑	☑
85	Yellow-billed shrike,	Lanius corvinus	f	LC			☑	☑
86	Black-tailed Godwit	Limosa limosa	W	LC	☑			
87	Oriole finch,	Linurgus olivaceus	f	LC	☑		☑	☑
88	African pied hornbill,	Lophoceros fasciatus	FF	LC			☑	☑

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
89	Hemprich's hornbill	Lophoceros hemprichii	FF	LC			☑	☑
90	Double-toothed barbet at Entebbe	Lybius bidentatus	O	LC			☑	
91	Red-faced barbet,	Lybius rubrifacies	O	LC			☑	
92	Grey-Headed Bush-Shrike	Malaconotus blanchoti	O	LC			☑	
93	Crested malimbe,	Malimbus malimbicus	O	LC			☑	
94	Moustached Grass Warbler	Melocichla mentalis	O	LC			☑	
95	White-fronted bee-eater	Merops bullockoides	O	LC			☑	
96	Little bee-eater,	Merops pusillus	O	LC			☑	
97	Long-tailed cormorant	Microcarbo africanus	W	LC	☑			
98	Black kite	Milvus migrans	O	LC			☑	☑
99	Rufous-naped lark	Mirafra africana	G	LC			☑	
100	Flappet Lark	Mirafra rufocinnamomea	G	LC			☑	
101	African pied wagtail,	Motacilla aguimp	G	LC			☑	
102	African dusky flycatcher,	Muscicapa adusta	F	LC			☑	
103	Yellow-footed flycatcher,	Muscicapa sethsmithi	F	LC			☑	☑
104	Rufous flycatcher-thrush,	Neocossyphus fraseri	F	LC			☑	☑
105	Chestnut-breasted nigrita,	Nigrita bicolor	F	LC			☑	☑
106	Helmeted guineafowl	Numida meleagris	G	LC			☑	
107	Familiar chat,	Oenanthe familiaris	A	LC			☑	
108	Brown-tailed chat,	Oenanthe scotocerca	A	LC			☑	
109	Olive-bellied sunbird,	Cinnyris chloropygius	FF	LC			☑	☑

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
110	Eastern Black-Headed Oriole	Oriolus larvatus	f	LC			☑	☑
111	Black-winged oriole,	Oriolus nigripennis	f	LC		☑	☑	☑
112	Compact weaver	Pachyphantes superciliosus	f	LC			☑	☑
113	Osprey,	Pandion haliaetus	W	LC	☑			
114	Rufous Sparrow	Passer cordofanicus	O	LC	☑		☑	
115	House sparrow,	Passer domesticus	O	LC	☑		☑	
116	Grey-Headed Sparrow	Passer griseus	O	LC			☑	
117	Green woodhoopoe,	Phoeniculus purpureus	O	LC			☑	
118	Uganda woodland-warbler,	Phylloscopus budongoensis	F	LC			☑	
119	Willow warbler	Phylloscopus trochilus	F	LC			☑	☑
120	Glossy Ibis	Plegadis falcinellus	W	LC	☑			
121	Orange weaver,	Ploceus aurantius	O	LC	☑		☑	
122	Baglafecht weaver	Ploceus baglafecht	O	LC	☑		☑	
123	Northern brown-throated weaver,	Ploceus castanops	O	LC	☑		☑	
124	Black-Headed Weaver	Ploceus cucullatus	O	LC	☑		☑	
125	Brown-capped weaver,	Ploceus insignis	O	LC	☑		☑	
126	Lesser masked-weaver,	Ploceus intermedius	O	LC	☑		☑	
127	Golden-backed weaver	Ploceus jacksoni	O	LC	☑		☑	
128	Little weaver	Ploceus luteolus	O	LC	☑		☑	
129	Black-headed weaver,	Ploceus melanocephalus	O	LC	☑		☑	
130	Vitelline masked-weaver	Ploceus vitellinus	O	LC	☑		☑	

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
131	Holub's golden-weaver,	Ploceus xanthops	O	LC	☑		☑	
132	Green tinkerbird	Pogoniulus simplex	F	LC			☑	
133	Allen's gallinule,	Porphyrio alleni	W	LC	☑			
134	Red-fronted prinia,	Prinia rufifrons	f	LC			☑	☑
135	Gray-headed social-weaver,	Pseudonigrita arnaudi	f	LC			☑	☑
136	Common Bulbul	Pycnonotus barbatus	f	LC			☑	☑
137	Cardinal quelea	Quelea cardinalis	G	LC			☑	
138	Red-headed quelea	Quelea erythrops	G	LC			☑	
139	Abyssinian scimitarbill,	Rhinopomastus minor	O	LC		☑	☑	
140	Three-banded courser,	Rhinoptilus cinctus	O	LC		☑	☑	
141	Plain Martin	Riparia paludicola	O	LC			☑	
142	Hamerkop	Scopus umbrette	f	LC			☑	☑
143	African broadbill,	Smithornis capensis	f	LC			☑	☑
144	Black-and-white mannikin,	Spermestes bicolor	G	LC			☑	
145	Bronze Mannikin	Spermestes cucullata	G	LC			☑	
146	Red-Eyed Dove	Streptopelia semitorquata	f	LC			☑	
147	Laughing Dove	Streptopelia senegalensis	O	LC			☑	
148	Crowned Tchagra	Tchagra australis Brown	O	LC			☑	
149	Marsh tchagra	Tchagra minutus	O	LC			☑	
150	Sacred Ibis	Threskiornis aethiopicus	W	LC	☑		☑	
151	Marsh Sandpiper	Tringa stagnatilis	W	LC	☑		☑	
152	Small buttonquail	Turnix sylvaticus	G	LC			☑	
153	Tambourine Dove	Turtur tympanistria	F	LC			☑	☑

#	Common Name	Scientific Name	Habitant Type	IUCN Redlist Status	Site			
					Intake & PH	Treatment Area	Transmission and distribution lines	Reservoir
154	Red-Cheeked Cordon-Bleu	Uraeginthus bengalus	O	LC			☑	
155	Blue-naped mousebird	Urocolius macrourus	f	LC		☑	☑	☑
156	Long-toed lapwing,	Vanellus crassirostris	W	LC	☑			
157	Spur-winged plover,	Vanellus spinosus	W	LC	☑			
158	Straw-tailed whydah	Vidua fischeri	G	LC			☑	
159	Steel-blue whydah,	Vidua hypocherina	G	LC			☑	
160	Eastern paradise-whydah	Vidua paradisaea	G	LC			☑	
161	Porphyrio alleni	Zapornia flavirostra	W	LC	☑			

APPENDIX D: WATER QUALITY RESULTS

MAKERERE UNIVERSITY
P.O. Box 7062 Kampala, Uganda : 256-041-540992
Fax: 256-041-531061 E-mail: chemistry@conas..mak.ac.ug
DEPARTMENT OF CHEMISTRY

CLIENT: M/S TECHNITAL S.P.A **RECEIVED: 12/12/2024** **Report: 16/12/2024**

CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

MATRIX: WATER, SOURCE: THE NILE RIVER AT MASINDI PORT IN KIRYANDONGO DISTRICT

ANALYSIS RESULTS

PARAMETER	UNIT	UPPER	LOWER
EC	µS/cm	272	280
pH	-	7.0	7.2
Turbidity	NTU	35	41
TDS	mg/l	136	140
TSS	mg/l	2	2
Total Hardness	mg/l	82	84
Total Alkalinity	mg/l	70	72
Chloride	mg/l	14	22
Phosphate	mg/l	0.20	0.34
Calcium	mg/l	18	22
Magnesium	mg/l	12	13
Nitrate	mg/l	0.22	0.32
Sodium	mg/l	26	32
Potassium	mg/l	8	8
Boron	mg/l	0.24	0.34
DO	mg/l	6.9	6.6
TOC	mg/l	0.6	0.9
Fecal coliforms	CFU/100mls	0	0
Ecoli	CFU/100mls	0	0
Intestinal enterococci	CFU/100mls	0	0
Escherichia coli	CFU/100mls	0	0
BOD	mg/l	4	5

Analysis by:
RuhararaBudigi
Email: rbudigi@gmail.com TEL: 0772682256

DEPARTMENT OF CHEMISTRY
SCHOOL OF PHYSICAL SCIENCES
16 DEC 2024
CONAS-MAKERERE UNIVERSITY
P.O.BOX 7062, KAMPALA

APPENDIX E: PCR REPORT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE

PHYSICAL CULTURAL RESOURCES (PCR) ASSESSMENT REPORT

©MAY 2025

1. BACKGROUND INFORMATION

This Physical Cultural Resources (PCR) assessment report presents the findings of the Environmental and Social Impact Assessment that was undertaken for the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure to be located in Masindi and Kiryandongo districts respectively. Initiated by government of Uganda Ministry of Water and Environment, Directorate of Water Development, Water for Production Department; the project intends to develop water supply for irrigation for farms in this project area, as well as water for domestic use to communities in some parts of the project area. The Masindi Port Bulk Water Supply and Irrigation Infrastructure is designed as electricity powered multipurpose water system to meet the water demand of 13,000 ha farm irrigation area, 10,340 livestock heads and 87,000 populations by catching water from the River Nile, pumping and transferring to the Water Treatment Plant (WTP), and transporting it to the reservoir tanks, after which it is distributed to the farms and communities through pipelines. African Development Bank (AfDB) has been mandated by the government of Uganda Ministry of Water and Environment the "Borrower" to structure and arrange the financing for the Project.

The Project is located in the districts of Masindi and Kiryandongo, and the first phase of the project considers supply of raw water to the farms of Soul Agric, Afrokai, Kazire, Zamburi, Kisiriza Excellence Ltd, CMG, Muhazi Heritage, Norma Agric, Lochab, Asiri, Medium scale farms and Kimengo area. Treated Drinking water shall also be supplied to Kimengo Town, Masindi Port town, Misenyi, Mile10 and Kiziba TC.

As required by the bank, an Environmental and Social Impact Assessment (ESIA) was recommended before commencement of the project. Accordingly, this Physical Cultural Resources (PCR) assessment was undertaken as part of the main ESIA

The project is composed of these main components which includes; Diversion sump along shores of River Nile at Masindi Port, Off-shore Water Abstraction Pipeline into the diversion sump, Intake Structure, sedimentation tank and Raw Water Pump station, Drinking Water Treatment Plant (DWTP) and Drinking Water Pumping Station, 33kV Power line extension, Administration Office Block, Laboratory, Workshop, Staff Houses, Warehouse, Ductile Iron Raw Water Pumping Transmission Main, Ductile Iron Treated Water Pumping Transmission Main, Storage Tanks, Reservoirs at the farms, Main and Sub-main Distribution Lines, Main Distribution line for treated water, Installation of SCADA and automation of the Plant and Irrigation operations and Supply of 2 No. sets of Earth moving equipment each comprising of an Excavator, Bulldozer, wheel loader, Tipper Truck.

1.1. Description of the Project

The main goal of this study is to assess and understand the potential direct and indirect impacts of the proposed project on cultural heritage resources during the planning phase, in order to

proactively avoid or reduce any adverse effects. A Physical Cultural Resources (PCR) assessment forms an essential part of this process, especially considering that the project activities will involve land clearance, infrastructure development, and regular operational tasks. These actions may significantly affect the environment and, more critically, areas of archaeological and cultural significance.

The assessment recognizes that such impacts may include the destruction, disturbance, or degradation of cultural heritage assets, as well as indirect effects on the surrounding context that may diminish their cultural value or threaten the physical integrity of archaeological sites. Particular attention is given to sensitive locations along the water pipe line routes and at key construction sites like treatment plants and reservoir tanks. In response, the study outlines targeted mitigation and management measures to safeguard cultural heritage, aiming to prevent or minimize damage during project implementation.

The Borrower Guidance Note for E&S Operational Safeguard 7 emphasizes the protection of cultural heritage both tangible and intangible particularly as it relates to vulnerable groups such as indigenous people and underserved Traditional Local Communities. It requires borrowers to assess potential impacts on cultural heritage, engage in meaningful, culturally appropriate consultations, and apply a mitigation hierarchy (avoid, minimize, restore). Projects must develop Cultural Heritage Management Plans when needed, protect sacred and legally recognized sites, and establish procedures for chance finds. The guidance prioritizes respect for traditional knowledge, community consent, and legal compliance to ensure that cultural heritage is preserved and community identity safeguarded throughout project development.

Regarding the proposed Masindi Port Bulk Water Supply and Irrigation Infrastructure project, cultural heritage is considered an important source of scientific and historical knowledge, an asset for economic and social development, and an essential component of a community's cultural identity and traditions.

Therefore, since the nature of this project will involve mass ground movements and surface clearance that may lead to direct or indirect, positive or negative impact on cultural heritage resources within the project area of influence both in the short run and long run, a physical cultural resources (PCRs) assessment was undertaken to define the nature and scale of the potential impacts on cultural heritage resources.

1.2. The primary Objectives of the Study were to;

i. Identify any archaeological and cultural heritage sites located within and adjacent to the impact zone of the project area;
ii. Assess possible impacts of the proposed project on any identified archaeological and cultural heritage sites, and;

iii. Recommend mitigation measures that comply with environmental and social requirements.

The above objectives will be reinforced by the criteria for evaluating impact on sites of cultural heritage significance, which include;

a) The general presumption in favour of the protection and conservation of all sites of cultural heritage, because they provide an essential, finite and irreplaceable link between the past and the future, and points of reference and identity for culture and tradition;
b) Adverse impacts on sites of cultural heritage shall be kept to the absolute minimum.

1.3. Historical and Archaeological Background of the Project Area

Masindi District, located in western Uganda, was officially established in 1976 after separating from the larger Bunyoro-Kitara region. The town of Masindi emerged as a key commercial center in the late 19th and early 20th centuries, driven primarily by the cotton trade. The establishment of a mission in the 1910s further connected Masindi to wider regional networks, enhancing its economic and social development.

Kiryandongo District, created from Masindi in 2010, is part of the Bunyoro sub-region. Its historical significance lies in its role as a major refugee resettlement area. Over time, it has hosted refugees from countries such as South Sudan, Rwanda, the Democratic Republic of Congo, and Kenya. The district has seen notable growth through contributions made by refugee communities to local infrastructure and economic activity. However, it has also experienced challenges, including land-related conflicts and forced evictions to make way for commercial agricultural projects, which have led to social and economic tensions.

Agriculture remains the backbone of the economy in both districts, underpinning their livelihoods and economic structures. These regions reflect Uganda's broader narrative of indigenous growth, colonial impact, and post-independence developments, with their histories continuing to influence their present-day cultural and economic identities.

The Bunyoro-Kitara Kingdom, one of Uganda's oldest and most influential traditional institutions, played a dominant role in the region's history from the 16th to the 19th century. Founded by King Rukidi and centered in Bujumbura (now Hoima), the kingdom expanded its reach through military strength and alliances, particularly with the Chwezi dynasty. It was known for its expertise in ironworking, salt extraction, and its participation in extensive trade networks. The kingdom's power waned with the onset of British colonization, culminating in the exile of King Kabalega in 1899. Although traditional kingdoms were abolished in 1967, Bunyoro-Kitara was reinstated as a constitutional monarchy in 1993.

Archaeological investigations across the Bunyoro sub-region have revealed rich insights into the kingdom's past. At Munsa, a 14th-century iron-smelting furnace was uncovered, identifying it as

the oldest known ironworking site in western Uganda. The presence of grain storage pits and animal remains points to a thriving agrarian society. Kibiro, located on the Lake Albert shoreline, served as a major salt production center for the kingdom. Excavations there have revealed centuries-old cultural layers, with pottery suggesting links to northern groups, possibly indicating Nilotic influence. Other key sites, such as Munsa and Bigo Bya Mugenyi, are linked to the Chwezi dynasty and were likely central to early settlement patterns in the region between the 11th and 12th centuries.

Today, Bunyoro-Kitara is home to numerous important cultural and historical sites, which provide deep insights into its advanced societal structures and lasting cultural legacy.

2.0. KEY POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The PCR assessment will be guided by the following local and international policies, legal and institutional frameworks that are relevant in the documentation and preservation of cultural heritage and archaeological resources;

2.1. Uganda Vision 2040

- NO. 94. Calls for improvement in research and development of the souvenir art and craft industry, tangible and intangible heritage, water-based tourism resources, cultural centres, butterfly viewing, bird watching, caving, canopy walk, and wilderness camping among others, in order to diversify tourism products to meet the needs for the tourism sector. The PCR assessment in this project will contribute to Uganda's Vision 2040.

2.2. National Policy Frame Work

Museums and Monuments Policy (2015)

- The main aim of the policy is to "create a framework for the preservation and sustainable development of Uganda`s Museums and Monuments for the benefit of the people of Uganda and posterity". The policy further provides guidance on collection, research and museum services.

The Uganda National Culture Policy 2006

- The Uganda National Culture Policy aims to promote aspects of Uganda's cultural heritage that are cherished by its people. The policy recognizes that Uganda has several cultural sites and monuments, some of which are man-made while others are natural and these sites, monuments and antiquities are important for socio-cultural and educational purposes. The PCR assessment in this project will help to implement the National Culture Policy 2006.

2.3. Legal Framework

The Constitution of the Republic of Uganda (Art 3. No 2.) Act 2005

- The Constitution of the Republic of Uganda lays the premise for all the laws that have a bearing on culture by; Obligating the state and citizens to preserve and protect the culture of preservation of public property and Uganda's heritage (Principle of XXV); obligating the state to promote and preserve those cultural values and practices which enhance the dignity and well-being of Ugandans (Principle XXIV); mandating the central Government to manage national monuments, antiquities and archives as parliament shall determine (189(1) Schedule 6(10); and; requiring districts to cooperate to promote cultural and traditional lands (Fifth Schedule article 178). The project team will work had in hand with the two districts to document and promote cultural heritage.

The Museums and Monuments Act, 2022

- The objective of this Act is to consolidate and reform the law relating to cultural and natural heritage; to strengthen the administrative structures for the effective management of the cultural and natural heritage subsector.

2.4. Relevant International Conventions

The UNESCO Convention on the Protection of the World Cultural and Natural Heritage (1972)

- Uganda is a signatory to the Convention on the Protection of the World Cultural and Natural Heritage in 1987 and is thus obliged among other things to; ensure the identification, protection, conservation, preservation and transmission to future generations of the cultural and natural heritage (Article 4); ensure that effective and active measures are taken for the protection, conservation and preservation of the cultural and natural heritage situated on its territory, each State Party to this Convention shall endeavour, in so far as possible, and as appropriate for each country (Article 4); and adopt a general policy, which aims to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programs.

World Bank's Environmental and Social Standard 8 (ESS8): Cultural Heritage

- ESS8 recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present and future. People identify with cultural heritage as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions. Cultural heritage, in its many manifestations, is important as a source of valuable scientific and

historical information, as an economic and social asset for development, and as an integral part of people's cultural identity and practice. ESS8 sets out measures designed to protect cultural heritage throughout the project life cycle.

The International Finance Committee (IFC) Performance Standard 8: Cultural Heritage

- The IFC Performance Standard 8 refers to cultural heritage as; tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and, certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles. Its objectives are to protect cultural heritage from the adverse impacts of project activities and support its preservation and promote the equitable sharing of benefits from the use of cultural heritage.
- Therefore, in line with IFC Performance Standard 8, proper documentation of all PCR through consultation and engagement of stakeholders will be conducted in the project area.

3.0. ASSESSMENT METHODOLOGY

3.1. Desktop Survey

To develop a thorough understanding of the project area, an assessment of prior studies and comparable developments within the country was carried out, concentrating on archaeology, palaeontology, and the socio-cultural context of the broader region. Special attention was given to the cultural practices and heritage of communities in Masindi and Kiryandongo districts in Uganda's Mid-Western Region, as these populations are the primary residents of the project area and are likely to be directly affected by its implementation.

The cultural heritage and archaeological database at Uganda National Museums (Statutory Instrument 2024 No. 69) was reviewed to obtain preliminary information on the project area. The preliminary review revealed some key sites the in wider project area, which include; Masindi Hotel and Kijura Monument. The two sites are on the list of gazetted archeological and cultural heritage sites of national significance as per Statutory Instrument 2024 No. 69. The PCR study team took note of these sites during assessment. It was however noted that the proposed project will not affect the two sites.

3.2. Community Consultation and Engagement

This process involved formal consultations with the Masindi Port Sub-County Chief, along with informal engagements with stakeholders across the project area. The main objective was to capture

stakeholder perspectives on the project and support the documentation of cultural resources within the project area.

The main objective was to inform the community about the project but also request them to guide in archaeological survey and documentation of heritage sites in the project area. The information got from the community was vital in the documentation of cultural heritage sites in the project area.

3.3. Archaeological Survey

Archaeological survey, as defined by Fagan and DeCorse (2005), involves both systematic and unsystematic methods to locate and document archaeological sites. Systematic surveys use structured approaches like grid systems or evenly spaced transects (Renfrew & Bahn, 2008), while unsystematic surveys involve scanning the ground while walking through areas such as ploughed fields to identify and record surface artifacts and features (Feder, 1997; Renfrew & Bahn, 1996). In Masindi and Kiryandongo districts, specifically within Masindi Port and Kimengo sub-counties, the survey primarily employed unsystematic methods due to factors like thick vegetation. Fieldwork included spot checks along open areas, road cuts, and accessible parts of the project area, focusing on burial sites, places of worship (such as mosques and churches), and other visible cultural features. Data was collected through direct observation, photography, and recording, with some analysis conducted on-site, helping to document cultural and archaeological sites potentially affected by the project (Plate 1 below).



Plate 1: Archaeological Survey in Progress at the Site

3.4. Data Analysis

Analysis of the relationships between the recorded cultural heritage sites and project area was conducted to ascertain the level of impact the project will exert on the sites and how to mitigate them.

4.0. BASELINE RESULTS

This section presents the results of field study conducted along the Masindi Port Bulk water supply and irrigation infrastructure project area. Physical foot walks and interviews were conducted alongside consultative meetings with sub county stakeholders and community members along the project area. This was to record and document sites and artefacts of archaeological, historical, palaeontological, ethnographical and traditional interest and significance that may be either directly or indirectly affected by the project.

4.1. Consultative Meetings

The feedback from the consultative meetings with stakeholders of the Masindi Port Bulk water supply and irrigation infrastructure project area are as summarised in Table 1 below.

Table 10-1: Results of the Consultative Meetings with Stakeholders

Insitution	Issues Raised	Mitigation Measures
Masindi Port Sub-County (Kiryandongo District) and Kimengo Sub-County (Masindi District)	• Consultation with stakeholders in Masindi Port and Kimengo Sub-Counties focused on obtaining information about the PCRs in relation to the proposed project. • The subcounties should guide consultant in identifying cultural and heritage sites in their jurisdiction to ensure their protection. • Also the team was advised to consider intangible heritage as well, and if identified should improve cultural tourism.	• The team was effectively guided but the two subcounties did not have a heritage list of sites in the district. • Involvement of the district at all stages was urged to continue as guided. • All (tangible and intagible) heritage considered during the study. • The team conducted consultations and community were fully engagad as guided. • The team will continue consulting with the various stakeholders in this phase.

	• What happens with cultural sites along project footprint, how will they be handled if found?	• All cultural sites in the project area should be documented and assessed. •

4.2. Results of Archaeological Survey in the Project Area

Systematic and unsystematic archaeological survey was conducted in the project area, targeting majorly the area of direct project influence. The survey in the project area recorded a total of 30 archaeological and cultural heritage sites. These are; four (4) mosques, 15 churches, one (1) burial site, three (3) archaeological sites, and seven (7) medicinal plant sites (see Table 1 below). Analysis of these sites in relation to the project revealed that 10 sites will be affected directly and 20 will receive indirect impact. The detail is in Table 2, 3 and 5 below.

Table 2: Summary of Archaeological and Cultural Heritage Sites Recorded

S/N	Site Category	Number
1	Mosques	04
2	Churches	15
3	Burial Site/Grave Yard	01
4	Archaeological Sites	03
5	Medicinal Plants	07
	Total	**30**

Table 1-2: Detail of Cultural Heritage Sites recorded in the Masindi Port Bulk Water Supply and Irrigation infrastructure Project Area

KIRYANDONGO DISTRICT			
MASINDI PORT SUB COUNTY			
001	***Site Name***	**Kitukuza Mosque (KM)**	
	GPS Coordinates	**36N 398339 187522, elevation 1046m**	
	Baseline Condition and Significance	It is located in Kitukuza village, Masindi Port Sub County, Kirya Ndongo district. The mosque looks in ruins and yet still functional. It is also a historical building that holds the history of Indians and their architectural influence in the area. The building is located outside the proposed project area and hence will not be affected directly.	 *Plate 2: KM*
002	***Site Name***	**Kitukuza Burial Site 1 (KBS1)**	
	GPS Coordinates	**36N 398393 187555, elevation 1028m**	
	Baseline Condition and Significance	This site is characterised by heaped soils that portrays signs if probable burial ground located in Kitukuza village, Masindi Port Sub County, around the proposed water intake and power house. One of the locals consulted argued that in the past years, this place was created as a burial site for fishermen especially and anyone who died on water and either were unidentified or had no place to be buried.	 *Plate 3: KBS1*
003	***Site Name***	**Kitukuza Church of Uganda (KCU)**	

	GPS Coordinates	**36N 398203 187709, elevation 1026m**	
	Baseline Condition and Significance	The church is located in Kitukuza village, Masindi Port Sub County, Kiryandongo district. The church is located approximately 100m from the Masindi Port road. It is outside the proposed water pipeline and hence will not be affected directly.	 *Plate 4: KCU*
004	***Site Name***	**Masjid Hawa (MH)**	
	GPS Coordinates	**36N 396988 188927, elevation 1033m**	
	Baseline Condition and Significance	The mosque is located in Kitukuza village, Masindi Port Sub County. It is a religious/spiritual site for the Muslims in this area. The site is located approximately 100m from the proposed treatment plant and associated facilities, hence will not be affected directly.	 *Plate 5: MH*
005	***Site Name***	**St. Peters Waibango Anglican Church (SPWAC)**	
	GPS Coordinates	**36N 392079 189059, elevation 1049m**	
	Baseline Condition and Significance	The church is located in Waibango village, approximately 30m from the Masindi Port road in Masindi Port Sub County. The site is outside the proposed water pipe line and hence will not be affected directly.	

			 *Plate 6: SPWAC*
006	***Site Name***	**Masindi Port Main Mosque (MPMM)**	 *Plate 7: MPMM*
	GPS Coordinates	**36N 391908 189014, elevation 1046m**	
	Baseline Condition and Significance	The mosque is located in Wakisanyi village along Masindi Port road, Masindi Port Sub County. It is spiritual site for the Muslim community in the area, located 40m from the Kampala-Gulu main raod. The mosque will not be affected directly by the proposed water pipe lines.	
007	***Site Name***	**Ndabulya Medicinal Tree 1 (NMT1)**	
	GPS Coordinates	**36N 387622 189492, elevation 1070m**	
	Baseline Condition and Significance	The medicinal tree is a tamarind. The tree bears fruits used to make tamarind juice and traditional brews, which are used to cleanse the stomach off impurities when consumed	

		because of its medicinal components. It is found along Masindi Port road in Ndabulya village, Masindi Port Sub County Kiryandongo district. It is within the proposed water pipeline area.	 *Plate 8: NMT1*
008	***Site Name***	**Ndabulya Born Again Church (NBAC)**	 *Plate 9: NBAC*
	GPS Coordinates	**36N 387699, 189540, 1068m**	
	Baseline Condition and Significance	It is a born again church located in Ndabulya village, Masindi Port Sub County. The church still an incomplete structure under construction though being used by the community for prayers. It is located 60m away from the Masindi Port road and hence ouside the proposed water pipeline corridor.	
009	***Site Name***	**Katuugo Paradise Church (KPC)**	
	GPS Coordinates	**36N 386411 189961, elevtion 1070m**	
	Baseline Condition and Significance	The church is located in Kaduku II village, Masindi Port Sub County. The contact person is pastor Ndizeye Tiima Frank-0706092293. It is a born again church, located 60m	

		off the road and hence ouside the proposed water pipeline corridor.	 *Plate 10: KPC*
010	***Site Name***	**Kaduku II Church of Uganda (KCOU)**	 *Plate 11: KCOU*
	GPS Coordinates	**36N 384388 191529, elelvation 1088m**	
	Baseline Condition and Significance	The church is for church of Uganda. It is located 50m along the Masindi Port road in Kaduku II village, Masindi Port Sub County in Kiryandongo district. It outside the proposed water pipline project corridor.	
011	***Site Name***	**Kaduku II Catholic Parish (KIICP**)	
	GPS Coordinates	**36N 384207 191634, elevation 1087m**	
	Baseline Condition and Significance	The church is located in Kaduku II village, Masindi Port Sub County. It is a Catholic church located 65m from the Masindi Port road and hence ouside the propoed water pipeline project corridor.	

			 *Plate 12: KIICP*
012	***Site Name***	**Kaduku II Medicinal Plants 1 (KIIMP1)**	 *Plate 13: KIIMP1*
	GPS Coordinates	**36N 390054 189166 elevation 1066m**	
	Baseline Condition and Significance	The site is located in Kaduku II village, Masindi Port Sub County. It contains acacia plants valued as traditional medicine used to treat various sicknesses, including stomach aches and diarrhea. Its bark and leaves are commonly used to relieve fever in children and to relieve colds, chest infections, and inflammations. Also, it is traditionally used for deworming. The site is located outside the proposed water pipline corridor	
013	***Site Name***	**Kaduku II Medicinal Plants 2 (KIIMP2)**	
	GPS Coordinates	**36N 384710 191287, elevation 1082m**	
	Baseline Condition and Significance	The medicinal plants are found along the boundary of Soul Agri farm, located in Kaduku village. It is grevillea robusta, locally known as “Kalivaliyo”, "Bishaka," is	

		traditionally used to relieve and treat sore throats, chest infections, coughs, flu, and headaches. It is also believed to help boost immunity and manage immune related illnesses. The plants are within the proposed water pipline corridor.	 *Plate 14: KIIMP2*
DISTRIBUTION LINE TO KISIRIZI FARM			
014	***Site Name***	**Christian Fellowship Church (CFC)**	 *Plate 15: CFC*
	GPS Coordinates	**36N 384230 191703, elevation1090m**	
	Baseline Condition and Significance	The church is located 30m along the road from Mile 10 centre to tarmac road to Kigumba. It is a temporary structure made of mud, wattle and iron sheets. It will not be affected directly because it is located outside the proposed water pipeline corridor.	
015	***Site Name***	**Kaduku II Mosque (KIIM)**	
	GPS Coordinates	**36N 384411 192075, elevation 1085m**	
	Baseline Condition and Significance	This mosque is located in Kaduku II village, Masindi Port Sub County, along the Mile 10 centre-Kigumba tarmac road. It is approximately 40m off the road and hence it will	

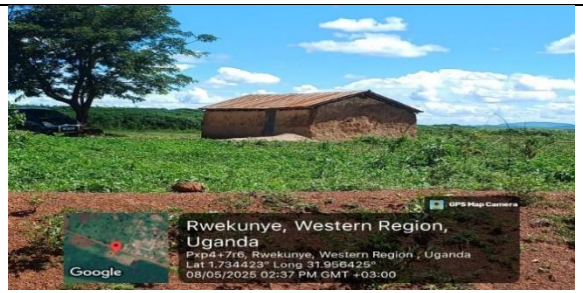
		not be affected directly by the proposed water piplne corridor.	 *Plate 16: KIIM*
016	***Site Name***	**Kaduku II Iron Age Site 1 (KIIIAS1)**	 *Plate 17: KIIIAS1*
	GPS Coordinates	**36N 385166 192863, elevation 1093m**	
	Baseline Condition and Significance	This archaeological site is located in Kaduku II village of Masindi Port Sub County. It is characterised by scatters of iron slags in association with pottery along the Mile10-Kigumba tarmac road. The archaeological materials reflect human settlement and landscape utilisation of the prehistoric societies. The site is located within the proposed water pipeline corridor.	
017	***Site Name***	**Kaduku II Salvation Army Church (KIISAC)**	
	GPS Coordinates	**36N 384959 192547, elevation 1087m**	
	Baseline Condition and Significance	This is church is located in Kaduku II village in Masindi Port Sub County, Kiryandongo district, 20m from the Masindi Port road. It is outside the proposed water pipeline corridor and hence it will not be affected directly.	

			 *Plate 18: KIISAC*
018	***Site Name***	**Kaduku I Medicinal Plants 1 (KIMP1)**	 *Plate 19: KIMP1*
	GPS Coordinates	**36N 382168, 192015, 1094m**	
	Baseline Condition and Significance	The castor medicinal plants are found along the road within the proposed water pipeline distribution lines. The plants seem to spread all the way from Kaduku II village to Kaduku I village in Masindi Port Sub county. The plants provide essential oils used for for personal adornments i.e skin care and hair oils, and for medicinal uses.	
019	***Site Name***	**Kaduku I Pottery Site 1 (KIPS1)**	
	GPS Coordinates	**36N 381217 192244, elevation 1109m**	
	Baseline Condition and Significance	The site is located along the road in Kaduku I village, Masindi Port Sub County, Kiryandongo district. It is characterised by scatters of pottery decorated in Plaited	

		Grass Roulette (PGR) appearing in a disturbed context. The site will not directly be affected by the project since it is outside the area of direct influence of the project.	 *Plate 20: KIPS1*
020	***Site Name***	**Bishenyi Seventh Day Adventist Church (BSDAC)**	
	GPS Coordinates	**36N 377548, 193148, 1111m**	
	Baseline Condition and Significance	The church is located in Bishenyi village, Masindi Port Sub County in Kiryandongo district. It is 50m from the road the Kampala-Gulu mainroan. It will not be affected directly since it is outside the proposed water pipeline corridor.	 *Plate 21: BSDAC*
021	***Site Name***	**Kichokwe Medicinal Tree 1 (KMT1)**	
	GPS Coordinates	**36N 373846, 189246**	
	Baseline Condition and Significance	It is a castor plants recorded along the Masindi Port road in Kichokwe village, Masindi Port Sub County. Castor plants provide essential oils that are used for for personal	

		adornments i.e skin care and hair oils, and for medicinal uses.	 *Plate 22: KMP1*
022	***Site Name***	**Kitwetwe Holy Spirit Church (KHSC)**	 *Plate 23: KHSC*
	GPS Coordinates	**36N 375917 191477, elevation 1128m**	
	Baseline Condition and Significance	It is a pentecostal church located 70m off the Masindi Port road in Bishenyi village, Masindi Port Sub County. The proposed water pipline corridor will not affect the church directly.	
023	***Site Name***	**Bishenyi Christian Fellowship Church (BCFC)**	
	GPS Coordinates	**36N 377896 193085, elevation 1118m**	
	Baseline Condition and Significance	The church is a born again church located in Bishenyi village, Masindi Port Sub County, Kiryandongo district. It is a temporary structure made of mud and wattle with iron sheets, 30m off the road. Churches hold a special place in society, drawing people in during times of tragedy and	

		hardship. In moments of crisis, the people turn to the church for comfort, solace and finding answers to their most profound needs.	 *Plate 24: BCFC*
024	***Site Name***	**Bishenyi Medicinal Plant (BMP)**	 *Plate 25: BMP*
	GPS Coordinates	**36N 383826 174928, elevation 1044m**	
	Baseline Condition and Significance	The accacia medicinal plant is located in Bishenyi village along the Masindi Port road along the proposed water pipeline corridor. Extracts from acacia is valued as traditional medicine for its healing properties and is used to treat various sicknesses, including stomach aches and diarrhea.	
025	***Site Name***	**Kaduku 1 Church (K1C)**	
	GPS Coordinates	**Lat 1.734423° Long 31.956425°**	
	Baseline Condition and Significance	The church is located in Kaduku 1 village in Masindi Port Sub County, Kiryandogo district. It is located along the distribution line to Soul Agric farm. The church is	

		approximately 40m from the Kampala-Gulu main road. It will not be affected directly by the proposed water pipelin to Soul Agric farm.	 *Plate 26: KIC*
MASINDI DISTRICT			
DISTRICTBUTION LINE FROM KIMENGO TO MUHOZI, KAZIRE, CMG FARMS			
026	***Site Name***	**Myeba Pentecostal Church (MPC)**	 *Plate 27: MPC*
	GPS Coordinates	**36N 383798 175398, elevation 1044m**	
	Baseline Condition and Significance	It is a Pentecostal church that embodys unity and devotion, playing a vital role in both individual growth and community well-being. The church is located in Myeba village, Kimengo Sub County, Masindi district, 30m from exisiting Myba village road. The chuch is outside the proposed water pipeline corridor and hence will not be affected directly.	
027	***Site Name***	**Myeba Church (MC)**	
	GPS Coordinates	**36N 384466 177061, elevation 1044m**	
	Baseline Condition and Significance	The church is a temporary church constructed in poles, mud, wattle and iron sheets. approximately 40m off the road. It is located40m off the road in Myeba village,	

		Kimengo Sub County, Masindi district. Irrespective of its physical structure, the church is highly valuable and important for spiritual-based guidance. This is ouside the proposed water pipeline corridor.	 *Plate 28: MC*
028	***Site Name***	**Myeba Church of God (MCG)**	 *Plate 29: MCG*
	GPS Coordinates	**36N 385080 178302, elevation 1045m**	
	Baseline Condition and Significance	The Myeba church of God is a Pentecostal church located in Myeba village, Kimengo Sub County, Masindi district, approximately 13m off the distribution line. The church will not be affected directly by the proposed water pipeline corridor.	
029	***Site Name***	**Myeba Medicinal Plant (MMP)**	
	GPS Coordinates	**36N 385057 178297, elevation 1047m**	
	Baseline Condition and Significance	The site is located in Myeba village, Kimengo Sub County, Masindi district. The medicinal plant is a Tamarind that bears fruits used to make tamarind juice and traditional brews, which are used to cleanse the stomach of impurities.	

		The tree is outside the proposed water pipeline and hence will not be affected directly.	 *Plate 30: MMP*
030	***Site Name***	**Myeba Iron Age Site (MIAS)**	
	GPS Coordinates	**36N 385073 178280, elevation 1046m**	
	Baseline Condition and Significance	This site is located in Myeba village. The site has a huge deposit of archaeological remains such as pottery and iron slags spread across a 30m x 20m on the church compound of Myeba church of God. The site reveals past human settlment in the area and provide useful clue into past human activities.	 *Plate 31: MIAS*

5.0. IMPACT ASSESSMENT AND MITIGATION MEASURES

Physical Cultural Resources (PCR) encompass both tangible and intangible elements of cultural heritage that hold archaeological, historical, architectural, religious, aesthetic, or cultural significance. These resources include movable and immovable objects, sites, structures, natural features, and landscapes found in various settings urban, rural, underground, or underwater and may be valued locally, nationally, or internationally. In line with IFC Performance Standard 8, cultural heritage covers tangible assets such as sites and artifacts, natural features with cultural meaning like sacred graves or waterfalls, and certain intangible cultural expressions.

For the Masindi Port Bulk Water Supply and Irrigation Infrastructure, cultural heritage is recognized as a valuable source of scientific and historical knowledge, a driver of economic and social development, and a key part of community identity and traditions. To prevent negative impacts, a cultural heritage impact assessment was carried out both within the project's area of influence and in the surrounding areas.

The cultural heritage impact assessment documented a total of 30 cultural heritage sites (Table 3 above). The recorded sites were assessed, evaluated (Table 4 below) and corresponding mitigation measures proposed in Table 5 and section 5 and the Appendices below.

Table 1-3: Determination of Impact Significance

			Sensitivity of receptor			
			Very low	Low	Medium	High
			1	2	3	4
Magnitude of Impact	Very low	1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low	2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Major
	High	4	4 Minor	8 Moderate	12 Major	16 Major

The table above indicates that the level of sensitivity of the project receptors is ***Moderate*** and hence the magnitude of the impact on cultural heritage is ***Medium***.

Table 1-4: Summary of Impact Evaluation and Mitigation Measures

Code	Site Name	Site Type (World Bank)	GPS Coordinates		Proximity to the Project Right of Way (Metre)	Significance/ Value	Magnitude of Potential Impact	Overall Impact Assessment	Recommendation/ Mitigation
			Eastings	Northings					
001	Kitukuza Mosque (KM)	Structure-movable	398339	187522	60m	High	Minor	Medium positive	Avoid the site
002	Kitukuza Burial site 1 (KBS1)	Structure-movable	398393	187555	In	High	Moderate	Medium negative	Relocate the site
003	Kitukuza Church of Uganda	Structure-movable	398203	187709	100m	High	Minor	Medium positive	Avoid the site
004	Masjid Hawa	Structure-movable	396988	188927	100m	High	Minor	Medium positive	Avoid the site
005	St. Peters Waibango Anglican church	Structure-movable	392079	189059	30m	High	Moderate	Medium negative	Avoid the site
006	Masindi Port Main Mosque (MPMM)	Structure-movable	391908	189014	40m	High	Moderate	Medium negative	Avoid the site
007	Ndabulya Medicinal Tree (NMT)	Site-immovable	387622	189492	In	High	Moderate	Medium negative	Avoid the tree
008	Ndabulya Born Again church (NBAC)	Structure-movable	387699	189540	60m	High	Minor	Medium negative	Avoid the site
009	Katuugo Paradise Church (KPC)	Structure-movable	386411	189961	60m	High	Minor	Medium negative	Avoid the site
010	Kaduku II Church of Uganda (KCOU)	Structure-movable	384388	191529	50m	High	Moderate	Medium negative	Avoid the site
011	Kaduku II Catholic Parish (KIIPC)	Structure-movable	384207	191634	65m	High	Minor	Medium negative	Avoid the site
012	Kaduku II Medicinal Plants 1 (KIIMP1)	Site-immovable	390054 386643	189166 189813	In	High	Moderate	Medium negative	Avoid the trees
013	Kaduku II Medicinal Plants 2 (KIIMP2)	Site-immovable	384710	191287	In	High	Moderate	Medium negative	Avoid the trees
014	Christian Fellowship Church (CFC)	Structure-movable	384230	191703	30m	High	Moderate	Medium negative	Avoid the site
015	Kaduku II Mosque (KIIM)	Structure-movable	384411	192075	40m	High	Moderate	Medium negative	Avoid the site

016	Kaduku II Iron Age Site 1 (KIIIAS1)	Site-immovable	385166	192863	In	High	Moderate	Medium positive	Conduct archaeological watching briefs.
017	Kaduku II Salvation Army Church (KIISAC)	Structure-movable	384959	192547	20m	High	Moderate	Medium negative	Avoid the site
018	Kaduku I Medicinal Plants 1 (KIMP1)	Site-immovable	382168	192015	In	High	Moderate	Medium negative	Replant the trees
019	Kaduku I Pottery Site 1 (KIPS1)	Structure-movable	381217	192244	In	High	Moderate	Medium negative	Conduct archaeological watching briefs.
020	Bishenyi Seventh Day Adventist Church (BSDAC)	Structure-movable	377548	193148	50m	High	Moderate	Medium negative	Avoid the site
021	Kichokwe Medicinal Tree 1 (KMT1)	Site-immovable	373846	189246	In	High	Moderate	Medium negative	Replant the trees
022	Kitwetwe Holy Spirit church (KHSC)	Structure-movable	375917	191477	70m	High	Minor	Medium positive	Avoid the site
023	Bishenyi Christian Fellowship Church (BCFC)	Structure-movable	377896	193085	30m	High	Moderate	Medium negative	Avoid the site
024	Bishenyi Medicinal Plant (BMP)	Site-immovable	383826	174928	In	High	Moderate	Medium negative	Avoid the tree
025	Kaduku 1 Church (K1C)	Structure-movable	1.734423°	31.956425°	out	High	Moderate	Medium negative	Avoid the site
026	Myeba Pentecostal Church (MPC)	Structure-movable	383798	175398	18m	High	Moderate	Medium positive	Avoid the site
027	Myeba Church (MC)	Structure-movable	383798	175398	40m	High	Moderate	Medium negative	Avoid the site
028	Myeba Church of God (MCG)	Structure-movable	385080	178302	13m	High	Moderate	Medium positive	Avoid the site
029	Myeba Medicinal Plant (MMP)	Site-immovable	385057	178297	14m	High	Moderate	Medium negative	Avoid the tree

030	Myeba Iron Age Site (MIAS)	Site-immovable	385073	178280	In	High	Moderate	Medium negative	Conduct archaeological watching briefs.

5.1. Project Impacts and Mitigation Measures

5.1.1. Positive Impacts of the Project

i). The project may support rescue archaeology at the preparation phase to salvage any stable artefacts that maybe underground during construction.
ii). In addition, cultural awareness creation and education regarding the environment and cultural resources should be encouraged at all phases of the project.
iii). Income will also be generated from the trading of cultural or local crafts to the project workers.

5.1.2. Enhancement of Positive Impacts

i). The contractors should work hand in hand with professional archaeologist(s) so that potential archaeological sites and materials can be identified and salvaged during the site clearance phase.
ii). Since archaeological artefacts are irreversible and priceless, professional archaeologists should be involved in all the project phases.
iii). Site workers should be trained in artefact identification and chance finds procedure.
iv). The surrounding community should be sensitized on the importance of cultural heritage sites and how to benefit from them.
v). Local residents and custodians should be trained in site protection and handling of valuable artefacts.
vi). The contractors should retrieve abandoned sacred burials/graves that may be discovered during project activities for reburial in a nearby public cemetery.

5.2. Negative Impact Mitigation Measures

Based on the analysis of cultural heritage sites recorded along the Masindi Port Bulk Water Supply and Irrigation Infrastructure project area, the following key mitigation measures are recommended.

5.2.1. Construction Phase

i). Burial Sites

- The study recorded one burial site (002 in table 5) in the project area. The burial site will be affected directly by the proposed project. It is therefore recommended that;

i). The burial site should be relocated in consultation with the caretakers, village and cultural leaders.
ii). Relocation of the burial site should be undertaken in a culturally acceptable manner that respects and puts into consideration the cultural norms and practices of the respective community in order to preserve their cultural significance.

iii). Since the caretakers of the burial site was not identified, the graves should be relocated to a public cemetery.

ii). Religious/Places of Worship

- Archaeological survey in the Masindi Port Bulk Water Supply and Irrigation Infrastructure project area recorded 15 churches and three (4) mosques. All the churches and the mosques will not be affected directly by the project. However, enhancement measures are explained below when deemed necessary.

i). Since the places of worship belong to the community, the respective community should be sensitised about the project and the extent of the impact of the project on the places of worship.
ii). The project should provide and improve access to the churches and the mosques at all phases of the project (during and after construction).
iii). Use of machinery that may cause excess vibration to places of worship should be avoided.
iv). Working with heavy equipment near places of worship during prayer days should be avoided.

iii). Archaeological Sites

- The archaeological survey conducted in the Masindi Port Bulk Water Supply and Irrigation Infrastructure project area recorded three (3) archaeological sites. The sites will be affected directly by the project, hence;

i). The project Specific Chance Finds Procedure (SCFP) should be developed, followed and adhered to during the construction phase of associated facilities of the project to make sure that incidental potential finds are appropriately managed.
ii). Project site workers should be trained on Chance Finds Procedure (CFP), so as to help in identification, documentation and reporting during the construction phase.
iii). Archaeological watching briefs should be undertaken by cultural heritage specialist/archaeologist to record any uncovered artefacts or features during ground breaking phase of the project. The phase includes site clearance, uprooting of huge trees, clearance of work camps, marram etc.
iv). The cultural heritage specialist/archaeologist should be assigned by the contractor as part of the cultural heritage management team.
v). Project construction activities should be limited to the proposed areas to avoid extended impact on sites in close proximity.
vi). In case there is a change of location of the previously selected project component or additional change in design that need more land, the new location should be subjected to archaeological and cultural heritage investigation.

vii). Appropriate equipment should be used when close to sites of cultural heritage to avoid damage due to vibration.

v). Medicinal Plants

Under the categories of medicinal plants, nine (7) cultural plants used for medicine and food purposes were recorded. Out of these, six (6) sites are directly affected while one (1) will not be affected directly. To enhance and mitigate the indirect and direct impact of the project, the following measures are recommended.

i). The one indirectly affected site (029 in Table 5) should be left preserved as it is because it is outside the area of direct influence of the project.

ii). Sites (007, 012, 013, 018, 021 and 024 in Table 5) which are directly affected should be preserved by working around them during project activities. However, more trees should be planted to replace the portion that may be affected during the project activities.

5.2.2. Operation and Maintenance/ Post Construction Stage

- Archaeological monitoring and evaluation.
- Salvage or rescue excavation of exposed archaeological artefacts should be conducted.
- Replant cultural trees as part of site restoration.

5.3. Conclusions

Extensive archaeological study was conducted in the Masindi Port Bulk Water Supply and Irrigation Infrastructure project area. The study methods comprised literature review community consultations and archaeological survey. Working with guides from the community, a number of archaeological and cultural heritage sites were recorded and analysed (Table 1,2,3,4 and 5). Analyses of the sites recorded indicate that Masindi Port Bulk Water Supply and Irrigation Infrastructure project will exert minimal negative impact on cultural heritage of the area. The negative impact should be mitigated using the above recommended mitigation measures.

APPENDICES

Appendix 1: Physical Cultural Resources (PCR) Management Plan

Potential Impact	Mitigation/Enhancement measures	Responsibility
Construction Phase		
Archaeological and cultural heritage	Archeological watching briefs during site clearance	Project Contractor
	Reporting of Chance finds	Project Contractor
	Review of Chance finds	Ministry of Energy and Mineral Development
	Approval of action on Chance finds and monitoring rescue activities	Department of Museums and Monuments
	Creation of protective Barricades	Project Contractor
	Creation of access to cultural heritage sites such as churches, mosques, memorial sites etc.	Project Contractor
	Continuous consultation of key stakeholders	Project Contractor
	Relocation of graves	Ministry of Energy and Mineral Development /Project Contractor
	Performing of cultural ceremonies for graves relocation and shear butter cutting	Cultural leaders/elders
	Monitoring of grave relocation activities	Contractor/Department of Museums and Monuments
Operation and Maintenance/ Post Construction Stage		
Archaeological and cultural heritage	Salvaging or rescue excavation of exposed Archaeological artefacts.	Project Contractor

Potential Impact	Mitigation/Enhancement measures	Responsibility
	Archaeological monitoring and evaluation.	Department of Museums and Monuments.

Appendix 2: Criteria for Assessing Value and Magnitude of Impact on Cultural Heritage Assets

- Assessment of value will involve consideration of how far the site(s) contribute to an understanding of the past, through their individual or group qualities, either directly or potentially. These are professional judgements, but they are also guided by legislation, national policies, acknowledged standards, designations, criteria and priorities.
- The assessment will involve reference to cultural heritage guidance which recommends the adoption of six ratings for value in relation to archaeology and cultural heritage: very high, high, medium, low, negligible and unknown. Definitions for each rating are outlined in Table 1 below.

Table 1: Factors for Assessing the Value of Cultural Heritage Assets

Value	Status and Definition
Very High	World Heritage Sites (including nominated sites) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled Monuments (including proposed sites) Undesignated assets of scheduled quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Designated or undesignated assets that contribute to regional research objectives
Low	Designated and undesignated assets of local importance Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives

Negligible	Assets with very little or no surviving archaeological interest
Unknown	The importance of the resource has not been ascertained

Magnitude of Impact

The determination of magnitude of impact will be based on the vulnerability of the study area, its current state of survival/condition and the nature of the impact upon it. The survival and extent of the archaeological deposits is often uncertain and consequently, the magnitude of change can be difficult to predict with any certainty.

The assessment will involve reference guidance to cultural heritage which recommends the adoption of five ratings for value in relation to archaeology, sacred sites and spiritual sites: major, moderate, minor, negligible and no change. Definitions for each rating are outlined in Table 2 below.

Table 2: Factors for Assessing the Magnitude of Impact

Magnitude of Impact	Factors in the Assessment of the Magnitude of Impacts
Major	Change to most or all key archaeological materials, such that the resource is totally altered Comprehensive changes to setting
Moderate	Changes to many key archaeological materials, such that the resource is clearly modified Considerable changes to setting that affect the character of the asset
Minor	Changes to key archaeological materials, such that the asset is slightly altered Slight change to setting
Negligible	Very minor changes to archaeological materials, or setting
No Change	No change

APPENDIX F: GEOTECHNICAL INVESTIGATION REPORT

Table of Contents

1 INTRODUCTION 1
1.1 Project Background 1
1.2 Purpose of the Geotechnical Investigations 1
1.3 Geology of the Project Area 2
1.3.1 Introduction 2
1.3.2 Masindi Port Site 2
1.3.3 Kaduku Hill Site 2
1.3.4 Transmission Mains Route 3
1.3.5 Hydrogeological Significance and Implications for Foundation Design 4
1.4 Regional Seismicity 5
1.5 Execution of the Geotechnical Investigations 5
2 GEOTECHNICAL INVESTIGATIONS 7
2.1 General 7
2.2 Field Investigations 8
2.2.2 DPL Testing 14
2.3 Geophysical Investigations 17
2.3.1 Geophysical Data Analysis 18
2.4 Laboratory Testing 19
3 INVESTIGATION FINDINGS 21
3.1 Soil Classification, Strength along the Transmission Line 21
3.1.1 Chemical Tests on soil samples 22
3.1.2 Drill Investigations 23
3.1.3 SPT test 24
3.1.4 Consolidation 24
3.1.5 Shear test 25
3.1.6 Soil moisture, permeability and groundwater 26
3.1.7 Data analysis and comparision of resistivity with borehole logs at the treatment plant. 27
3.1.8 Data analysis and comparision of resistivity with borehole logs at the reservoir. ..30
3.1.9 Engineering Recommendation for Foundation Design and Seismic Design Consideration 34
REFERENCES 36
APPENDICES 37
Appendix 1: Geological Features Around the Project Area. 38

Appendix 2: Seismicity Map 39
Appendix 3: Test Point Location Map 40
Appendix 4: Borehole logs.....41
Appendix 5: Test Pit Logs 42
Appendix 6 : Laboratory Classification Test Results for Trial Pits 43
Appendix 7 : Laboratory Classification Test Results for Boreholes.....44
Appendix 8: Consolidation Test Results 45
Appendix 9:Shear Test Results 46
Appendix 10: Geophysical Test Results 47
Appendix 11: SPT N Bearing Capacities Test Results.....48
Appendix 12: DPL Test Results.....49
Appendix 13: BOREHOLE PICTURES.....50

List of Figures

Figure 1: Main Physical Features of Masindi Port Site 9
Figure 2: Bore hole drilling at the masindi port 10
Figure 3: Location of the proposed reservoir point 11
Figure 4: Some of the Features on Transmission Mains Route..... 13
Figure 5: Sample of the agricultural activities adjacent to the proposed reservoir..... 13
Figure 6: Photos showing Dynamic Penetrometer Tests in Progress..... 15
Figure 7: Resistivity test at the treatment point..... 18
Figure 8: Resistivity Analysis Curves 19
Figure 9: Material Strength along the transmission Line 21
Figure 10: Soil chemical composition along the transmission line..... 23
Figure 11: Drilling along the proposed alignment 24

List of Tables

Table 1-1: Summary Geological Formations 3
Table 2-1: Summary of Scope of Work 7
Table 2-2 : Bore holes at the Masindi port 10
Table 2-3 Location of Boreholes for Treatment Plant Site 11
Table 2-4 Location of Borehole for Reservoir Site 12
Table 2-5 Boreholes along the Transmission Main Route 14
Table 2-6 Consistency along the proposed pipe alignment 16
Table 2-7 : Standards used 19
Table 3-1: Summary Consolidation Test Results 25
Table 3-2: Summary Shear Test Results 25
Table 3-3: Depth of Perched Water Table 26
Table 3-4: Comparision of resistivity results with the borehole logs at the treatment plant 27
Table 3-5: Comparision of resistivity results with the borehole logs at the reservoir 30
Table 3-6: Summary of Engineering Recommendation 35

1 INTRODUCTION

1.1 Project Background

TECHNICAL S.P.A./BETA Studio/Segamu 14 Consults Limited/Tawi Research Limited were contracted by the Ministry of Water and Environment to undertake the feasibility studies of the Masindi bulk water supply and sanitation Project. The main aspects of the assignment involved coming up with a detailed design of the water treatment structures at Kiryandongo sub-county, the water reservoir at Kaduku Hill as well as the sizing of the water transmission mains from the Masindi Port to Kiryandongo.

It is against this background that the services of Geo Concrete Laboratory SMC Ltd., a fast-reputable growing civil engineering laboratory requested to carry out geotechnical investigations at the sites proposed for the construction of water treatment structures at Kaduku Hill water reservoir tank at Kiryandongo District as well as along the entire proposed transmission water mains. The field exploratory activities in respect with this assignment were conducted between 14th January 2025 and 21st January 2025 followed by detailed laboratory soil testing.

1.2 Purpose of the Geotechnical Investigations

The purpose of the geotechnical investigation assignment was to ascertain the engineering properties of the subsurface soil conditions at all sites proposed for the various components of the proposed water supply expansion project.

In particular, the geotechnical investigations were undertaken to meet the following objectives:

- To confirm the geotechnical properties likely to affect the design and construction
- To provide all the necessary information for the design and construction of the water transmission mains, storage reservoirs, pumping stations and treatment structures
- To determine if any soil strengthening requirements are necessary and identify any other critical components that are likely to affect the design.

1.3 Geology of the Project Area

1.3.1 Introduction

The desk study of the geology of the project area was conducted using the 1:100,000 scale geological map of Uganda, published by the department of geological survey and mines in August 2012. This study focused particularly on sheet Nr 85, which covers the areas relevant to the project, including Masindi Port and Kiryandongo district. A copy of this map is provided in Appendix 1. Additional technical details were also gathered from the technical explanation note for the geological map, which further supports the geological understanding of the region. The results of the study are summarized in the following subsections. Table 1-1 provides a summary of the geological formations encountered at the three main site locations.

1.3.2 Masindi Port Site

The Masindi Port site is primarily underlain by quartzite and Awela granodiorite gneiss, both of which are igneous rocks of intrusive origin. These rocks are known for their high durability and resistance to weathering, making them significant in construction projects. The Awela granodiorite gneiss is a coarse-grained rock that is typically light to medium grey in color, while quartzite is a metamorphosed sandstone, characterized by its hardness and resistance to erosion. The thickness of these formations in the area is not explicitly mapped in the available resources but is typically substantial in the region.

1.3.3 Kaduku Hill Site

The proposed Kaduku Hill water reservoir site is primarily underlain by an isolated phyllite formation. This formation is made up of mudstone, shale, and slates, which are sedimentary rocks. These rocks are generally fine-grained and are subject to weathering, often forming residual soils at the surface. The formation typically has a relatively shallow thickness, and its weathered nature may vary across the site. The phyllite formation is also prone to foliation, which could impact the stability of excavations and construction. The underlying mudstone, shale, and slates are

softer compared to the hard quartzite and granodiorite gneiss, making this site more suitable for certain types of infrastructure.

1.3.4 Transmission Mains Route

The transmission main runs between Masindi Port and Kaduku Hill, crossing through regions dominated by quartzite and Awela granodiorite gneiss, similar to the geology at the Masindi Port site. These geological formations will influence the construction and installation of the transmission mains. The characteristics of the quartzite and granodiorite gneiss along this route are similar to those found at Masindi Port, where these intrusive igneous rocks form the bedrock, which is generally resistant to erosion and weathering. The thickness of these formations along the transmission route is expected to be consistent with the known local geological patterns, although further investigation is required to determine the precise depth of these formations at various points along the route.

Table 1-1: Summary Geological Formations

Site	Geological Formation	Description
Masindi Port	Shale, Slate, Phyllite, Sandstone, Quartzite	Igneous, hard, compact rocks with low permeability.
Transmission Line	Quartzite, Awela Granodiorite Gneiss	Similar to Masindi Port, these formations are intrusive and highly compact.
Kaduku Hill (Reservoir)	Mudstone, Shale, Slate	Sedimentary, fissile rocks with moderate to low permeability.

This table compares the geological formations, allowing for clearer stratigraphic correlations between the three sites. The formations at Masindi Port and the Transmission Line are similar, both consisting of quartzite and Awela granodiorite gneiss, which are igneous, intrusive rocks with low permeability. The Kaduku Hill site is distinct, composed of mudstone, shale, and slate, which are sedimentary rocks that generally have higher porosity and permeability.

1.3.5 Hydrogeological Significance and Implications for Foundation Design

The geological formations play a significant role in the hydrogeological context, especially about water infiltration, groundwater potential, and foundation design. Here's a more detailed explanation of their implications:

I. **Masindi Port & Transmission Line (Quartzite and Awela Granodiorite Gneiss)**

These rocks are igneous and intrusive, characterized by low permeability. As a result, water infiltration is minimal, and groundwater potential is generally low unless fractures or faults are present. Water movement through these rocks is typically restricted to joint systems or weathered zones.

The low permeability and solid nature of these rocks suggest that foundation design can focus on stability and load-bearing capacity, as settlement due to water infiltration. However, it's important to consider the potential for groundwater under specific conditions (e.g., fractured zones) that could impact deep foundations or drainage systems.

II. **Kaduku Hill (Mudstone, Shale, Slate)**

The mudstone, shale, and slate at Kaduku Hill are sedimentary rocks, which tend to have higher porosity and permeability than igneous rocks. This means that these formations have the potential to allow water infiltration, which could lead to groundwater accumulation. Water movement could be more significant in fissures or joints within the rocks.

The higher permeability of the sedimentary rocks at Kaduku Hill may require more detailed groundwater management in the foundation design. The potential for water accumulation, seepage, or changes in groundwater levels must be considered. Adequate drainage systems and waterproofing may be necessary to prevent foundation instability or erosion. Pile foundations might be more appropriate in areas where water movement could cause soil consolidation or erosion risks.

1.3.5.1 Summary of Geological and Hydrogeological Implications for Foundation Design

I. **Masindi Port & Transmission Line**: Both sites are underlain by igneous rocks (Quartzite and Awela Granodiorite Gneiss), characterized by low permeability. This suggests that the foundation design can focus on structural stability without significant concerns for water infiltration. However, fractured zones should be checked to ensure proper drainage.

II. **Kaduku Hill**: The sedimentary formations (Mudstone, Shale, Slate) indicate moderate to high permeability. Special attention should be given to groundwater flow, seepage, and the risk of water accumulation near the foundation, especially if the site is prone to seasonal changes in water levels. Effective drainage solutions, potentially including impermeable barriers or pile foundations, may be necessary to address these concerns.

1.4 Regional Seismicity

According to the Seismic Code of Practice for Structural Designs, (MoWT, 2010), the project area lies in zone 1 (seismically high-risk area) on the seismic zoning map as shown in **Appendix 2.,** However, the project area is free from the fault lines as shown in **Appendix 1.**

1.5 Execution of the Geotechnical Investigations

The surface and subsurface soil exploratory investigations were conducted for the sites at Kaduku Hill, and the proposed Transmission Mains from the water source to Kaddu Hill to determine pertinent soil physical properties that shall form part of inputs into the design of foundations for the various proposed structures. The geotechnical exercise involved defining site physical features, profiling of the project soils through test pit soil logs, sampling of soils and conducting laboratory testing of the sampled soils. In addition, dynamic penetrometer tests were performed to characterise in-situ soil strength in terms of soil consistency and allowable bearing capacities.

This report is organized into three chapters according to the tasks that were executed as shown below.

Chapter 1.0 – A brief project background, the purpose of the geotechnical investigations and the description the of project geology.

Chapter 2.0 – Covers geotechnical Investigations and is divided into two sections that is field investigations and laboratory testing.

Chapter 3.0 – Presents the investigation results and discussions, conclusions and recommendations based on the investigation findings.

2 GEOTECHNICAL INVESTIGATIONS

2.1 General

The geotechnical investigations were commenced with field exploratory activities that were conducted in accordance with BS 5930:2015 “Code of Practice for Site Investigations” and were concluded with laboratory examination of the retrieved test pit soil samples. Specifically, the following activities were conducted at each site location and along the proposed transmission mains route:

- Excavation of 20 No. test pits up to 2m depth along the transmission line.
- Logging of all 20 No. excavated test pits (soil profiling or strata description)
- Sampling i.e. extraction of disturbed samples for soil classification, strength and chemical tests
- Conducting 20 No. DPL tests to 5m depth or refusal at the transmission route.
- Conducting Standard Penetration Tests (SPT) in 12 No. boreholes at the interval of 1.5m to the investigated depth. SPTs were based on a 63.5kg driving hammer falling ‘free’ from a height of 760mm i.e 2No. boreholes at the main reservoir, 2No. boreholes at the intake, 1No. borehole at the sub reservoir, 2 No. boreholes at the treatment plant and 5No. boreholes long the transmission line.
- Conducting 2 No. electrical resistivity test 1No. at the treatment plant and the other at the reservoir
- Testing of the recovered samples in the laboratory as shown the table below

Table 2-1: Summary of Scope of Work

Activity	Details	Quantity/No.
Test Pit Locations	Along the transmission line	20 No.
Logging of Test Pits	Soil profiling or strata description	20 No.

Soil Sampling (Disturbed)	For soil classification, strength & chemical tests	20 No.
Dynamic Penetration Tests (DPL)	To 5m depth or refusal at transmission route	20 No.
Standard Penetration Tests (SPT)	63.5 kg driving hammer, 760mm fall	12 No.
Borehole Locations for SPT	2 at the main reservoir, 2 at intake, 1 at the reservoir, 2 at the treatment plant, 5 along the transmission line	12 No.
Electrical Resistivity Tests	1 at the treatment plant, 1 at the reservoir	2 No.
Laboratory Testing of Samples	Includes classification, strength, and chemical tests	Multiple samples

Appendix 3 shows the location of test pits, drilled boreholes and soil resistivity that were excavated and the subsequent sections detail the different activities that were performed during the investigation.

2.2 Field Investigations

2.2.1.1 Site Description, Rotary Drilling, Test Pit Excavation, Sampling & Logging

In this section, pertinent physical site features and activities associated with subsurface soil explorations are described in detail. Generally, for each test pit excavated, the following activities were performed in line with the relevant sections of BS 5930:2015.

- Recording the type and thickness of the different soil strata encountered.
- Disturbed sampling for laboratory classification, and chemical and strength tests. Details of laboratory testing of the recovered samples to determine particle size distribution, Atterberg limits, natural moisture determination, pH, sulphates, chlorides, compaction tests and CBR tests are shown in Section 3.0.

2.2.1.2 Masindi Port Site

The proposed water source site is located a Masindi port in Kiryandongo district which is located approximately 8km from Kampala Gulu Road Highway. As shown in **Figure 1**, the site is fairly flat covered by savanna grassland surrounded by papyrus swamp.



Figure 1: Main Physical Features of Masindi Port Site

Two (2) Boreholes were drilled to the rock formation depth at this site (see figure 2 below) and presented in **Table 2-2** is the summary of work performed during the boring and water table was measured using piezometer. **Appendix 4** shows the soil profiles from the boreholes.



Figure 2: Bore hole drilling at the masindi port

Table 2-2 : Bore holes at the Masindi port

No.	BH No.	Location as per Coordinates	Elevation (m)	Drilling Date	Excavated Depth	Remarks
1	BH 01	1.694184,32.092153	1038	14-Jan-25	12m	Rock Encountered at 12m
2	BH 02	1.695146,32.092012	1038	14-Jan-25	13m	Rock Encountered at 13m

2.2.1.3 Kiryandongo Sub County Site (Treatment Plant)

The proposed treatment plant is located approximately 3km from Masindi Port road towards Kampala Gulu highway. The site is located on the flat terrain near Masindi subcounty offices and its surrounding areas. The site is surrounded by several residence dwellings including the church, covered by tropical pine trees.

At this site, two boreholes were drilled to a given depth as presented in table 2-3 below.

Table 2-3 Location of Boreholes for Treatment Plant Site

No	BH No.	Location as per Direction	Excavation Date	Elevation (m)	Excavated Depth (m)
1	BH 03	1.695810,32.089690	15-Jan-25	1037	12
2	BH 04	1.696390,32.087117	16-Jan-25	1040	13

2.2.1.4 Kaduku Hill (Reseviour)

The proposed reservoir site is located approximately 8km from Masindi Port road and it crosses the Kampala Gulu highway to Kaduku Hill. The site is located on a hilly terrain surrounded by forest reserves as seen in figure 3 below.



Figure 3: Location of the proposed reservoir point

At this site, two boreholes were drilled to 10m depth and the summary of work performed is presented in **Table 2.4**

Table 2-4 Location of Borehole for Reservoir Site

No	BH No.	Location as per Direction	Excavation Date	Elevation (m)	Excavated Depth (m)
1	BH 010	1.751474,31.929816	19-Jan-25	1149	13
2	BH 011	1.751474,31.931788	19-Jan-25	1149	13

2.2.1.5 Proposed Main Route to the Reservoir Location

The proposed transmission line begins from the Masindi port water source towards the Kampala Gulu Highway and then crosses the Kampala Gulu Highway up to Kaduku Hill. An extra transmission line is proposed to connect the proposed reservoir at Kaduku Hill to the sub-reservoir at Soul Agric farm.

The section of the proposed transmission mains from the source to Kampala Gulu highway is characterized by, initially a gentle ascend towards the main road followed by a short steep section leading towards the last section running along the highway junction. This section was also characterized by moderate to sharp horizontal and vertical curves. The adjacent areas are mainly comprised of savanna grassland with some lined trees, gardens and lined settlements, especially in the section located within town centres. The section of the transmission mains along the Masindi Port to Kampala Gulu highway generally passes through mainly flat terrain sections and is therefore characterized by gentle to steep vertical curves. Furthermore, due to the nature of the terrain, a significant portion of the area adjacent to the road along which the transmission main is proposed to be installed is flat, with no embarkments created during the process of road construction. Most of the areas outside the road reserve are used for the cultivation of crops (see Figure 4).



Figure 4: Some of the Features on Transmission Mains Route

The proposed transmission mains within the section from the reservoir junction site to the top of Kaduku Hill through a mixed rolling and hilly terrain, characterized by a series of sharp horizontal curves and steep vertical curves. 2km at the crest of one of the fairly steep hills was covered by large gravelly material and a weathered rock at the foot of the hill along the access road to the hilltop as shown in **Figure 5**. The land adjacent to the road on the southern side of the proposed main reservoir is mainly used for farmland mostly cassava plantations.



Figure 5: Sample of the agricultural activities adjacent to the proposed reservoir

A summary of work performed during the drilling of boreholes is presented in Table 2-5 and Appendix 4- shows the borehole logs.

Table 2-5 Boreholes along the Transmission Main Route

No	BH No.	Location as per Direction	Elevation (m)	Excavation Date	Excavated Depth (m)
1	BH 05	1.695810,32.092153	1043	15-Jan-25	12
2	BH 06	1.710571,32.027833	1042	16-Jan-25	13
3	BH 07	1.710141,32.029533	1056	15-Jan-25	12
4	BH 08	1.710811,32.028302	1055	16-Jan-25	13
5	BH 09	11.714644,31.987093	1069	18-Jan-25	12
Sub-Reservoir					
1	BH 012	1.586735,31.915383	1060	16-Jan-25	13

Testpits were also excavated at this location and Appendix 5 shows the test pit logs.

2.2.1.6 Standard Penetration Tests

The Standard Penetration Tests (SPTs) were performed within each borehole using Rotary Cone drilling machine and a driving standard split spoon sampler of internal and external diameters 35 mm and 50 mm respectively. A 63.5 kg hammer weight falling freely through a height of 760 mm was used during the field SPT tests. This test was performed at every 1.5m depth interval. The number of blows that were required to drive the sampler each 150 mm increment of a total of 450 mm penetration were recorded. The blow counts for the first 150 mm (seat drive) increment were discarded and the sum of the blow counts for the second and the third 150 mm increment (test drive) were then taken as the measured uncorrected SPT 'N' value.

2.2.2 DPL Testing

The DPL test was conducted such that the equipment was set vertically at test location with its cone in direct contact with top ground surface. The 10 kg hammer mass was then dropped under free fall of gravity at falling height of 1.0m. The

number of blows per 100mm (N10) penetration into the ground were then consecutively read and recorded throughout the entire 1m length of the rod. When the first rod reached a depth of 80 cm into the ground, the next rod was then securely placed and the process was repeated till the required termination depth or refusal was encountered. The rods were then withdrawn using an extrusion lever.

DPL tests were conducted at twenty (20) no. points along the transmission line to refusal as shown in the figure below. Figure 6 Photos showing Dynamic Penetrometer Tests in Progress



Figure 6: Photos showing Dynamic Penetrometer Tests in Progress

Table 2-6 presents summaries of consistencies at each location as per coordinates location. DPL refusal depths at the different locations. Detailed results of these tests were tabulated and analysed as attached in Appendix 12

Table 2-6 Consistency along the proposed pipe alignment

DPL Test Locations	DEPTH (m)									
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
DPL 01	Very stiff	firm	stiff	Very stiff	Dense	Very stiff	Very stiff	Refusal		
DPL 02	Very soft	firm	stiff	Ver stiff	Very stiff	Very stiff	Refusal			
DPL 03	Very soft	firm	Very stiff	Very stiff	Very stiff	Very stiff	Refusal			
DPL 04	firm	stiff	Very stiff	Very stiff	Refusal					
DPL 05	Soft	stiff	Very stiff	Very stiff	Refusal					
DPL 06	Firm	stiff	stiff	Very stiff	Refusal					
DPL 07	Firm	stiff	Very stiff	Very stiff	Refusal					
DPL 08	stiff	Very stiff	Very stiff	Very stiff	Refusal					
DPL 09	Firm	stiff	Very stiff	Very stiff	Refusal					
DPL 10	Firm	Firm	stiff	Very stiff	Refusal					
DPL 11	Firm	stiff	Very stiff	Refusal						
DPL 12	Firm	stiff	Very stiff	Refusal						
DPL 13	Firm	stiff	Very stiff	Refusal						
DPL 14	stiff	stiff	Very stiff	Refusal						
DPL 15	stiff	stiff	Very stiff	Very stiff	Refusal					

DPL 16	Firm	stiff	Very stiff	Refusal						
DPL 17	Firm	Firm	stiff	Very stiff	Refusal					
DPL 18	stiff	stiff	Very stiff	Refusal						
DPL 19	Firm	Very stiff	Very stiff	Refusal						
DPL 20	Firm	stiff	Very stiff	Refusal						

2.3 Geophysical Investigations

The geophysical survey involved geo-electric Resistivity measurements by running profiles to detect anomalous zones along the profile. In addition, parallel profiling was done at sections where anomalies were detected as confirmatory tests with a more precise potential length. Vertical Electrical Soundings (VES's) were made at prioritized spots to have an insight into the vertical layering, hence detecting the presence and size of fractured/weathered formations as potential zones of groundwater abstraction.

In all Resistivity-profiling patterns, profiles were run to cut through the anticipated topographic lineaments at acute angles, thus anomalous readings were expected along approaching the topographic structural lineaments, though some anomalies were encountered at high altitude points.

Note: Resistivity-profiling was carried out, using STING RI IP Earth Resistivity meter (made in U S A), and all profiles were configured to: Shrumberg-set up with: ½ AB=90m, 1/2MN=5.0m, 2.5m and inter-station intervals of 5m. GPS receivers were used to obtain coordinates of the start/ finish points of profiles. For VESs, the maximum ½ AB was 120m, while ½ MN of: were varied from 0.5m to 5m, and finally to 20m to ensure reliable signal strength.

2.3.1 Geophysical Data Analysis

This involved data entry, analysis and modelling of field data aided by geophysical resistivity measurement software. Hydrogeological modelling and interpretation of VES's was done using Winsev™, EarthIMAGER-1D™ and VES™ software.

Details of geophysical results per site are annexed. (Appendix -10)

In locating the proposed site in this Location, three (3) Vertical electrical soundings (VES) were carried out as shown below.

Three (3) resistivity profiles were run with AB/2 (current electrode separation) of 58m, Station intervals of 5.0m and MN/2 (potential electrode separation) fixed at 5.0m. The survey with resistivity profiling aims to map anomalous resistivity values.

Details are presented in the VES section Figure 7 below shows Resistivity test at the treatment point.



Figure 7: Resistivity test at the treatment point

Comparison Curves for Reserviour Site and Treatment Plant

As it can be seen from the model curves shown above the reservoir site shows better curve characteristics than the treatment plant.

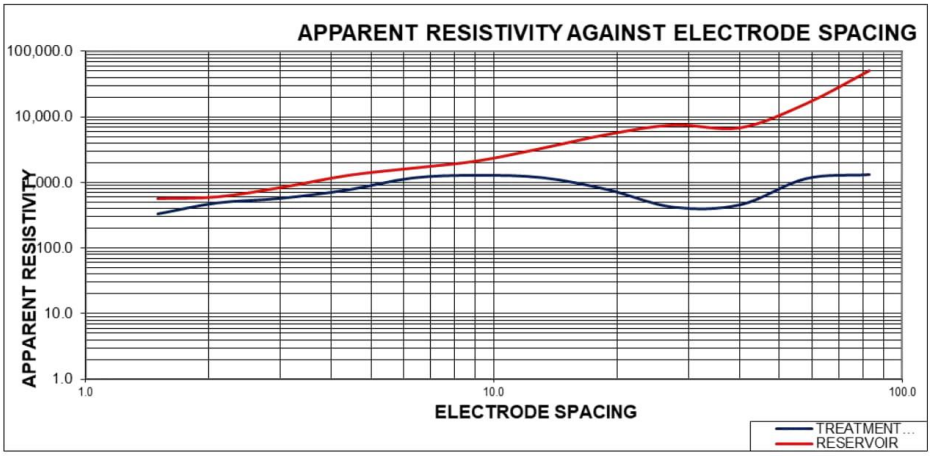


Figure 8: Resistivity Analysis Curves

2.4 Laboratory Testing

The samples of soil recovered from excavated test pits and drilled boreholes described in the preceding **Subsection 2.2** were tested following the commonly used BS test standard procedures listed in **Table 2-7**. Atterberg limits tests were used to determine the liquid limit, plastic limit and plasticity index. The particle size distribution tests were important in distinguishing the different grain sizes of soils. Tests such as in-situ moisture content and linear shrinkage enabled a comprehensive soil phase understanding of the investigated soils.

Table 2-7 : Standards used

Test Description	**International Standard**
1. Disturbed Samples	
In-situ Moisture Content	BS 1377: Part 2, Clause 3:1990
Liquid Limit	BS 1377: Part 2, Clause 4:1990
Plastic Limit & Plasticity Index	BS 1377: Part 2, Clause 5:1990
Linear Shrinkage	BS 1377: Part 2, Clause 6:1990
Particle Size Distribution	BS 1377: Part 2, Sub cl. 9.2:1990

Chemical Test (Sulphates, Chlorides & pH)	1990BS 1377: Part 3, 1990
Compaction & CBR Test	BS 1377: Part 4: 1990
2. Undisturbed Samples	
Shear Strength	BS 1377: Part 7:1990
Consolidation	BS 1377: Part 5, 1990

In addition, chemical tests such as sulphates and chlorides accompanied by pH were performed to determine the likelihood of corrosivity of the soil environment on steel and concrete ground structures such as reinforced concrete structures and underground steel pipes. Finally, strength laboratory tests such as compaction and CBR were executed to establish the quality of the subsurface soils in relation to load bearing. Such loads are transmitted by the dead loads/ weights from both substructures and superstructures and imposed loads mainly from traffic accessing the site after construction.

Against such a background, the globally recognized test methods listed in **Table 2-4** were applied in testing the recovered soil samples and details of their results are presented in **Section 3.0**.

3 INVESTIGATION FINDINGS

3.1 Soil Classification, Strength along the Transmission Line

The laboratory CBR test indirectly measures the shearing resistance of a soil at its optimum moisture content to varying degrees of density. The CBR tests have been carried out on laboratory compacted subgrade soil specimens from the trial pits to evaluate the subgrade soil strength along the transmission line. The graph in figure 9 below shows subgrade soil laboratory CBR values concerning their Trial Pit locations. Details of all these test results are presented in **Appendix 6**

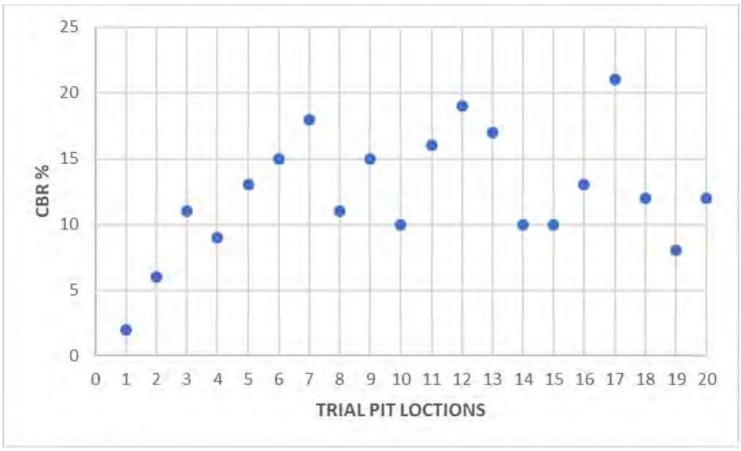


Figure 9: Material Strength along the transmission Line

Based on the summary of the test results in this table, the following site findings were drawn

- Except for TP1 soils, the investigated soils' were to be compacted at 95% MDD, a minimum CBR of 5% would be obtained. In support of the soil classification results, this implies that the majority of the site soils are granular and can be re-used as suitable fill materials except for TP1 soils once excavated. Suggesting that there is no need to haul materials from outside the site to backfill the subsurface foundation structures such as pad and strip footings if enough materials can be obtained from such excavations. However, it is cautioned that such materials must be well stockpiled and protected from the ingress of stormwater if it is to be re-used.

- While the reusability of the excavated soils is feasible and offers a cost-effective solution for backfilling, consideration should be given to improving the bearing capacity through soil stabilization if needed for heavier structures. Furthermore, detailed measures for proper stockpiling and moisture control should be put in place to maintain the integrity of the excavated materials for reuse.

3.1.1 Chemical Tests on soil samples

The extent of ground corrosivity of the surveyed sites and transmission mains was determined from the results of sulphates, chlorides and pH tests., see figure 10 below The pH results (5.0-7.2) showed that the soils are slightly acidic and since the soils' chloride content values (≤ 0.1%) did not exceed the chloride content threshold (0.15%) necessary together with moisture and oxygen presence to commence corrosion (refer to Table 4.4.1 in ACI 381-95 Building Code Requirements for Reinforced Concrete), it can be inferred that the soils with respect to chlorides do not cause any such threat. However, from the ranges of sulphate content that is (0.4-1.0%), the potential concrete exposure to sulphates contained in the soils ranges from negligible (<0.1%) to very severe (>2.0%) according to Table 4.3.1 ACI 318-05 Building Code Requirements for Structural Concrete, implying that a mild sulphate attack on concrete is possible. Details of all these test results are presented in **Appendix 6**

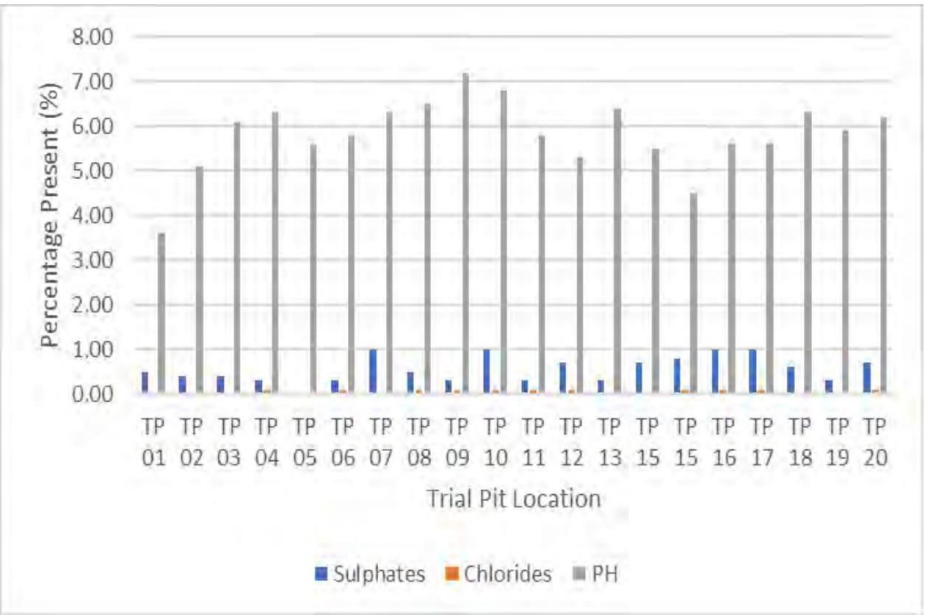


Figure 10: Soil chemical composition along the transmission line

The concrete mix design should incorporate **sulphate-resistant cement** (or another appropriate method) to mitigate the risk of mild sulphate attack. This will help ensure the structural integrity of the concrete in the presence of these sulphate levels.

3.1.2 Drill Investigations

Drill investigations were conducted at the proposed locations with an XY-200 drill with a 150mm diameter barrel up 10.0m depth. Disturbed samples were retained at 1.0m intervals, and undisturbed samples were retained at 1.5 and 3.0m depth. Borehole samples were logged and profiled as attached in **Appendix 4**. Samples were transported to the laboratory for tests and results are attached in appendices 15 and 22. See figure 11 below



Figure 11: Drilling along the proposed alignment

3.1.3 SPT test

Standard Penetration Test was conducted at 1.5m intervals along the borehole depth using a hand dropped hammer to exert blows and a standard sampler. N values, were recorded as the number of blows that caused a penetration of 300mm. These are shown on the drill logs. The N values were further used to compute bearing capacities of the soil layers as attached in appendix 11

3.1.4 Consolidation

The undisturbed soil samples were saturated and loading and unloading for consolidation test as per BS:1377 Part 5-1990. The coefficients of volume compressibility, Mv and coefficients of consolidation, Cv were determined as summarized in table 3-1. Detailed results are attached in appendix 8.

Table 3-1: Summary Consolidation Test Results

BH No.	Site Location Name	Depth (m)	Coeffiecient of voilume compressibility,M_V			Coeffiecient of voilume compressibility,C_V			Permeability,K(m/ssec)		
			Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
1	Intake	3.5-3.7	0.02	0.998	0.508	2.167	2.737	2.452	1.05E-09	8.50E-09	4.78E-09
		5.8-6.0	0.02	1.170	0.596	1.926	3.467	2.697	1.26E-08	6.69E-10	6.63E-09
2		3.5-3.7	0.02	0.981	0.499	2.167	2.737	2.452	1.03E-09	8.35E-09	4.69E-09
		5.8-6.0	0.02	1.103	0.562	1.926	3.467	2.697	1.19E-08	7.84E-10	6.34E-09
3	Treatment Plant	3.5-3.7	0.02	1.134	0.577	1.733	3.586	2.660	1.27E-08	6.65E-10	6.68E-09
		5.8-6.0	0.02	1.323	0.673	2.080	4.160	3.120	1.59E-09	9.70E-10	1.28E-09
4		3.5-3.7	0.02	0.945	0.481	1.387	2.811	2.099	1.44E-10	8.28E-10	4.86E-10
		5.8-6.0	0.02	1.052	0.536	1.300	2.600	1.950	1.50E-10	8.61E-11	1.18E-10
5	Transmission Line	3.5-3.7	0.02	1.031	0.525	1.486	2.537	2.012	1.68E-10	9.84E-11	1.33E-10
		5.8-6.0	0.02	0.997	0.508	1.300	2.600	1.950	1.42E-10	8.16E-11	1.12E-10
6		3.5-3.7	0.02	1.014	0.516	1.486	2.971	2.229	1.65E-10	9.68E-11	1.31E-10
		5.8-6.0	0.02	1.048	0.534	1.284	2.889	2.087	1.00E-09	9.42E-09	5.21E-09
		8.0-8.2	0.02	1.310	0.664	1.316	2.600	1.958	1.49E-10	9.64E-10	5.57E-10
7		3.5-3.7	0.02	1.082	0.551	1.300	2.737	2.019	1.06E-09	9.22E-09	5.14E-09
		5.8-6.0	0.02	1.030	0.524	1.552	3.852	2.702	1.08E-09	9.84E-11	5.89E-10
		8.0-8.2	0.02	1.082	0.551	1.486	3.467	2.477	1.00E-10	6.05E-10	3.53E-10
8		3.5-3.7	0.02	1.065	0.542	1.095	4.160	2.628	1.28E-10	8.15E-10	4.72E-10
		5.8-6.0	0.02	1.014	0.516	1.051	3.714	2.383	1.17E-10	7.75E-10	4.46E-10
9		3.5-3.7	0.02	1.014	0.516	1.095	2.971	2.033	1.22E-10	9.37E-09	4.75E-09
		5.8-6.0	0.02	0.979	0.498	1.061	3.467	2.264	1.06E-08	9.35E-11	5.35E-09

3.1.5 Shear test

Undisturbed soil samples were tested for shear strength following the standard method stipulated in BS 1377 Part 7. Table 3-2 and appendix 9 show summary and detailed results respectively.

Table 3-2: Summary Shear Test Results

BH ID	Site Location Name	Depth(m)	Cohesion (c) Kpa	Angle of Internal friction,Θ ^{o}
BH 01	Intake	3.5-3.7	26.81	15.72
		5.8-6.0	12.19	19.71
BH 02		3.5-3.7	19.99	27.93
		5.8-6.0	28.03	16.30
BH 03	Treatment Plant	3.5-3.7	25.59	15.74
		5.8-6.0	19.01	23.84
BH 04		3.5-3.7	26.33	19.23
		5.8-6.0	29.62	15.99

BH 05	Transimission Line	3.5-3.7	32.91	18.54
		5.8-6.0	14.63	24.73
BH 06		3.5-3.7	14.63	22.63
		5.8-6.0	18.53	22.27
		8.0-8.2	30.23	20.08
BH 07		3.5-3.7	19.97	20.53
		5.8-6.0	8.53	27.44
		8.0-8.2	28.52	16.34
BH 08		3.5-3.7	13.39	21.49
		5.8-6.0	16.32	23.84
BH 09		3.5-3.7	10.48	22.09
		5.8-6.0	11.96	20.08

3.1.6 Soil moisture, permeability and groundwater

The site is located in a dry climatic area where prolonged rainfall is common but heavy downpours do occur in summer. Infiltration of rainwater will be restricted by fine grained soils (silts and fine sands) with low permeability and most rainfall will end up as run-off or accumulate in localised depressions.

A strong perched water table was encountered in BH 1,2,3 and 4 between 0.0 to 2.5m. A summary of the depth of the water table is provided in Table 3-3 and detailed results for permeability in Appendix 4.

Table 3-3: Depth of Perched Water Table

Borehole No,	PWT Depth (m)
BH 01	Surface water
BH 02	Surface water
BH 03	Surface water
BH 04	2.5
BH 05	Not encountered
BH 06	Not encountered
BH 07	Not encountered
BH 08	Not encountered
BH 09	Not encountered
BH 10	Not encountered
BH 11	Not encountered
BH 12	Not encountered

3.1.7 Data analysis and comparision of resistivity with borehole logs at the treatment plant.

The table 3-4 below shows the comparision between the resistivity results and the borehole logs.

Table 3-4: Comparision of resistivity results with the borehole logs at the treatment plant

Depth (m)	Core Run (m)	Casing Depth (m)	Core Recovery (%)	Sample Type	SPT (No. of Blows)	Field Description	Apparent Resistivity (ohm-m)	Remarks
BH-O3 (Total Depth: 10.0m)								
0	0.5		85	D	22	Moist stiff dark grey sandy CLAYs, Residual	567.4	The resistivity is moderate for this moist clay, indicating a low conductivity.
1	0.5		85	D	30	Wet stiff dark grey sandy CLAYs, Residual	603.7	The resistivity increases slightly as the clay becomes wetter, but remains low due to its fine-grain nature.
1.5	0.5		90	D	22	Wet stiff dark grey sandy CLAYs, Residual	836.7	The resistivity increases as the material becomes stiffer and wetter, showing some influence of higher clay content.
2	1.5		95	D	30	Wet stiff dark grey sandy CLAYs, Residual	1287	The resistivity continues to rise, likely due to increased compaction and reduced water content in the material.
3	1.5		95	UD & D	39	Wet stiff dark grey sandy CLAYs, Residual	1650.9	The resistivity is higher here, likely due to a change in sediment composition towards more compacted layers.
4	1.5		95	UD & D	47	Wet dense greyish Weathered rock which disintegrates	2128.9	The resistivity jumps significantly, indicating more granular or mineralized material, likely related to weathered rock.

5	1.5		95	UD & D	47	Wet dense greyish Weathered rock which disintegrates	3348.7	Resistivity remains high, in line with further weathered rock material, likely due to mineral content.
6	1.5		95	D	49	Wet dense greyish Weathered rock which disintegrates	5401.5	At this depth, resistivity is still increasing due to continued compaction and mineral content in the weathered rock.
7	1.5		95	D	49	Wet dense greyish Weathered rock which disintegrates	7504.9	Very high resistivity indicates strong mineral content and compacted rock layers.
7.5	1.5		50	D	Refusal	Wet dense greyish Weathered rock which disintegrates	6786.6	The resistivity is still quite high, consistent with hard-to-penetrate rock material that disintegrates.
BH-O4 (Total Depth: 8.5m)								
0	0.5		90	D	23	Moist stiff dark grey sandy CLAYs, Residual	567.4	Similar to BH-O3, resistivity is low due to moist, clay-rich material.
1	0.5		90	D	35	Wet very stiff dark grey sandy CLAYs with angular cobbles	603.7	Resistivity slightly higher with angular cobbles, indicating more mineral content, but still typical of clayey material.
1.5	0.5		90	D	39	Wet very stiff dark grey sandy CLAYs with angular cobbles	836.7	The increase in resistivity is likely due to increased compactness and higher mineral content in the cobbles.
2	1.5		95	D	39	Wet very stiff dark grey sandy CLAYs with angular cobbles	1287	Resistivity increases with depth, as compaction and the presence of cobbles contribute to higher resistivity values.
3	1.5		95	UD & D	39	Wet very stiff dark grey sandy CLAYs with angular cobbles	1650.9	As the material continues to compact, resistivity rises due to a shift towards more mineralized or

								consolidated material.
4	1.5		95	UD & D	49	Wet dense greyish Weathered rock which disintegrates	2128.9	Significant increase in resistivity, indicating the presence of weathered rock, likely more compact and mineralized.
5	1.5		95	D	49	Wet dense greyish Weathered rock which disintegrates	3348.7	Resistivity remains high, consistent with dense weathered rock layers.
6	1.5		95	D	49	Wet dense greyish Weathered rock which disintegrates	5401.5	High resistivity is still evident due to continued mineralization in the weathered rock.
7	1.5		95	D	49	Wet dense greyish Weathered rock which disintegrates	7504.9	At these depths, the resistivity is high, consistent with hard, dense rock material.
7.5	1.5		75	D	Refusal	Wet very stiff dark grey sandy SILTs with fragments of weathered rock	50327.5	Exceptional increase in resistivity, indicating a significant presence of mineralized or compacted materials in the form of weathered rock fragments.

- **Resistivity increases** significantly with depth in both boreholes (BH-O3 and BH-O4), reflecting changes in soil and rock composition, such as the transition from clay to weathered rock.
- **At higher depths**, the resistivity values are much higher, indicating the presence of more compacted, mineralized, or weathered materials like rocks that resist electrical flow.
- The **field descriptions** (e.g., "sandy clay," "weathered rock," and "weathered rock fragments") align with the changes in resistivity, where wetter clays have lower resistivity, while denser, more compacted or weathered materials show higher resistivity.

3.1.8 Data analysis and comparision of resistivity with borehole logs at the reservoir.

Table 3-5: Comparision of resistivity results with the borehole logs at the reservoir

Depth (m)	Core Run (m)	Casing Depth (m)	Core Recovery (%)	Sample Type	SPT (No. of Blows)	Field Description	Apparent Resistivity (ohm-m)	Remarks
BH-10 (Total Depth: 10.0m								
0	0.5		95	D	13	Moist firm reddish brown sandy CLAYs, Residual	334	Low resistivity typical for moist firm clays, indicating high water content.
1	0.5		95	D	16	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	492	Slight increase in resistivity due to the addition of gravel and cobbles, which are more resistive than pure clay.
1.5	0.5		95	D	22	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	576.9	Further increase in resistivity, likely due to denser material and the presence of cobbles and boulders.
2	1.5		85	D	16	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	779	As the clayey gravel becomes denser, resistivity rises, indicating reduced conductivity due to the coarse particles.

3	1.5		85	D	26	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	1,176.50	Higher resistivity suggests increased mineral content or less water saturation in the gravel and cobbles.
4	1.5		90	D	39	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	1,295.30	Resistivity continues to rise with further compaction and less water content in the gravel and boulders.
5	1.5		80	D	39	Moist dense gravel and boulders, Residual	1,186.60	The increase in resistivity is consistent with denser, more compacted gravel layers with fewer voids.
6	1.5		80	D	39	Moist dense gravel and boulders, Residual	780.2	Resistivity decreases slightly, potentially due to the composition changing or more moisture in the material.
7	1.5		50	D	Refusal	Moist dense gravel and boulders, Residual	423.2	Significant decrease in resistivity, likely due to deeper layers containing more moisture or finer material

								mixed with gravel.
8.5	1.5		45	D	Refusal	Moist dense gravel and boulders, Residual	459.4	The resistivity increases again due to the stabilization of compacted layers and less moisture in deeper gravel.
BH-11 (Total Depth: 10.0m)								
0	0.5		95	D	12	Moist firm reddish brown clayey GRAVELs, Residual	334	Similar to BH-10, low resistivity due to moist clayey gravel mixture.
1	0.5		95	D	17	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	492	Resistivity increases slightly due to the introduction of cobbles and boulders.
1.5	0.5		95	D	22	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	576.9	Further increase in resistivity due to denser gravel with cobbles and higher mineral content.
2	1.5		85	D	17	Moist medium dense yellowish brown clayey GRAVELs	779	Similar to BH-10, resistivity rises as the gravel becomes denser and

						with cobbles and boulders, Residual		contains more boulders.
3	1.5		85	D	23	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	1,176.50	As the material compacts, the resistivity rises due to the reduction in water saturation.
4	1.5		90	D	31	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual	1,295.30	Resistivity continues to increase with depth as the material becomes denser and more mineralized.
5	1.5		80	D	31	Moist dense gravel and boulders, Residual	1,186.60	The resistivity continues to rise, consistent with the presence of well-compacted gravel and boulders with less moisture.
6	1.5		80	D	31	Moist dense gravel and boulders, Residual	780.2	Decrease in resistivity likely due to more moisture content or a mix of finer materials within the gravel.
7	1.5		50	D	Refusal	Moist dense gravel and boulders, Residual	423.2	Significant decrease in resistivity suggests

								higher moisture content or less mineralized gravel.
8.5	1.5		45	D	Refusal	Moist dense gravel and boulders, Residual	459.4	The resistivity increases slightly due to more compacted layers and reduced moisture.

- **Resistivity increases** generally with depth in both boreholes, especially where compacted gravel and boulders are present, which show higher resistivity values compared to clayey or silty materials.
- **Lower resistivity** at shallower depths is observed, likely due to the presence of moist clays and fine-grained materials that allow for higher conductivity.
- **Moisture content** appears to correlate with resistivity: where more moisture is present (e.g., at shallower depths with clay), resistivity is lower, whereas drier, more compacted gravel and boulders show higher resistivity.
- The **field descriptions** of "gravel," "cobbles," and "boulders" match the increasing resistivity, as these materials are less conductive than clay.

3.1.9 Engineering Recommendation for Foundation Design and Seismic Design Consideration

Table 3-6 below summary the engineering recommendation based on the soil-bearing capacities.

Table 3-6: Summary of Engineering Recommendation

Borehole No.	Depth (m)	Soil Type	Allowable Bearing Capacity (kPa)	CBR (%)	Moisture Content (%)	pH	Sulphates (SO4)	Recommended Foundation Type	Seismic Design Considerations
BH01-BC	1.5	Stiff Clay	158	16	24.4	5	1.25	Shallow footing, slab foundations	No special measures required
BH01-BC	7.5	Firm Clay	475	48	24.4	5	1.25	Shallow foundation or piled foundation for deeper depths	No special measures required
BH02-BC	1.5	Stiff Clay	173	17	23.6	5.1	1.02	Shallow footing	No special measures required
BH03-BC	1.5	Stiff Clay	158	16	24.4	5	1.25	Shallow footing	No special measures required
BH04-BC	1.5	Stiff Clay	205	20	24.4	5	1.25	Shallow footing	No special measures required
BH05-BC	1.5	Dense Clayey Gravel	205	20	24.4	5	1.25	Shallow footing or compacted gravel base for footing	No special measures required
BH06-BC	1.5	Dense Clayey Gravel	102	10	24.4	5	1.25	Shallow footing	No special measures required
BH07-BC	1.5	Dense Clayey Gravel	118	12	24.4	5	1.25	Shallow footing	No special measures required
BH08-BC	1.5	Dense Clayey Gravel	126	13	24.4	5	1.25	Shallow footing	No special measures required
BH09-BC	1.5	Dense Clayey Gravel	142	14	24.4	5	1.25	Shallow footing	No special measures required
BH10-BC	1.5	Dense Clayey Gravel	102	10	24.4	5	1.25	Shallow footing	No special measures required
BH11-BC	1.5	Dense Clayey Gravel	95	9	24.4	5	1.25	Shallow footing	No special measures required
BH12-BC	1.5	Dense Clayey Gravel	32	3	24.4	5	1.25	Shallow footing	No special measures required

REFERENCES

1. BRITISH STANDARDS INSTITUTION. British Standards 1377: 1995 and British Standard 1377: 1990. Methods of Test for Soils for Civil Engineering Purposes, London, 1990.
2. BRITISH STANDARDS INSTITUTION. British Standards 5930: 2015. Code of Practice for Site Investigations, London 1981.
3. VICKERS, BRIAN (1978); Laboratory work in Civil Engineering Soil Mechanics. Granada Publishers, London.
4. Bowles Joseph E; Foundation Analysis and Design, Second Edition. McGraw Hill Companies, Tokyo, 1997.
5. G.E Barney; Principles and Practice of Soil Mechanics, First Edition. Macmillan Press Ltd, London, 1995
6. G Bryen, JP Everett and K. Schwartz. A Guide to Practical Geotechnical Engineering in Southern Africa, Franki pile, Third Edition, 1995.
7. MJ Tomlinson; Foundation Design & Construction, Sixth Edition. Addison Wesley Longman Limited, Edinburgh Gate, Harlow Essex CM20 2JE, 1998.
8. R. F. Craig; Soil Mechanics, Fourth Edition. Chapman and Hall, 2-6 Boundary Row, London SEI 8HN, 1990.
9. V.N.S Murthy (2002): Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, @ Marcel Dekker, Inc. 270 Madison Avenue, New York, New York 10016.
10. Burt G. Look; Handbook of Geotechnical Investigation and Design Tables © 2007 Taylor & Francis Group, London, UK.

APPENDICES

Appendix 1: Geological Features Around the Project Area.



Lithology

8. Bunyoro Group: Shale, Slate, Phyllite, Sandstone, Quartzite

50.Gneissic Granitoids of Ugandan Ncoarchacan (2.59-2.65 Ga)

61.Karuma Complex, feisic and mafic granulite,Charnockite

Structural elements

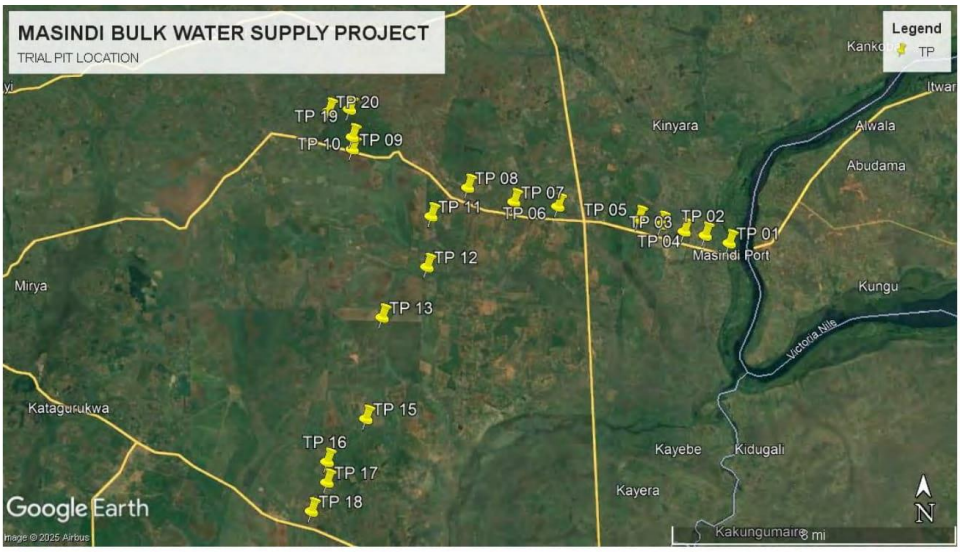
- – – – Fracture
- —|— Normal fault
- ——— Strike slip fault
- —▲— Thrust fault

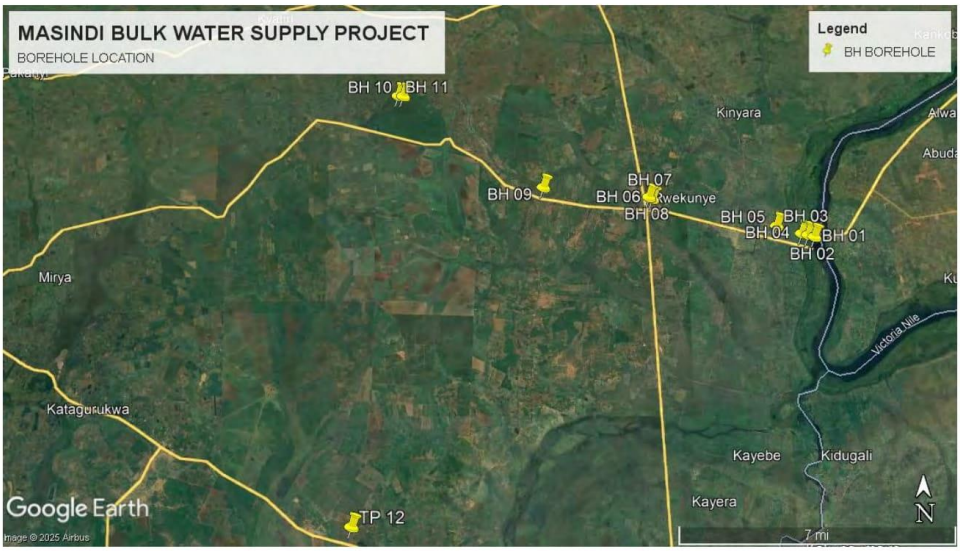
Appendix 2: Seismicity Map



THE SEISMIC HAZARD MAP OF UGANDA ACCORDING TO MINISTRY OF WORKS AND TRANSPORT 2010

Appendix 3: Test Point Location Map


MASINDI BULK WATER SUPPLY PROJECT
TRIAL PIT LOCATION
Legend
TP
TP 20
TP 19
TP 10
TP 09
TP 08
TP 07
TP 11
TP 06
TP 05
TP 03
TP 02
TP 04
TP 01
Masindi Port
TP 12
TP 13
Mirya
Kungu
Kinyara
Alwala
Abudama
Victoria Nile
Kataguru-kwa
TP 15
TP 16
TP 17
TP 18
Kayebe
Kidugali
Kayera
Kakungumaire
3 mi
Google Earth
Image © 2025 Airbus
N


MASINDI BULK WATER SUPPLY PROJECT
BOREHOLE LOCATION
Legend
BH BOREHOLE
BH 10
BH 11
Kinyara
BH 09
BH 07
BH 06
Rwekunye
BH 08
BH 05
BH 03
BH 04
BH 01
BH 02
Mirya
Victoria Nile
Kataguru-kwa
Kayebe
Kidugali
Kayera
TP 12
7 mi
Google Earth
Image © 2025 Airbus
N


MASINDI BULK WATER SUPPLY PROJECT
Legend
RESISITIVITY TEST POINT
INTAKE
RESERVOIR
TREATMENT PLANT
INTAKE
Google Earth
Image © 2025 Airbus
5 mi
N

Appendix 4: Borehole logs

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	9.0m
Client	Ministry of Water and Environment	Sampling Date	14-Jan-25
Rig type	XY-200 T1	BH Code	BH-O1
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Intake Structure	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0 ▽									
0.5	0.5		85			D			Moist medium dense yellowish brown clayey Gravel with cobbles, Imported
1.0	0.5		75						
1.5	0.5		75			D		9, 11, 12 N=23	Wet loose greyish sandy CLAYs, Residual
2.0									
3.0	1.5		55			D			
4.0									Wet loose greyish-white very Sand CLAY with angular cobbles and boulders, Residual
4.5	1.5		55			UD & D		12, 13, 15 N=28	
5.0									
6.0	1.5		50			UD & D		15, 15, 18 N=33	
7.0									Wet loose Greyish clayey SANDs with angular cobbles and weathered rock, Residual
7.5	1.5		45			D		Refusal N>50	
8.5									
9.0	1.5		65			D		Refusal N>50	Shiny White-Grey weathered Coarse grained Solid Very Hard holocrystalline plutonic Granite which disintergrate into sandy SILTs

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

- **UD-** Undisturbed
- **D-** Disturbed
- **BH-** Borehole
- Water table



Remarks

1. Water table encountered at 1.5m depth

Logged by;

Kalyowa Emmanuel

GEO-CONCRETE LABORATORY

Date 16-02-2025

Approved by;

Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	9.0m
Client	Ministry of Water and Environment	Sampling Date	14-Jan-25
Rig type	XY-200 T1	BH Code	BH-O2
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Transmission Line	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		70			D			Wet loose greyish clayey SANDs, Residual
0.5									
1.0	0.5		75						
1.5	0.5		75			D		8, 9, 11 N=20	
2.0	1.5		55			D			Wet loose greyish-white very sandy CLAYs with angular cobbles and boulders, Residual
3.0									
4.0	1.5		55			UD & D		11, 12, 12 N=24	
4.5									
5.0	1.5		50			UD & D		13, 18, 20 N=38	Wet loose greyish clayey SANDs with angular cobbles and weathered rock, Residual
6.0									
7.0	1.5		40			D		Refusal N>50	
7.5									
9.0	1.5		70			D		Refusal N>50	Shiny White-Grey weathered coarse grained solid very hard holocrystalline plutonic Granite which disintergrate into sandy SILTs

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

- **UD-** Undisturbed
- **D-** Disturbed
- **BH-** Borehole
- Water table



Remarks

1. Water table encountered at 1.0m depth

Logged by;

Kalyowa Emmanuel

Approved by;

Date: 16-02-205

Eng. Kagoda Fred

GEO CONCRETE LABORATORY

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	14-Jan-25
Rig type	XY-200 T1	BH Code	BH-O3
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Transmission Line	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		85			D			Moist stiff dark grey sandy CLAYs, Residual
0.5									
1.0	0.5		85						
1.5	0.5		90			D		7, 9, 13 N=22	
2.0	1.5		95			D			
3.0									
4.0	1.5		95			UD & D		12, 14, 16 N=30	Wet stiff dark grey sandy CLAYs, Residual
4.5									
5.0	1.5		95			UD & D		14, 17, 22 N=39	
6.0									
7.0	1.5		95			D		15, 20, 27 N=47	
7.5									
10.0	1.5		50			D		Refusal N>50	Wet dense greyish Weathered rock which disintergrate into sandy SILTs

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

- **UD-** Undisturbed
- **D-** Disturbed
- **BH-** Borehole
- Water table



Remarks

1. Water table encountered at 0.5m

Logged by;

Kalyowa Emmanuel

Approved by;

Date: 16-02-2025

Eng. Kagoda Fred

GEO - CONCRETE LABORATORY

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	8.5m
Client	Ministry of Water and Environment	Sampling Date	14-Jan-25
Rig type	XY-200 T1	BH Code	BH-O4
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Transmission Line	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0									
0.5	0.5		90			D			Moist stiff dark grey sandy CLAYs, Residual
1.0	0.5		90						
1.5	0.5		90			D		8, 8, 15 N=23	
2.0	1.5		95			D			
3.0									
4.0	1.5		95			UD & D		11, 16, 19 N=35	Wet very stiff dark grey sandy CLAYs with angular cobbles, Residual
4.5									
5.0	1.5		95			UD & D		15, 18, 21 N=39	
6.0									
7.0	1.5		95			D		15, 21, 28 N=49	
7.5									
8.5	1.5		75			D			Wet very stiff dark grey sandy SILTs with fragments of weathered rock, Residual

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed
D- Disturbed
BH- Borehole
Water table



Remarks

1. Water table encountered at 1.0m

Logged by;

Kalyowa Emmanuel

Approved by;
Date: 16-02-2025

Eng. Kagoda Fred

GEO - CONCRETE LABORATORY

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	14-Jan-25
Rig type	XY-200 T1	BH Code	BH-O5
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Transmission Line	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery			Sample type	Graphic Log	SPT (No. of Blows)	Field Description
			TCR (%)	RQD (%)	AFS (cm) No. of frac				
0.0	0.5		85			D			Moist stiff dark grey sandy CLAYs, Residual
0.5									
1.0	0.5		90						
1.5	0.5		85			D		8, 9, 17 N=26	
2.0	1.5		85			D			Wet very stiff dark grey sandy CLAYs with angular cobbles, Residual
3.0									
4.0	1.5		90			UD & D		10, 15, 22 N=37	
4.5									
5.0	1.5		90			UD & D		12, 17, 24 N=41	
6.0									
7.0	1.5		90			D		Refusal, N>50	
7.5									
8.5	1.5		65			D			Wet very stiff dark grey sandy CLAYs with fragments of weathered

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed
D- Disturbed
BH- Borehole
Water table



Remarks

1. Water table encountered at 1.0m

Logged by;

Kalyowa Emmanuel

GEO - CONCRETE LABORATORY
Date:....16-02-2025

Approved by;

Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	14-Jan-25
Rig type	XY-200 T1	BH Code	BH-O6
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Treatment Plant	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		85			D			Moist firm brown sandy CLAYs, Residual
0.5									
1.0	0.5		90						
1.5	0.5		85			D		4, 6, 7 N=13	
2.0	1.5		90			D			Moist stiff yellowish brown sandy CLAYs, Residual
3.0									
4.0	1.5		90			UD & D		4, 8,12 N=20	
4.5									
5.0	1.5		90			UD & D		5, 9, 13 N=22	
6.0									
7.0	1.5		90			D		6, 11, 13 N=24	
7.5									
8.5	1.5		85			UD & D		7, 13, 15 N=28	Moist stiff yellowish brown sandy CLAYs, Residual
9.0									
9.5	0.5		90			D			
10.0	0.5		90			D			

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

- **UD-** Undisturbed
- **D-** Disturbed
- **BH-** Borehole
- Water table



Remarks

1. No water table encountered

Logged by;

Kalyowa Emmanuel

GEO - CONCRETE LABORATORY Date: 16-02-2025

Approved by;

Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	14-Jan-25
Rig type	XY-200 T1	BH Code	BH-O7
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Treatment Plant	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		90			D			Moist firm brown sandy CLAYs, Residual
0.5									
1.0	0.5		90						
1.5	0.5		90			D		5, 6, 9 N=15	
2.0	1.5		90			D			
3.0									
4.0	1.5		90			UD & D		6, 8,12 N=20	Moist stiff yellowish brown sandy CLAYs, Residual
4.5									
5.0	1.5		90			UD & D		6, 10, 14 N=24	
6.0									
7.0	1.5		90			D		6, 12, 15 N=27	
7.5									
8.5	1.5		90			UD & D		8, 14, 18 N=32	Moist dense yellowish brown clayey SANDs, Residual
9.0									
9.5	0.5		90			D			
10.0	0.5		90			D			

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed

D- Disturbed

BH- Borehole

Water table



Remarks

1. No water table encountered

Logged by;

Kalyowa Emmanuel

GEO-CONCRETE LABORATORY Date: 16-02-2025

Approved by;

Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	15-Jan-25
Rig type	XY-200 T1	BH Code	BH-O8
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Transmission Line	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		95			D			Moist firm brown sandy CLAYs, Residual
0.5									
1.0	0.5		95						
1.5	0.5		95			D		4, 6, 10 N=16	
2.0	1.5		85			D			Moist medium dense yellowish brown clayey SANDs, Residual
3.0									
4.0	1.5		85			UD & D		5, 9,13 N=22	
4.5									
5.0	1.5		90			UD & D		6, 11, 15 N=26	
6.0									
7.0	1.5		80			D		7, 13, 15 N=28	
7.5									
8.5	1.5		90			D		9, 15, 20 N=35	Moist medium dense yellowish brown clayey SANDs, Residual
9.0									
9.5	0.5		95			D			
10.0	0.5		95			D			

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed
D- Disturbed
BH- Borehole
Water table



Remarks
1. No water table encountered

Logged by;
Kalyowa Emmanuel

GEO - CONCRETE LABORATORY
Date: 16-02-2025

Approved by;
Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	15-Jan-25
Rig type	XY-200 T1	BH Code	BH-O9
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Transmission Line	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		95			D			Moist firm brown sandy CLAYs, Residual
0.5									
1.0	0.5		95						
1.5	0.5		95			D		5, 8, 10 N=18	
2.0	1.5		85			D			Moist yellowish brown medium dense clayey GRAVELs, Residual
3.0									
4.0	1.5		85			UD & D		6, 9,15 N=24	
4.5									
5.0	1.5		90			UD & D		9, 11, 15 N=26	
6.0									
7.0	1.5		80			D		12, 15, 19 N=34	
7.5									
8.5	1.5		50			D		Refusal, N>50	Moist yellowish weathered rock which disintergrate into sandy SILTs
9.0									
9.5	0.5		55			D			
10.0	0.5		45			D			

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed
D- Disturbed
BH- Borehole
Water table



Remarks
1. No water table encountered

Logged by;
Kalyowa Emmanuel

GEO - CONCRETE LABORATORY
Date: 16-02-2025

Approved by;
Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	15-Jan-25
Rig type	XY-200 T1	BH Code	BH-10
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Main Reservoir site	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	Core Recovery: RQD (%)	Core Recovery: AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		95			D			Moist firm reddish brown sandy CLAYs, Residual
0.5									
1.0	0.5		95						
1.5	0.5		95			D		4, 6, 7 N=13	
2.0	1.5		85			D			Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual
3.0									
4.0	1.5		85			D		5, 7, 9 N=16	
4.5									
5.0	1.5		90			D		7, 10, 16 N=26	
6.0									
7.0	1.5		80			D		13, 17, 22 N=39	
7.5									
8.5	1.5		50			D		14, 20, 28 N=48	
9.0									
9.5	0.5		55			D			
10.0	0.5		45			D			

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed
D- Disturbed
BH- Borehole
Water table



Remarks

1. No water table encountered

Logged by;

Kalyowa Emmanuel

GEO - CONCRETE LABORATORY Date: 16-02-2025

Approved by;

Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	15-Jan-25
Rig type	XY-200 T1	BH Code	BH-11
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Main Reservoir site	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery			Sample type	Graphic Log	SPT (No. of Blows)	Field Description
			TCR (%)	RQD (%)	AFS (cm) No. of frac				
0.0	0.5		95			D			Moist firm reddish brown clayey GRAVELs, Residual
0.5									
1.0	0.5		95						
1.5	0.5		95			D		5, 5, 7 N=12	
2.0	1.5		85			D			
3.0									
4.0	1.5		85			D		5, 7, 10 N=17	
4.5									
5.0	1.5		90			D		6, 9, 14 N=23	Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual
6.0									
7.0	1.5		80			D		10, 13, 18 N=31	
7.5									
8.5	1.5		50			D		10, 14, 17 N=31	
9.0									
9.5	0.5		55			D			
10.0	0.5		45			D			

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed
D- Disturbed
BH- Borehole
Water table



Remarks
1. No water table encountered

Logged by;
Kalyowa Emmanuel

GEO-CONCRETE LABORATORY
Date: 16-02-2025

Approved by;
Eng. Kagoda Fred

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

BOREHOLE CORE LOGGING SHEET

Project	Masindi Port Bulk Water Supply	Total Depth	10.0m
Client	Ministry of Water and Environment	Sampling Date	15-Jan-25
Rig type	XY-200 T1	BH Code	BH-12
Method	Water flush by single core barrel	BH Diameter	150mm
Location	Sub Reservoir	Cordinates	

Depth	Core run (m)	Casing Depth (m)	Core Recovery: TCR (%)	RQD (%)	AFS (cm) No. of frac	Sample type	Graphic Log	SPT (No. of Blows)	Field Description
0.0	0.5		95			D			Moist firm reddish brown clayey GRAVELs, Residual
0.5									
1.0	0.5		95						
1.5	0.5		95			D		1, 2, 2 N=4	
2.0	1.5		85			D			Moist medium dense yellowish brown clayey GRAVELs with cobbles and boulders, Residual
3.0									
4.0	1.5		85			D		3, 5, 6 N=11	
4.5									
5.0	1.5		90			D		4, 5, 7 N=12	
6.0									
7.0	1.5		80			D		5, 6, 8 N=14	
7.5									
8.5	1.5		50			D		5, 6, 9 N=15	
9.0									
9.5	0.5		55			D			
10.0	0.5		45			D			

Legend

- Gravel
- Clay
- Silt & sand
- Cobbles
- Organic matter
- Weathered rock

Acronyms

UD- Undisturbed
D- Disturbed
BH- Borehole
Water table



Remarks
1. No water table encountered

Logged by;
Kalyowa Emmanuel

GEO - CONCRETE LABORATORY Date: 16-02-2025

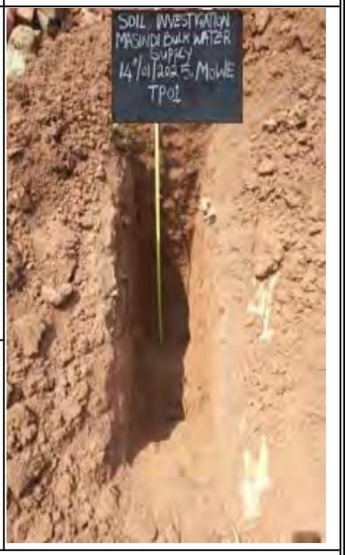
Approved by;
Eng. Kagoda Fred

Appendix 5: Test Pit Logs

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 01
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.5		Moist brown firm sandy CLAYs, Residual	
2.0		Moist firm yellowish brown sandy CLAYs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 02
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.6		Moist brown firm sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy CLAYs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 03
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.4		Moist firm brown sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy SILTs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 04
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.3		Moist firm brown sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy CLAYs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date:16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 05
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.4		Moist brown firm sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy CLAYs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

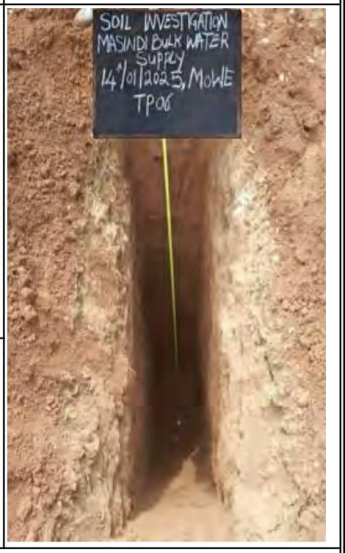
GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 06
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.4		Moist brown firm sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy CLAYs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 07
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.2		Moist firm brown sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy SILTs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 08
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.7		Moist firm brown sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy SILTs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 09
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.3		Moist firm dark brown sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy CLAYs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 10
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.6		Moist firm brown sandy SILTs, Residual	
2.0		Moist firm yellowish brown sandy CLAYs, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 11
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
2.0		Moist firm dark brown sandy CLAYs with cobbles and boulders, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY

	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

GEO - CONCRETE LABORATORY Date: 16-02-2025

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 12
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
2.0		Moist firm yellowish brown sandy CLAYs with cobbles and boulders, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 13
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
2.0		Moist firm yellowish brown sandy CLAYs with cobbles and boulders, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 14
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
2.0		Moist firm yellowish brown sandy SILTs with cobbles and boulders, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 15
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
2.0		Moist medium dense yellowish brown clayey SANDs with cobbles and boulders, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 16
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
2.0		Moist medium dense yellowish brown clayey SANDs with cobbles and boulders, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY

	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 17
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.2		Moist loose dark brown silty Sand, Residual	
2.0		Moist firm yellowish brown sandy SILTs with cobbles, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY

	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 18
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.2		Moist loose yellowish brown silty SANDs, Residual	
2.0		Moist firm dark brown sandy SILTs with cobbles, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY

	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 19
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.2		Moist loose brownish clayey SANDs, Residual	
2.0		Moist firm Brownish clayeys GRAVELs with cobbles, Residual	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY

	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date: 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Geo-concrete Laboratory, P.O. Box 133448 Kampala, Uganda,
Tel: +256 752 202 393 Kyakima Road Gayaza
Email: balenzienoch@gmail.com www.geoconcretelab.com

TEST PIT LOGGING SHEET

Project Name	Geotechnical Investigations for Masindi Port Bulk Water Supply Project		
Client's Name	MoWE	**Test Pit No**	TP 20
Logging Date	14-Jan-24	**Cordinates**	

Depth (m)	Soil Profile	Visual Description	Photographic Represention
1.0		Moist loose brown clayey SANDs, Residual	
1.5		Hard pan	

Remarks:

1. **MoWE**- Ministry of Water and Environment
2. No water table encountered

KEY	
	Gravel
	Clay
	Cobbles
	Silt
	Weathered Rock
	Water Table

GEO - CONCRETE LABORATORY Date 16-02-2025

Logged by	Approved by
Kalyowa Emmanuel	**Eng. Kagoda Fred**

Appendix 6 : Laboratory Classification Test Results for Trial Pits

CONSULTANT: SEGAMU 14 CONSULTS LTD

CLIENT: THE REPUBLIC OF UGANDA, Ministry of Water and Environment

TESTING LAB: Geo-concrete Laboratory, TEST & QUALITY CONTROL ENGINEERS

ALIGNMENT CLASSIFICATION RESULTS

Project Name	Masindi Port Bulk WaterSupply project	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT	Report Ref. No.	GCL-SGM/MOWE-RPT-001
Client	Ministry of water and Environment		Issuance Date	26-Jun-25
Sample Source	Transimition Line		Testing Date	15-28 Jan 2025
Depth of Test Pits	0-2.0 m		Tested by	Lab Team
Sampled by	Lab team		Sampling Date	14-Jan-25

SUMMARY OF LABORATORY TEST RESULTS FOR SOILS SAMPLED FROM EXCAVATED TEST PITS ALONGTHE PROPOSED TRANSMISSION LINE

Location	Depth (m)	Material Description	% passing sieve (mm)										LL (%)	PL (%)	PI (%)	LS (%)	PM	USCS Class	OMC (%)	MDD (kg/m³)	NMC (%)	4 days Soaked CBR			Swell (%)	Chemical Properties		
			28 (%)	20 (%)	14 (%)	10 (%)	5 (%)	2 (%)	1.18 (%)	0.425 (%)	0.300 (%)	0.075 (%)	GM (%)										95% MDD	93% MDD	90% MDD		SO_4	Cl	PH
TP 01	1.5 - 2.0	Sandy CLAYs of high plasticty	100	100	100	100	98	93	89	85	84	0.29	60.0	26.8	33.2	15.6	2955	CH	24.4	1520	37.0	2	1	1	1.25	0.50	0.00	5.00
TP 02	1.6 - 2.0	Sandy CLAYs of high plasticty	100	100	100	100	100	99	98	97	95	0.07	53.6	21.4	32.2	16.2	3156	CH	23.6	1896	20.3	6	5	3	1.02	0.40	0.00	5.10
TP 03	1.4 - 2.0	Sandy SILTs of very high plasticty	100	100	100	100	100	99	98	95	94	92	0.14	77.4	40.1	37.3	21.7	3544	MH	25.4	1813	21.4	11	8	7	1.07	0.40	0.00	6.10
TP 04	1.3 - 2.0	Sandy CLAYs of low plasticty	100	100	100	99	97	93	90	82	79	65	0.60	30.2	15.6	14.6	7.2	1197	CL	20.6	1808	17.2	9	5	4	0.52	0.30	0.10	6.30
TP 05	1.4 - 2.0	Sandy CLAYs of intermediate plasticty	100	100	100	100	98	95	92	88	87	78	0.39	46.1	23.7	22.4	11.8	1971	CL	17.0	1850	20.8	13	11	9	0.64	0.00	0.00	5.58
TP 06	1.4 - 2.0	Sandy CLAYs of intermediate plasticty	100	100	100	99	99	98	90	76	71	60	0.66	41.0	22.4	18.6	10.1	1414	CL	15.6	1860	23.8	15	14	12	1.32	0.30	0.10	5.80
TP 07	1.2 - 2.0	Sandy SILTs of intermediate plasticty	100	100	100	100	100	99	93	81	78	66	0.54	46.5	27.8	18.7	11.8	1515	ML	18.2	1854	25.2	18	15	14	2.70	1.00	0.00	6.30
TP 08	1.7 - 2.0	Sandy SILTs of high plasticty	100	100	100	99	94	96	93	74	71	56	0.74	55.3	28.7	26.6	13.4	1968	MH	18.7	1801	25.1	11	8	7	0.52	0.50	0.10	6.50
TP 09	1.3 - 2.0	Sandy CLAYs of intermediate plasticty	100	100	98	96	96	95	90	88	68	58	0.59	45.7	23.8	21.9	11.1	1927	CL	10.9	1801	26.6	15	11	10	0.11	0.30	0.10	7.20
TP 10	1.6 - 2.0	Sandy CLAYs of intermediate plasticty	100	100	100	100	100	99	94	82	77	59	0.60	43.8	22.6	21.2	10.6	1738	CL	14.6	1780	17.2	10	11	11	0.52	2.20	0.10	6.80
TP 11	0.0 - 2.0	Sandy CLAYs of intermediate plasticty	100	100	100	100	99	96	90	77	72	63	0.64	42.9	22.3	20.6	10.2	1586	CL	17.2	1805	21.7	16	12	9	0.18	0.30	0.10	5.80
TP 12	0.0 - 2.0	Sandy CLAYs of intermediate plasticty	100	100	100	100	100	99	95	77	67	55	0.69	39.4	21.8	17.6	8.9	1355	CL	13.6	1880	24.6	19	15	14	1.62	0.70	0.10	5.30
TP 13	0.0 - 2.0	Sandy CLAYs of high plasticty	100	100	100	100	97	95	94	91	90	88	0.26	57.3	26.1	31.2	15.6	2839	CH	15.8	1674	19.4	17	15	12	0.38	0.30	0.00	6.40
TP 14	0.0 - 2.0	Sandy SILTs of intermediate plasticty	100	100	100	100	100	100	92	75	69	55	0.70	47.5	31.6	15.9	7.9	1193	ML	14.6	1860	26.3	10	8	7	1.34	0.70	0.00	5.50
TP 15	0.0 - 2.0	Clayey SANDs of intermediate plasticity	100	100	100	99	99	98	90	70	62	45	0.87	41.3	22.2	19.1	9.5	1337	SC	12.8	1892	18.5	10	8	6	0.35	0.80	0.10	4.50
TP 16	0.0 - 2.0	Clayey SANDs of intermediate plasticity	100	100	100	97	93	88	80	76	59	42	0.94	42.3	23.5	18.8	9.4	1429	SC	11.4	1870	19.6	13	10	8	1.82	1.00	0.10	5.60
TP 17	1.2 - 2.0	Sandy SILTs of high plasticty	100	99	97	95	85	76	74	69	65	55	1.00	60.8	30.7	30.1	15.0	2077	MH	13.2	2130	12.5	21	16	11	0.02	1.00	0.10	5.60
TP 18	1.2 - 2.0	Sandy SILTs of intermediate plasticty	100	100	100	100	100	99	93	84	81	70	0.47	47.9	28.9	19.0	9.7	1596	ML	17.4	1760	26.6	12	9	7	0.93	0.60	0.00	6.30
TP 19	1.2 - 2.0	Clayey GRAVELs of intermediate plasticty	79	69	58	54	44	40	35	33	31	27	2.01	45.7	25.3	20.4	10.2	669	ML	15.2	1830	23.4	8	7	5	0.88	0.30	0.00	5.90
TP 20	0.0-1.0	Clayey SANDs of intermediate plasticty	90.3	82	79	71	68	63	60	55	36	32	1.50	41.0	22.3	18.7	9.4	1029	CL	15.4	1825	19.5	12	10	7	0.98	0.70	0.10	6.20

Legend
(L)-Low Plasticity/LL<50 **N.P** Non Plastic **LS** Linear Shrinkage **GM** Grading Modulus **LL** Liquid Limit **PL** Plastic Limit **PM** Plasticity Modulus

Client's representative		Prepared by		Checked by
Name		KAWISO BENARD		Eng. KAGODA FRED
Signature		Signature		Signature
Date		Date		Date
Contact		Laboratory Engineer		Materials Engineer

GEO-CONCRETE LABORATORY Date 16-02-2025

Appendix 7 : Laboratory Classification Test Results for Boreholes

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

ALIGNMENT CLASSIFICATION RESULTS

Project Name	Masindi Port Bulk WaterSupply project	GE										Report Ref. No.	GCL-SGM/MOWE-RPT-001
Client	Ministry of water and Environment											Issuance Date	26-Jun-25
Sample Source	Borehole											Testing Date	15-28 Jan 2025
Depth of Test Pits(m)												Tested by	Lab Team
Sampled by	Lab team											Sampling Date	14-Jan-25

SUMMARY OF LABORATORY TEST RESULTS FOR SOILS SAMPLED FROM EXCAVATED TEST PITS ALONGTHE PROPOSED TRANSMISSION LINE

Location	Depth (m)	Material Description	% passing sieve (mm)											LL (%)	PL (%)	PI (%)	LS (%)	USCS	NMC (%)
			28 (%)	20 (%)	14 (%)	10 (%)	5 (%)	2 (%)	1.18 (%)	0.425 (%)	0.300 (%)	0.075 (%)	GM (%)						
BH 01	0.5 -1.5	Sandy CLAYs of intermediate plasticity	100	98	94	14	91	87	84	81	81	79	0.53	49.2	23.4	25.8	13.6		
	1.5 -5.0	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	100	99	98	97	95	0.07	42.3	20.2	22.1	11.6		
	5.0 - 7.5	Clayey SANDs of intermediate plasticity	100	100	100	92	66	45	41	36	29	21	1.98	43.9	18.9	25.0	13.2		
	7.5 - 9.0	Sandy SILTs of low plasticity	100	100	100	100	98	90	80	68	66	61	0.81	20.8	0.0	0.0	1.2		
BH 02	0.5 -1.5	Clayey SANDs of intermediate plasticity	100	100	99	95	75	40	31	27	26	24	2.09	43.6	23.9	19.7	10.4		
	1.5 -5.0	Sandy CLAYs of intermediate plasticity	100	100	100	100	99	95	93	91	90	89	0.25	48.0	25.4	22.6	11.9		
	5.0 - 7.5	Clayey SANDs of intermediate plasticity	100	100	100	96	83	65	60	50	47	38	1.47	41.6	18.1	23.5	12.4		
	7.5 - 9.0	Sandy SILTs of low plasticity	100	100	100	100	99	94	88	84	84	80	0.42	23.1	0.0	0.0	1.4		
BH 03	0.0 - 1.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	98	94	89	87	84	0.29	47.7	25.5	22.2	11.7		
	1.5 - 7.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	99	98	95	94	90	0.16	48.6	23.5	25.1	13.2		
	7.5 - 10	Sandy SILTs of low plasticity	100	100	100	100	100	98	96	93	93	91	0.18	19.8	0.0	0.0	1.1		
BH 04	0.0 - 1.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	100	99	98	97	95	0.07	49.3	20.2	29.1	15.3		
	1.5 - 7.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	100	100	98	97	95	0.07	42.3	20.2	22.1	11.6		
	7.5 - 8.5	Sandy SILTs of low plasticity	100	100	100	100	100	100	100	99	97	96	0.05	22.7	0.0	0.0	1.3		
BH 05	0.0 - 1.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	99	95	90	85	85	83	0.37	40.0	21.5	18.5	9.7		
	1.5 - 7.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	100	99	96	95	93	0.11	45.7	22.8	22.9	12.1		
	7.5 - 8.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	98	96	96	95	95	93	0.16	49.3	20.2	29.1	15.3		

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

ALIGNMENT CLASSIFICATION RESULTS

Project Name	Masindi Port Bulk WaterSupply project	GE										Report Ref. No.	GCL-SGM/MOWE-RPT-001
Client	Ministry of water and Environment											Issuance Date	26-Jun-25
Sample Source	Borehole											Testing Date	15-28 Jan 2025
Depth of Test Pits(m)												Tested by	Lab Team
Sampled by	Lab team											Sampling Date	14-Jan-25

SUMMARY OF LABORATORY TEST RESULTS FOR SOILS SAMPLED FROM EXCAVATED TEST PITS ALONGTHE PROPOSED TRANSMISSION LINE

Location	Depth (m)	Material Description	% passing sieve (mm)											LL (%)	PL (%)	PI (%)	LS (%)	USCS	NMC (%)
			28 (%)	20 (%)	14 (%)	10 (%)	5 (%)	2 (%)	1.18 (%)	0.425 (%)	0.300 (%)	0.075 (%)	GM (%)						
BH 06	0.0 - 1.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	99	99	95	90	89	85	0.26	50.0	22.5	27.5	14.5		
	1.5 - 7.5	Sandy CLAYs of intermediate plasticity	100	97	91	86	83	74	71	66	64	57	1.03	46.0	25.9	20.1	10.6		
	7.5 - 10.0	Sandy CLAYs of intermediate plasticity	100	100	100	99	97	94	92	89	88	81	0.36	43.9	25.1	18.8	9.9		
BH 07	0.0 - 1.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	99	98	92	87	78	0.31	46.9	20.3	26.6	14.0		
	1.5 - 7.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	99	95	93	90	90	87	0.28	42.6	20.5	22.1	11.6		
	7.5 - 10.0	Clayey SANDs of intermediate plasticity	100	97	92	91	91	90	89	78	70	41	0.91	37.6	17.0	20.6	10.8		
BH 08	0.0 - 1.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	99	98	96	95	91	0.14	41.0	20.5	20.5	10.8		
	1.5 - 7.5	Clayey SANDs of intermediate plasticity	100	99	97	85	75	60	52	38	30	24	1.78	43.6	23.9	19.7	10.4		
	7.5 - 10.0	Clayey SANDs of intermediate plasticity	100	90	87	78	68	62	57	44	38	27	1.67	41.6	18.1	23.5	12.4		
BH 09	0.0 - 1.5	Sandy CLAYs of intermediate plasticity	100	100	100	100	100	99	98	95	94	91	0.15	40.5	21.3	19.2	10.1		
	1.5 - 7.5	Clayey GRAVELs of intermediate plasticity	100	98	84	63	53	33	29	25	22	18	2.24	42.5	17.4	25.1	13.2		
	7.5 - 10.0	Sandy SILTs of low plasticity	100	100	100	100	92	88	86	75	69	55	0.82	25.8	0.0	0.0	1.1		
BH 10	0.5 -1.5	Sandy CLAYs of low plasticity	100	99	97	97	90	89	88	72	60	53	0.86	32.7	19.4	13.3	7.0		
	1.5 -10	Clayey GRAVELs of low plasticity	79	66	60	58	50	47	47	44	37	34	1.75	31.5	17.6	13.9	7.3		
BH 11	0.5 -1.5	Clayey GRAVELs of low plasticity	72	71	62	61	52	45	44	36	34	33	1.86	30.5	15.6	14.9	7.8		
	1.5 -10	Clayey GRAVELs of low plasticity	80	77	68	62	59	51	48	41	36	26	1.82	25.5	12.7	12.8	6.7		

CONSULTANT | CLIENT | TESTING LAB

SEGAMU 14 CONSULTS LTD

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

ALIGNMENT CLASSIFICATION RESULTS

Project Name	Masindi Port Bulk WaterSupply project	GE										Report Ref. No.	GCL-SGM/MOWE-RPT-001
Client	Ministry of water and Environment											Issuance Date	26-Jun-25
Sample Source	Borehole											Testing Date	15-28 Jan 2025
Depth of Test Pits(m)												Tested by	Lab Team
Sampled by	Lab team											Sampling Date	14-Jan-25

SUMMARY OF LABORATORY TEST RESULTS FOR SOILS SAMPLED FROM EXCAVATED TEST PITS ALONGTHE PROPOSED TRANSMISSION LINE

Location	Depth (m)	Material Description	% passing sieve (mm)											LL (%)	PL (%)	PI (%)	LS (%)	USCS	NMC (%)
			28 (%)	20 (%)	14 (%)	10 (%)	5 (%)	2 (%)	1.18 (%)	0.425 (%)	0.300 (%)	0.075 (%)	GM (%)						
BH 12	0.5 -1.5	Clayey GRAVELs of low plasticity	71	70	68	65	53	46	44	40	37	31	1.83	30.9	16.2	14.7	7.7		
	1.5 -10	Clayey GRAVELs of low plasticity	77	72	65	60	50	41	38	30	26	15	2.14	23.5	11.4	12.1	6.4		

Legend
(L)-Low Plasticity/LL<50 **N.P** Non Plastic **LS** Linear Shrinkage **GM** Grading Modulus **LL** Liquid Limit

Client's representative		Prepared by	Checked by
Name		KAWISO BENARD	Eng. KAGOLA FRED
Signature		Signature	Signature
Date		Date	Date 16-02-2025
Contact		Laboratory Engineer	Materials Engineer

GCL - CONCRETE LABORATORY

Appendix 8 Consolidation Test Results

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH01	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
					σH	σP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.718	0	0	-	-	-	-	-
1	100	0.58	19.419	0.6683	0.581	100	0.998	3.8	19.7095	2.737	8.50E-09
2	200	0.87	19.1285	0.6433	0.2905	100	0.250	4.0	19.56425	2.600	2.02E-09
3	400	1.17	18.826	0.6174	0.302	200	0.130	4.0	19.41319	2.600	1.05E-09
4	800	1.55	18.449	0.5849	0.378	400	0.081	4.6	19.224365	2.261	5.70E-10
5	1600	2.03	17.967	0.5435	0.482	800	0.052	4.8	18.98325	2.167	3.49E-10
6	3200	2.69	17.310	0.4871	0.657	1600	0.035	4.8	18.654985	2.167	2.38E-10
7	800	2.20	17.804	0.5295	-0.49385	-2400	0.018	3.8	18.90191	2.737	1.55E-10
8	400	1.86	18.1408	0.5585	-0.34	-400	0.072	3.8	19.0704	2.737	6.16E-10
Average							**0.204**			**2.501**	**1.69E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

Date: 18-08-2025

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**H_o**	20	**Sampling Date**	18-Jan-25
Chainage		**H_s**	11.6	**Test Date**	16-Aug-24
BH ID	BH01	**e_o**	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_S$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.718	0	0	-	-	-	-	-
1	100	0.68	19.32	0.660	0.68	100	1.170	3.0	19.6595	3.467	1.26E-08
2	200	1.02	18.9785	0.630	0.3405	100	0.293	3.7	19.489	2.811	2.56E-09
3	400	1.38	18.624	0.600	0.354	200	0.152	3.7	19.312	2.811	1.33E-09
4	800	1.82	18.182	0.562	0.443	400	0.095	4.6	19.091	2.261	6.69E-10
5	1600	2.38	17.617	0.513	0.565	800	0.061	4.6	18.808	2.261	4.27E-10
6	3200	3.15	16.847	0.447	0.770	1600	0.041	5.4	18.423	1.926	2.48E-10
7	800	2.57	17.426	0.497	-0.579	-2400	0.021	4.1	18.713	2.537	1.63E-10
8	400	2.18	17.821	0.531	-0.395	-400	0.085	3.3	18.910	3.152	8.22E-10
			Average				**0.240**			**2.653**	**2.36E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH02	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
					σH	σP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.718	0	0	-	-	-	-	-
1	100	0.57	19.429	0.6692	0.571	100	0.981	3.8	19.7145	2.737	8.35E-09
2	200	0.86	19.1435	0.6446	0.2855	100	0.245	4.0	19.57175	2.600	1.98E-09
3	400	1.15	18.847	0.6191	0.297	200	0.128	4.0	19.42329	2.600	1.03E-09
4	800	1.52	18.475	0.5872	0.371	400	0.080	4.6	19.237715	2.261	5.61E-10
5	1600	2.00	18.002	0.5465	0.474	800	0.051	4.8	19.00075	2.167	3.43E-10
6	3200	2.64	17.356	0.4911	0.645	1600	0.035	4.8	18.678135	2.167	2.34E-10
7	800	2.16	17.842	0.5328	-0.48535	-2400	0.017	3.8	18.92081	2.737	1.48E-10
8	400	1.83	18.1728	0.5612	-0.33	-400	0.071	3.8	19.0864	2.737	6.06E-10
			Average				**0.201**			**2.501**	**1.66E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA, Ministry of Water and Environment	Geo-concrete Laboratory, TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH02	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_S$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
					oH	oP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.718	0	0	-	-	-	-	-
1	100	0.64	19.358	0.663	0.64	100	1.103	3.0	19.679	3.467	1.19E-08
2	200	0.96	19.037	0.635	0.321	100	0.276	3.7	19.519	2.811	2.41E-09
3	400	1.30	18.703	0.607	0.334	200	0.143	3.7	19.352	2.811	1.25E-09
4	800	1.71	18.286	0.571	0.417	400	0.090	4.6	19.143	2.261	6.30E-10
5	1600	2.25	17.753	0.525	0.533	800	0.057	4.6	18.877	2.261	4.02E-10
6	3200	2.97	17.028	0.463	0.725	1600	0.039	5.4	18.514	1.926	2.33E-10
7	800	2.43	17.573	0.510	-0.546	-2400	0.020	4.1	18.787	2.532	1.54E-10
8	400	2.05	17.946	0.542	-0.372	-400	0.080	3.3	18.973	3.150	6.91E-10
			Average				**0.226**			**2.653**	**2.23E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH03	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.718	0	0	-	-	-	-	-
1	100	0.66	19.34	0.6615	0.66	100	1.134	2.9	19.67	3.586	1.27E-08
2	200	0.99	19.01	0.6332	0.33	100	0.284	3.4	19.505	3.059	2.70E-09
3	400	1.33	18.667	0.6037	0.343	200	0.147	3.6	19.3334	2.889	1.32E-09
4	800	1.76	18.238	0.5668	0.429	400	0.092	4.0	19.1189	2.600	7.45E-10
5	1600	2.31	17.690	0.5198	0.548	800	0.059	4.8	18.845	2.167	3.96E-10
6	3200	3.06	16.944	0.4557	0.746	1600	0.040	6.0	18.4721	1.733	2.16E-10
7	800	2.49	17.505	0.5039	-0.561	-2400	0.020	5.1	18.7526	2.039	1.27E-10
8	400	2.11	17.888	0.5368	-0.38	-400	0.082	4.0	18.944	2.600	6.65E-10
			Average				**0.232**			**2.584**	**2.33E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA, Ministry of Water and Environment	Geo-concrete Laboratory, TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH03	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_S$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.77	19.23	0.6521	0.77	100	1.323	2.5	19.615	4.160	1.71E-08
2	200	1.16	18.845	0.6190	0.385	100	0.331	3.5	19.423	2.971	3.06E-09
3	400	1.56	18.445	0.5846	0.400	200	0.172	3.5	19.222	2.971	1.59E-09
4	800	2.06	17.944	0.5416	0.501	400	0.107	4.1	18.972	2.537	8.48E-10
5	1600	2.70	17.305	0.4867	0.639	800	0.069	4.1	18.653	2.537	5.42E-10
6	3200	3.57	16.435	0.4119	0.870	1600	0.047	5.0	18.217	2.080	3.02E-10
7	800	2.91	17.089	0.4682	-0.655	-2400	0.023	4.0	18.545	2.600	1.89E-10
8	400	2.46	17.536	0.5065	-0.447	-400	0.096	3.2	18.768	3.250	9.70E-10
			Average				**0.271**			**2.588**	**3.08E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH04	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
					σH	σP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.718	0	0	-	-	-	-	-
1	100	0.55	19.45	0.6710	0.55	100	0.945	3.7	19.725	2.811	8.26E-09
2	200	0.83	19.175	0.6473	0.275	100	0.236	4.7	19.5875	2.213	1.63E-09
3	400	1.11	18.889	0.6228	0.286	200	0.123	4.8	19.4445	2.167	8.28E-10
4	800	1.47	18.532	0.5921	0.358	400	0.077	6.0	19.26575	1.733	4.14E-10
5	1600	1.93	18.075	0.5528	0.457	800	0.049	6.0	19.0375	1.733	2.64E-10
6	3200	2.55	17.454	0.4994	0.622	1600	0.033	7.5	18.72675	1.387	1.44E-10
7	800	2.08	17.921	0.5396	-0.4675	-2400	0.017	6.5	18.9605	1.600	8.33E-11
8	400	1.76	18.24	0.5670	-0.32	-400	0.069	5.0	19.12	2.080	4.35E-10
Average							**0.194**			**1.965**	**1.51E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH04	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_S$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.61	19.39	0.6656	0.61	100	1.052	4.0	19.694	2.600	8.50E-09
2	200	0.92	19.082	0.6393	0.306	100	0.263	4.2	19.541	2.476	2.02E-09
3	400	1.24	18.76376	0.6120	0.31824	200	0.137	5.5	19.382	1.891	8.04E-10
4	800	1.63	18.366	0.5778	0.398	400	0.085	5.7	19.183	1.825	4.85E-10
5	1600	2.14	17.858	0.5342	0.508	800	0.055	6.8	18.929	1.529	2.60E-10
6	3200	2.83	17.166	0.4748	0.692	1600	0.037	8.0	18.583	1.300	1.50E-10
7	800	2.31	17.68664	0.5195	-0.520	-2400	0.019	7.0	18.843	1.486	8.61E-11
8	400	1.96	18.042	0.5500	-0.35496	-400	0.076	6.0	19.021	1.733	4.41E-10
			Average				**0.215**			**1.855**	**1.59E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH05	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.60	19.4	0.6667	0.6	100	1.031	4.1	19.7	2.537	8.13E-09
2	200	0.90	19.1	0.6409	0.3	100	0.258	4.1	19.55	2.537	2.03E-09
3	400	1.21	18.788	0.6141	0.312	200	0.134	4.5	19.394	2.311	9.64E-10
4	800	1.60	18.398	0.5806	0.39	400	0.084	4.5	19.199	2.311	6.02E-10
5	1600	2.10	17.9	0.5378	0.498	800	0.053	6.0	18.95	1.733	2.88E-10
6	3200	2.78	17.222	0.4796	0.678	1600	0.036	7.0	18.611	1.486	1.68E-10
7	800	2.27	17.732	0.5234	-0.51	-2400	0.018	6.0	18.866	1.733	9.84E-11
8	400	1.92	18.08	0.5533	-0.35	-400	0.075	5.5	19.04	1.891	4.40E-10
Average							**0.211**			**2.065**	**1.69E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer Date 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH05	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_S$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
					oH	oP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.58	19.42	0.6684	0.58	100	0.997	4.0	19.71	2.600	8.06E-09
2	200	0.87	19.13	0.6435	0.29	100	0.249	4.2	19.565	2.476	1.92E-09
3	400	1.17	18.8284	0.6176	0.3016	200	0.130	5.5	19.414	1.891	7.62E-10
4	800	1.55	18.451	0.5852	0.377	400	0.081	5.7	19.226	1.825	4.60E-10
5	1600	2.03	17.970	0.5438	0.481	800	0.052	6.8	18.985	1.529	2.46E-10
6	3200	2.69	17.315	0.4875	0.655	1600	0.035	8.0	18.657	1.300	1.42E-10
7	800	2.19	17.8076	0.5299	-0.493	-2400	0.018	7.0	18.904	1.486	8.16E-11
8	400	1.86	18.144	0.5588	-0.3364	-400	0.072	6.0	19.072	1.733	3.90E-10
			Average				**0.204**			**1.855**	**1.51E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

GEO-CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH06	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.59	19.41	0.6675	0.59	100	1.014	3.5	19.705	2.971	9.37E-09
2	200	0.89	19.115	0.6422	0.295	100	0.253	3.5	19.5575	2.971	2.34E-09
3	400	1.19	18.8082	0.6158	0.3068	200	0.132	4.5	19.4041	2.311	9.47E-10
4	800	1.58	18.4247	0.5829	0.3835	400	0.082	5.5	19.21235	1.891	4.84E-10
5	1600	2.07	17.935	0.5408	0.4897	800	0.053	5.6	18.9675	1.857	3.04E-10
6	3200	2.73	17.2683	0.4835	0.6667	1600	0.036	7.0	18.63415	1.486	1.65E-10
7	800	2.23	17.7698	0.5266	-0.5015	-2400	0.018	6.0	18.8849	1.733	9.68E-11
8	400	1.89	18.112	0.5560	-0.34	-400	0.073	5.5	19.056	1.891	4.27E-10
			Average				**0.208**			**2.139**	**1.77E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 18-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH06	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_S$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.61	19.39	0.6658	0.61	100	1.048	3.6	19.695	2.889	9.42E-09
2	200	0.92	19.085	0.6396	0.305	100	0.262	4.4	19.543	2.364	1.93E-09
3	400	1.23	18.7678	0.6124	0.3172	200	0.136	4.4	19.384	2.364	1.00E-09
4	800	1.63	18.371	0.5783	0.397	400	0.085	5.7	19.186	1.825	4.83E-10
5	1600	2.14	17.865	0.5348	0.506	800	0.054	6.3	18.933	1.651	2.79E-10
6	3200	2.82	17.176	0.4756	0.689	1600	0.037	8.1	18.588	1.284	1.48E-10
7	800	2.31	17.6942	0.5201	-0.519	-2400	0.019	7.3	18.847	1.425	8.23E-11
8	400	1.95	18.048	0.5505	-0.3538	-400	0.076	6.2	19.024	1.670	3.97E-10
			Average				**0.215**			**1.935**	**1.72E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH06	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	8.0-8.2m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
					σH	σP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.60	19.4	0.6667	0.6	100	1.031	4.0	19.7	2.600	8.34E-09
2	200	0.90	19.1	0.6409	0.3	100	0.258	4.0	19.55	2.600	2.08E-09
3	400	1.21	18.788	0.6141	0.312	200	0.134	4.5	19.394	2.311	9.64E-10
4	800	1.60	18.398	0.5806	0.39	400	0.084	6.0	19.199	1.733	4.52E-10
5	1600	2.10	17.9	0.5378	0.498	800	0.053	6.8	18.95	1.529	2.54E-10
6	3200	2.78	17.222	0.4796	0.678	1600	0.036	7.9	18.611	1.316	1.49E-10
7	800	2.27	17.732	0.5234	-0.51	-2400	0.018	6.2	18.866	1.677	9.53E-11
8	400	1.92	18.08	0.5533	-0.35	-400	0.075	5.0	19.04	2.080	4.27E-10
Average							**0.211**			**1.981**	**1.60E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

GEO-CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA, Ministry of Water and Environment	Geo-concrete Laboratory, TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH07	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_S$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.63	19.37	0.6641	0.63	100	1.082	3.8	19.685	2.737	9.22E-09
2	200	0.95	19.055	0.6370	0.315	100	0.271	4.3	19.528	2.419	2.04E-09
3	400	1.27	18.7274	0.6089	0.3276	200	0.141	4.3	19.364	2.419	1.06E-09
4	800	1.68	18.318	0.5737	0.410	400	0.088	5.5	19.159	1.891	5.17E-10
5	1600	2.21	17.795	0.5288	0.523	800	0.056	6.0	18.898	1.733	3.03E-10
6	3200	2.92	17.083	0.4676	0.712	1600	0.038	8.0	18.542	1.300	1.55E-10
7	800	2.38	17.6186	0.5136	-0.536	-2400	0.019	7.2	18.809	1.444	8.61E-11
8	400	2.02	17.984	0.5450	-0.3654	-400	0.078	6.0	18.992	1.733	1.06E-10
			Average				**0.222**			**1.960**	**1.72E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH07	e_o	0.718		
Description	Sandy CLAYs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.60	19.4	0.6667	0.6	100	1.031	2.7	19.7	3.852	1.24E-08
2	200	0.90	19.1	0.6409	0.3	100	0.258	3.2	19.55	3.250	2.61E-09
3	400	1.21	18.788	0.6141	0.312	200	0.134	4.0	19.394	2.600	1.08E-09
4	800	1.60	18.398	0.5806	0.39	400	0.084	4.5	19.199	2.311	6.02E-10
5	1600	2.10	17.9	0.5378	0.498	800	0.053	5.5	18.95	1.891	3.15E-10
6	3200	2.78	17.222	0.4796	0.678	1600	0.036	6.7	18.611	1.552	1.76E-10
7	800	2.27	17.732	0.5234	-0.51	-2400	0.018	6.0	18.866	1.733	9.84E-11
8	400	1.92	18.08	0.5533	-0.35	-400	0.075	5.2	19.04	2.000	4.55E-10
			Average				**0.211**			**2.396**	**2.21E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

Date: 16-02-2025

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**H_o**	20	**Sampling Date**	18-Jan-25
Chainage		**H_s**	11.6	**Test Date**	16-Aug-24
BH ID	BH07	**e_o**	0.718		
Description	Clayey SANDs	Corrected as overconsolidated according to Das, 2010		**Depth**	8.0-8.2m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_o+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.63	19.37	0.6641	0.63	100	1.082	3.0	19.685	3.467	1.17E-08
2	200	0.95	19.055	0.6370	0.315	100	0.271	3.5	19.5275	2.971	2.50E-09
3	400	1.27	18.7274	0.6089	0.3276	200	0.141	4.0	19.3637	2.600	1.14E-09
4	800	1.68	18.3179	0.5737	0.4095	400	0.088	4.7	19.15895	2.213	6.05E-10
5	1600	2.21	17.795	0.5288	0.5229	800	0.056	5.9	18.8975	1.763	3.08E-10
6	3200	2.92	17.0831	0.4676	0.7119	1600	0.038	7.0	18.54155	1.486	1.77E-10
7	800	2.38	17.6186	0.5136	-0.5355	-2400	0.019	6.2	18.8093	1.672	1.90E-10
8	400	2.02	17.984	0.5450	-0.3654	-400	0.078	5.8	18.992	1.792	7.28E-10
			Average				**0.222**			**4.246**	**2.12E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH08	e_o	0.718		
Description	Clayey SANDs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.62	19.38	0.6649	0.62	100	1.065	2.5	19.69	4.160	1.38E-08
2	200	0.93	19.07	0.6383	0.31	100	0.266	4.0	19.535	2.600	2.15E-09
3	400	1.25	18.7476	0.6106	0.3224	200	0.138	5.5	19.3738	1.891	8.15E-10
4	800	1.66	18.3446	0.5760	0.403	400	0.087	6.8	19.1723	1.529	4.12E-10
5	1600	2.17	17.83	0.5318	0.5146	800	0.055	8.0	18.915	1.300	2.23E-10
6	3200	2.87	17.1294	0.4716	0.7006	1600	0.038	9.5	18.5647	1.095	1.28E-10
7	800	2.34	17.6564	0.5169	-0.527	-2400	0.019	7.8	18.8282	1.333	7.82E-11
8	400	1.98	18.016	0.5478	-0.36	-400	0.077	5.6	19.008	1.857	4.46E-10
			Average				**0.218**			**1.971**	**2.26E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

GEO-CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**H_o**	20	**Sampling Date**	18-Jan-25
Chainage		**H_s**	11.6	**Test Date**	16-Aug-24
BH ID	BH08	**e_o**	0.718		
Description	Clayey SANDs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
					σH	σP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.59	19.41	0.6675	0.59	100	1.014	2.8	19.705	3.714	1.17E-08
2	200	0.89	19.115	0.6422	0.295	100	0.253	4.0	19.5575	2.600	2.05E-09
3	400	1.19	18.8082	0.6158	0.3068	200	0.132	5.5	19.4041	1.891	7.75E-10
4	800	1.58	18.4247	0.5829	0.3835	400	0.082	7.2	19.21235	1.444	3.70E-10
5	1600	2.07	17.935	0.5408	0.4897	800	0.053	8.5	18.9675	1.224	2.00E-10
6	3200	2.73	17.2683	0.4835	0.6667	1600	0.036	9.9	18.63415	1.051	1.17E-10
7	800	2.23	17.7698	0.5266	-0.5015	-2400	0.018	8.5	18.8849	1.224	6.83E-11
8	400	1.89	18.112	0.5560	-0.3422	-400	0.073	6.6	19.056	1.576	5.08E-10
			Average				**0.208**			**1.840**	**1.96E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH09	e_o	0.718		
Description	Clayey GRAVELs	Corrected as overconsolidated according to Das, 2010		**Depth**	3.5-3.7m

VOID RATIO					**Volume Compressibility**			**Coefficient of Consolidation**			**Permeability**
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change oH	Pressure Change oP	$Mv=(oH/H_1+1000/op)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w gm_v$
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	m^2/year	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.59	19.41	0.6675	0.59	100	1.014	3.5	19.705	2.971	9.37E-09
2	200	0.89	19.115	0.6422	0.295	100	0.253	4.5	19.5575	2.311	1.82E-09
3	400	1.19	18.8082	0.6158	0.3068	200	0.132	5.8	19.4041	1.793	7.35E-10
4	800	1.58	18.4247	0.5829	0.3835	400	0.082	7.0	19.21235	1.486	3.81E-10
5	1600	2.07	17.935	0.5408	0.4897	800	0.053	8.1	18.9675	1.284	2.10E-10
6	3200	2.73	17.2683	0.4835	0.6667	1600	0.036	9.5	18.63415	1.095	1.22E-10
7	800	2.23	17.7698	0.5266	-0.5015	-2400	0.018	8.0	18.8849	1.300	7.26E-11
8	400	1.89	18.112	0.5560	-0.3422	-400	0.073	7.0	19.056	1.486	6.10E-10
Average							**0.208**			**1.716**	**1.63E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer
Date: 16-02-2025

GEO-CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

OEDOMETER CONSOLIDATION TEST WITH 2NO. UNLOADING INCREMENTS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	H_o	20	**Sampling Date**	18-Jan-25
Chainage		H_s	11.6	**Test Date**	16-Aug-24
BH ID	BH09	e_o	0.718		
Description	Clayey GRAVELs	Corrected as overconsolidated according to Das, 2010		**Depth**	5.8-6.0m

VOID RATIO					Volume Compressibility			Coefficient of Consolidation			Permeability
		Cumulative Compression	Consolidated height	Void Ratio	Incremental		Coef.of vol.Comp	t_{50}	$H=0.5(H_0+Hs)$	Cv	K
Increment no.	Pressure, P	(ΔH-y)	H=Ho-(ΔH-y)	$e=H-H_s/H_s$	Height Change	Pressure Change	$Mv=(\sigma H/H_1+1000/\sigma p)$			$Cv=0.026(H_1^2)/t_{50}$	$K_v=C_v\rho_w g m_v$
					σH	σP					
-	kPa	mm	mm	e	mm	Kpa	m^2/MN	min	mm	$m^2/year$	m/s
0	50	0	20	0.7182	0	0	-	-	-	-	-
1	100	0.57	19.43	0.6692	0.57	100	0.979	3.0	19.715	3.467	1.06E-08
2	200	0.86	19.145	0.6448	0.285	100	0.245	4.0	19.5725	2.600	1.98E-09
3	400	1.15	18.8486	0.6193	0.2964	200	0.127	5.1	19.4243	2.039	8.08E-10
4	800	1.52	18.4781	0.5875	0.3705	400	0.080	7.0	19.23905	1.486	3.68E-10
5	1600	2.00	18.005	0.5468	0.4731	800	0.051	8.1	19.0025	1.284	2.03E-10
6	3200	2.64	17.3609	0.4915	0.6441	1600	0.035	9.8	18.68045	1.061	1.14E-10
7	800	2.15	17.8454	0.5331	-0.4845	-2400	0.017	6.0	18.9227	1.733	9.35E-11
8	400	1.82	18.176	0.5615	-0.3306	-400	0.071	5.2	19.088	2.000	6.42E-10
Average							**0.201**			**1.969**	**1.82E-09**

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Checked by
Kawiso Benard
Laboratory Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

Appendix 9:Shear Test Results

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

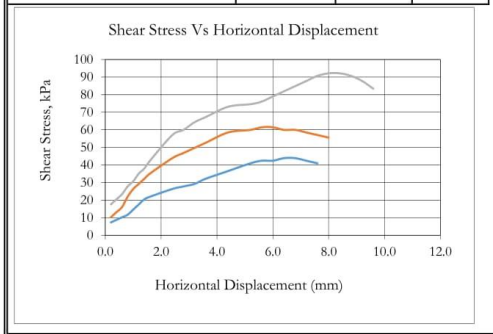
DIRECT SHEAR STRENGTH TEST REPORT

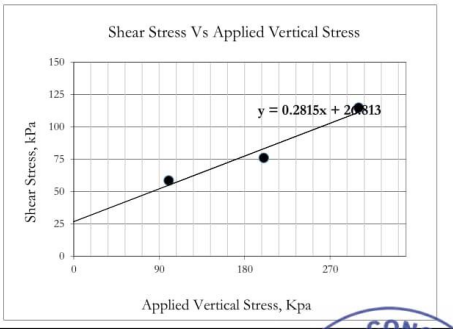
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH1	**Date Sampled :-**	16-01-2025
Depth :-	3.3 - 3.7m	**Date Received :-**	
Sample Description:-	Sandy Clay	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.821
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		54		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	59	76	115		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	26.81
Angle of Internal Friction,ϕ	15.72





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kaboda Fred
Materials Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

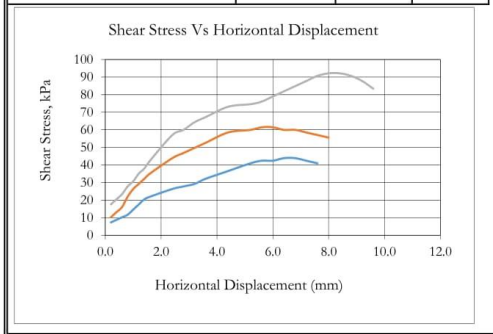
CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

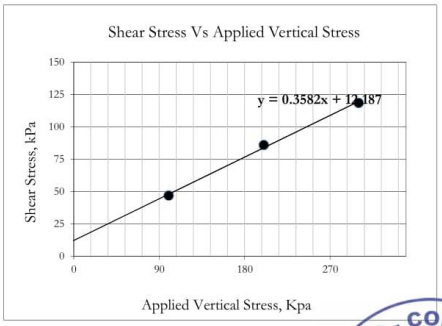
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH1	**Date Sampled :-**	16-01-2025
Depth :-	5.8-6.0m	**Date Received :-**	
Sample Description:-	Sandy Clay	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.788
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		53		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300	Cohesion,C (KN/m2)	12.19
Maximum Shear Stress,Kpa	47	86	119	Angle of Internal Friction,ϕ	19.71
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred Date:...16-02-2025
Materials Engineer

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

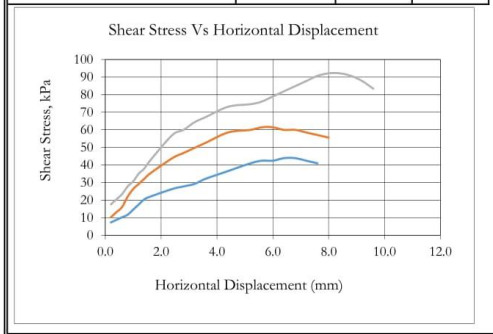
DIRECT SHEAR STRENGTH TEST REPORT

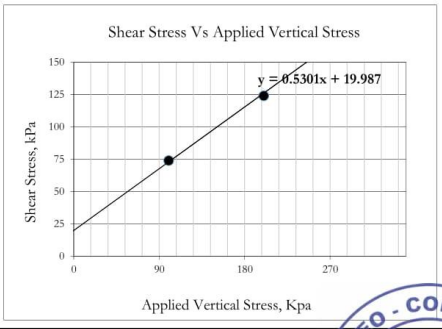
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH2	**Date Sampled :-**	16-01-2025
Depth :-	3.5 - 3.7m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.796
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		53		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	74	124	180		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	19.99
Angle of Internal Friction,ϕ	27.93





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

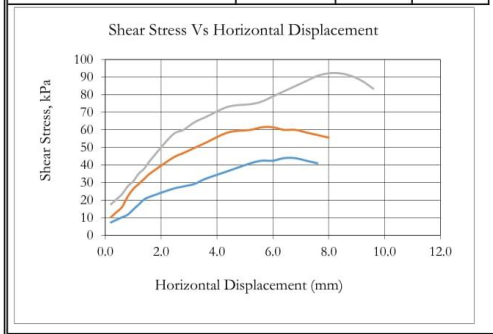
DIRECT SHEAR STRENGTH TEST REPORT

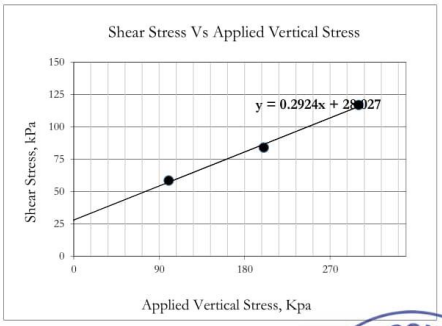
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH2	**Date Sampled :-**	16-01-2025
Depth :-	5.8 6.0m	**Date Received :-**	
Sample Description:-	Sandy Clay	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.754
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		52		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	59	84	117		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	28.03
Angle of Internal Friction,ϕ	16.30





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

DIRECT SHEAR STRENGTH TEST REPORT

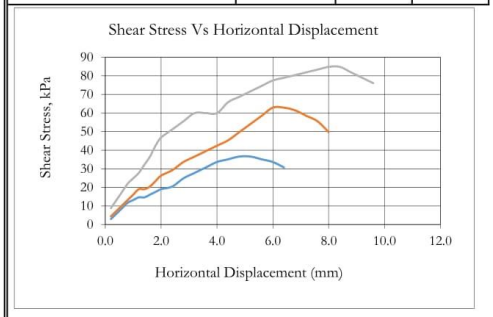
TEST METHOD : BS 1377-2:2022 Clause 25

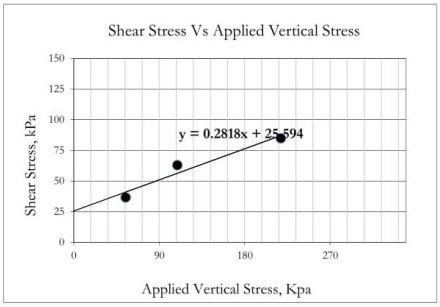
Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 3	**Date Sampled :-**	16-01-20245
Depth :-	3.5 - 3.7m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-20245
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

			Ring Calibration Factor(N/div)	5.265
Thickness of sample, mm	23		Bulk density (gm/cm^3)	1.834
Length of sample, mm	60		Dry density (gm/cm^3)	
Width of sample, mm	60		Moisture (%)	
Unit Weight (KNm-3)			Acceleration Due Gravity (ms-1)	9.81
Overburden Pressure (Kpa)			Area of Sample (m2)	0.0036
Sample Depth (m)	3			

Applied Vertical Stress,Kpa	55	109	218
Maximum Shear Stress,Kpa	37	63	85
Mass verticle Loading (Kg)	2.0	4.0	8.0
Force on sample (N)	196.2	392.4	784.8
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0
Pressure (Kpa)	55	109	218

Cohesion,C (KN/m2)	25.59
Angle of Internal Friction,Φ	15.74





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer Date:...16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

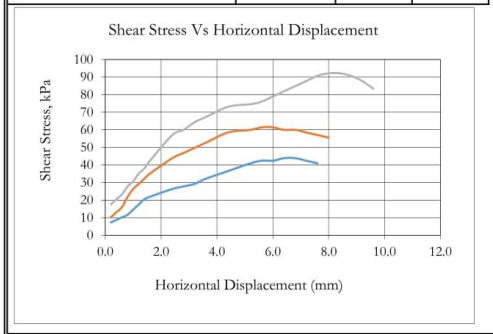
DIRECT SHEAR STRENGTH TEST REPORT

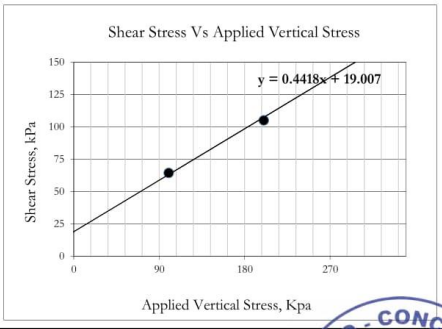
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH3	**Date Sampled :-**	16-01-2025
Depth :-	5.5 - 6.0m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.802
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		53		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	64	105	153		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	19.01
Angle of Internal Friction,ϕ	23.84





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date: 16-01-2025

GEO - CONCRETE LABORATORY

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

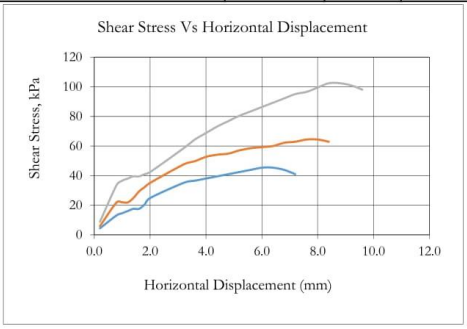
Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

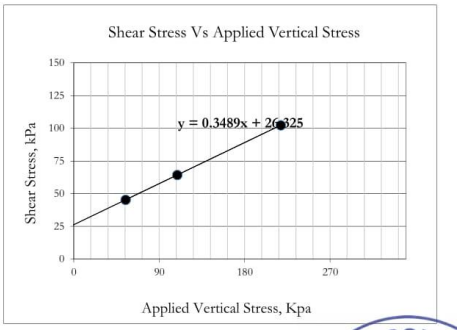
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 04	**Date Sampled :-**	16-01-2025
Depth :-	3.5 - 3.7m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.805
Width of sample, mm		60		Dry density (gm/cm^3)	
Unit Weight (KNm-3)		17.7		Moisture (%)	
Overburden Pressure (Kpa)		106		Acceleration Due Gravity (ms-1)	9.81
Sample Depth (m)		6		Area of Sample (m2)	0.0036
Applied Vertical Stress,Kpa	55	109	218	Cohesion,C (KN/m2)	26.33
Maximum Shear Stress,Kpa	45	64	102	Angle of Internal Friction,ϕ	19.23
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT | CLIENT | TESTING LAB

SEGAMU 14 CONSULTS LTD

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

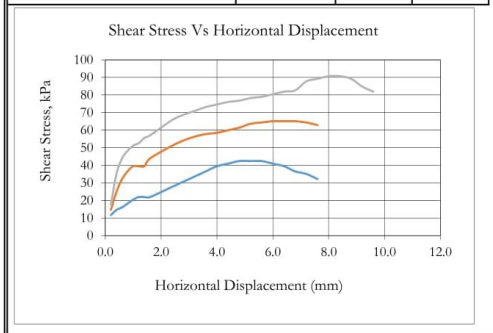
Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

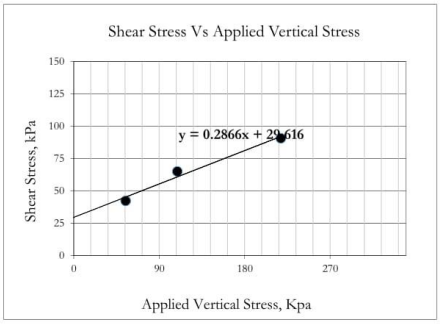
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 04	**Date Sampled :-**	16-01-2025
Depth :-	5.8 - 6m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.868
Width of sample, mm		60		Dry density (gm/cm^3)	
Unit Weight (KNm-3)		18.3		Moisture (%)	
Overburden Pressure (Kpa)		110		Acceleration Due Gravity (ms-1)	9.81
Sample Depth (m)		6		Area of Sample (m2)	0.0036
Applied Vertical Stress,Kpa	55	109	218	Cohesion,C (KN/m2)	29.62
Maximum Shear Stress,Kpa	42	65	91	Angle of Internal Friction,Φ	15.99
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date 16-02-2025

GEO - CONCRETE LABORATORY

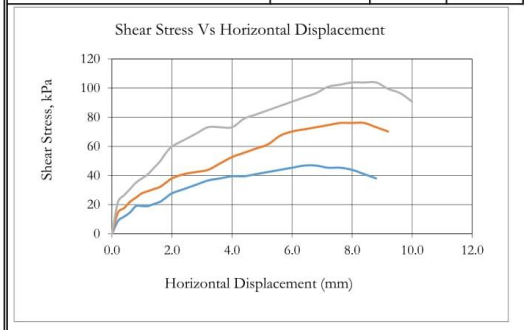
CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

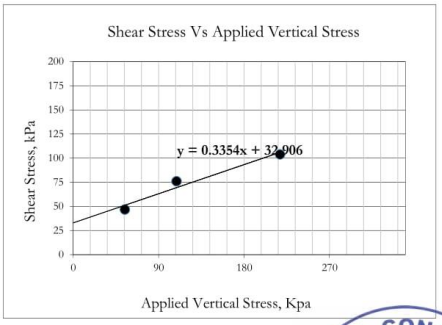
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project:	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample:**	Un-disturbed
Client:	MINISTRY OF WATER AND ENVIRONMENT	**Sampled By:**	Lab Team
Trial Pit No:	TP 9	**Date Sampled:**	16-Jan-25
Station :-	BH 05	**Date Received:**	
Depth (m):	3.5 3.7m	**Date Tested:**	18-Jan-25
Sample Description:	Sandy Clays		

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.877
Width of sample, mm		60		Dry density (gm/cm^3)	1.416
Unit Weight (KNm-3)		18.4		Moisture (%)	31.2
Overburden Pressure (Kpa)		55		Acceleration Due Gravity (ms-1)	9.81
Sample Depth (m)		3		Area of Sample (m2)	0.0036
Applied Vertical Stress,Kpa	55	109	218	Cohesion,C (KN/m2)	32.91
Maximum Shear Stress,Kpa	47	76	104	Angle of Internal Friction,Φ	18.54
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

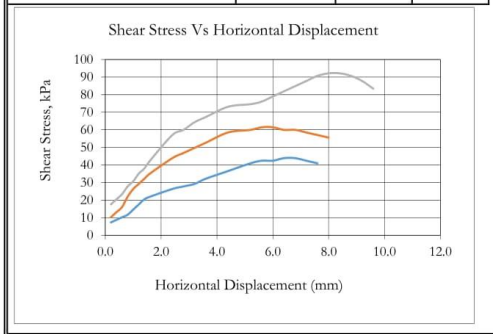
CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

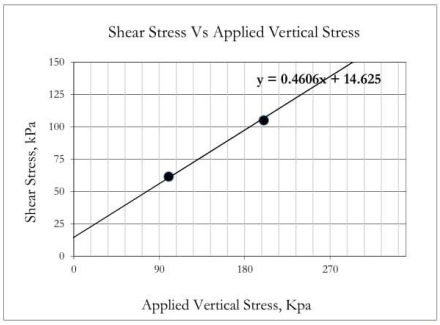
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 05	**Date Sampled :-**	16-01-2025
Depth :-	5.8 - 6.0m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.743
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		51		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300	Cohesion,C (KN/m2)	14.63
Maximum Shear Stress,Kpa	62	105	154	Angle of Internal Friction,ϕ	24.73
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer Date: 16-02-2025

GEO - CONCRETE LABORATORY

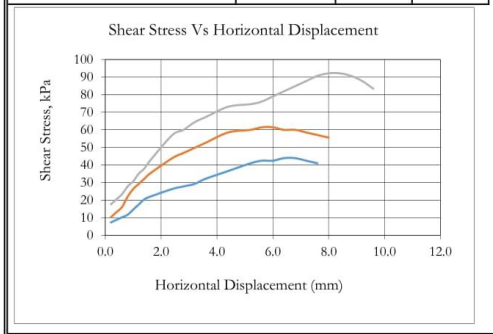
CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

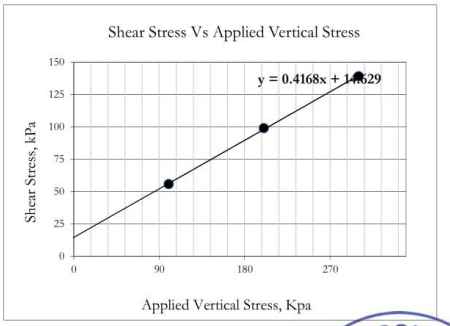
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 06	**Date Sampled :-**	16-01-2025
Depth :-	3.5 -3.7m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.812
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		53		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300	Cohesion,C (KN/m2)	14.63
Maximum Shear Stress,Kpa	56	99	139	Angle of Internal Friction,ϕ	22.63
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

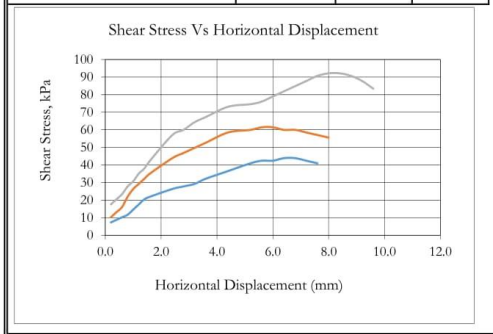
DIRECT SHEAR STRENGTH TEST REPORT

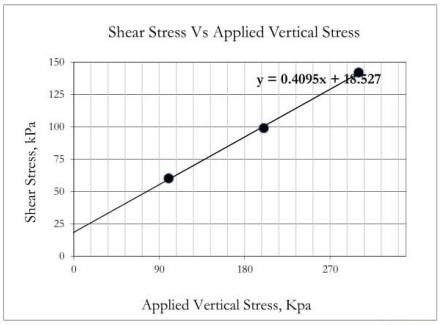
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH6	**Date Sampled :-**	16-01-2025
Depth :-	5.8 - 6.0m	**Date Received :-**	
Sample Description:-	Sandy clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.921
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		57		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	60	99	142		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	18.53
Angle of Internal Friction,ϕ	22.27





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

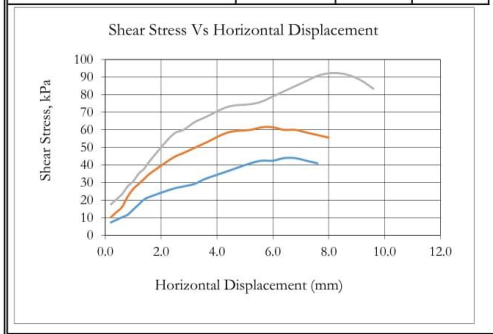
DIRECT SHEAR STRENGTH TEST REPORT

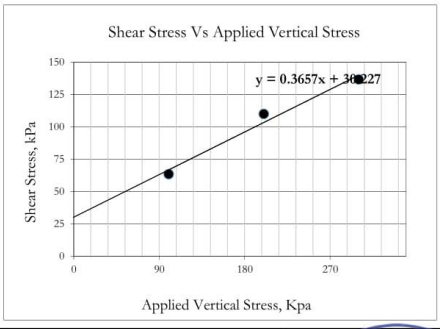
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 06	**Date Sampled :-**	16-01-2025
Depth :-	8.0 -8.2m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.855
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		55		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	63	110	137		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	30.23
Angle of Internal Friction,ϕ	20.08





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer

Date:.....16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

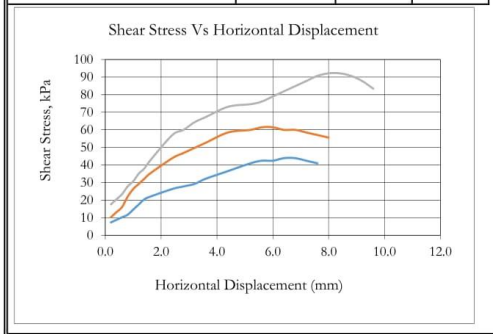
DIRECT SHEAR STRENGTH TEST REPORT

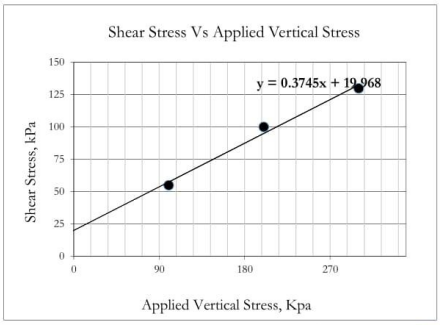
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 07	**Date Sampled :-**	16-01-2025
Depth :-	3.5 3.7m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.845
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		54		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	55	100	130		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	19.97
Angle of Internal Friction,ϕ	20.53





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT | CLIENT | TESTING LAB

SEGAMU 14 CONSULTS LTD

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

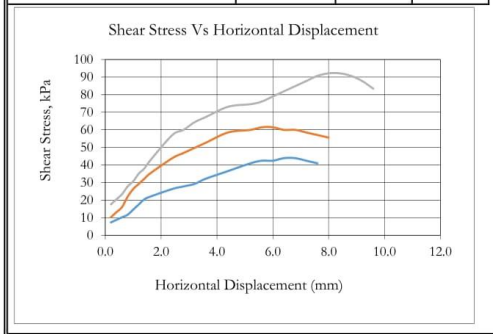
Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

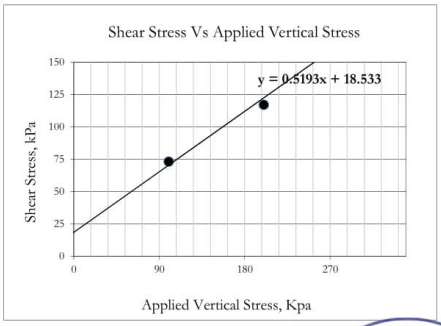
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 07	**Date Sampled :-**	16-01-2025
Depth :-	5.8 - 6.0m	**Date Received :-**	
Sample Description:-	Sandy Clays	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.852
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		55		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300	Cohesion,C (KN/m2)	18.53
Maximum Shear Stress,Kpa	73	117	177	Angle of Internal Friction,ϕ	27.44
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date: 16-02-2025

GEO - CONCRETE LABORATORY

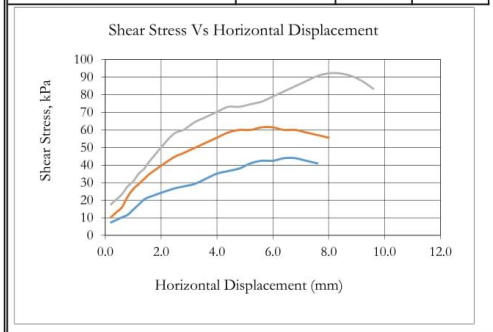
CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

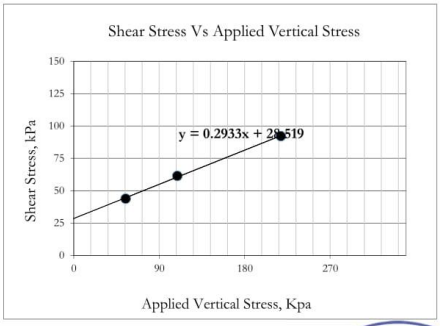
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 07	**Date Sampled :-**	16-01-2025
Depth :-	8.0 - 8.2m	**Date Received :-**	
Sample Description:-	Clayey Sand	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.844
Width of sample, mm		60		Dry density (gm/cm^3)	
Unit Weight (KNm-3)		18.1		Moisture (%)	
Overburden Pressure (Kpa)		54		Acceleration Due Gravity (ms-1)	9.81
Sample Depth (m)		3		Area of Sample (m2)	0.0036
Applied Vertical Stress,Kpa	55	109	218	Cohesion,C (KN/m2)	28.52
Maximum Shear Stress,Kpa	44	61	92	Angle of Internal Friction,Φ	16.34
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT | CLIENT | TESTING LAB

SEGAMU 14 CONSULTS LTD

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

DIRECT SHEAR STRENGTH TEST REPORT

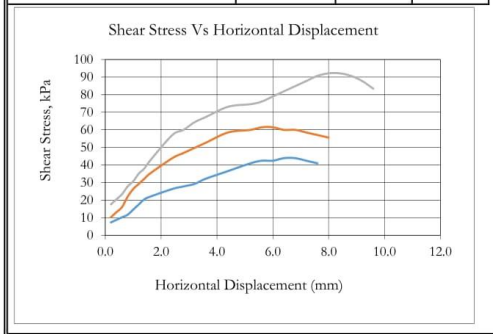
TEST METHOD : BS 1377-2:2022 Clause 25

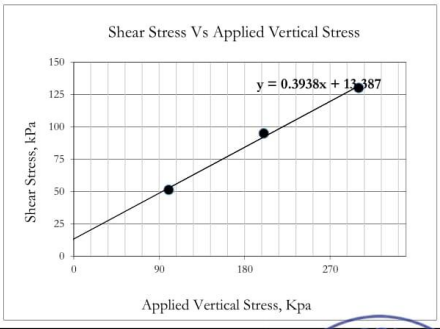
Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH8	**Date Sampled :-**	16-01-2025
Depth :-	3.5 - 3.7m	**Date Received :-**	
Sample Description:-	Clayey Sand	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.808
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		53		Acceleration Due Gravity (ms-1)	9.81

Applied Vertical Stress,Kpa	100	200	300
Maximum Shear Stress,Kpa	51	95	130
Mass verticle Loading (Kg)	2.0	4.0	8.0
Force on sample (N)	196.2	392.4	784.8
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0
Pressure (Kpa)	55	109	218

Cohesion,C (KN/m2)	13.39
Angle of Internal Friction,ϕ	21.49





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kaboda Fred
Materials Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT | CLIENT | TESTING LAB

SEGAMU 14 CONSULTS LTD

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

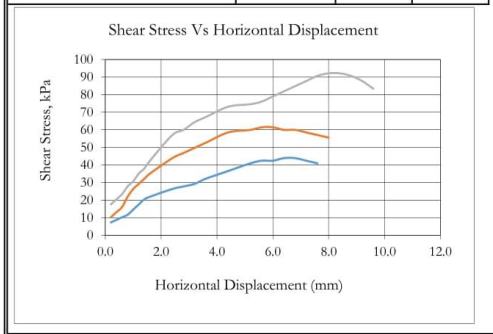
Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

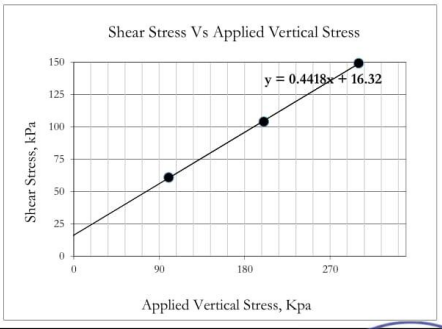
DIRECT SHEAR STRENGTH TEST REPORT

TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH8	**Date Sampled :-**	16-01-2025
Depth :-	5.8-6.0m	**Date Received :-**	
Sample Description:-	Clayey sand	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.786
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		53		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300	Cohesion,C (KN/m2)	16.32
Maximum Shear Stress,Kpa	61	104	149	Angle of Internal Friction,ϕ	23.84
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer
Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

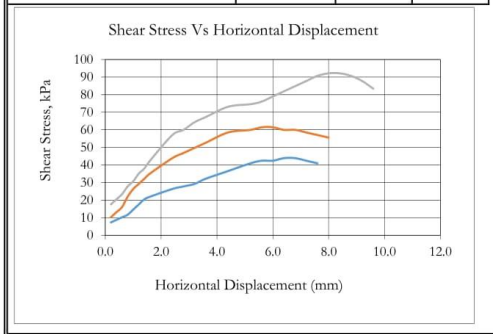
DIRECT SHEAR STRENGTH TEST REPORT

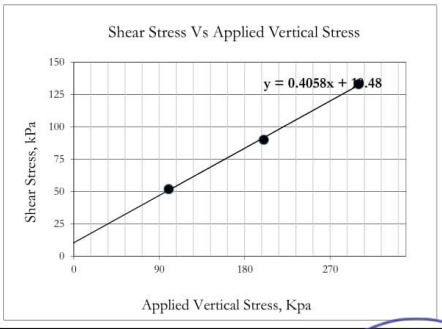
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 09	**Date Sampled :-**	16-01-2025
Depth :-	3.5 -3.7m	**Date Received :-**	
Sample Description:-	Clayey Gravel	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.862
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		55		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	52	90	133		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	10.48
Angle of Internal Friction,ϕ	22.09





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer

Date: 16-02-2025

GEO - CONCRETE LABORATORY

CONSULTANT | CLIENT | TESTING LAB

SEGAMU 14 CONSULTS LTD

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

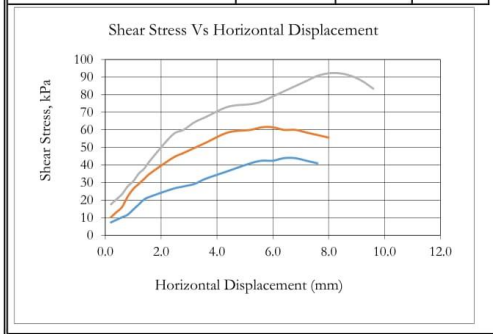
DIRECT SHEAR STRENGTH TEST REPORT

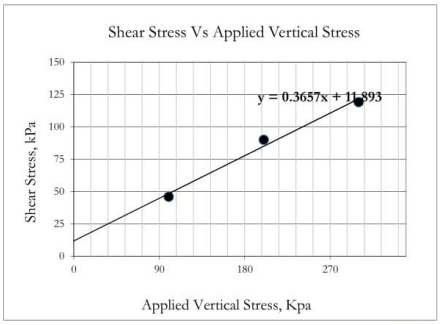
TEST METHOD : BS 1377-2:2022 Clause 25

Project :-	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY	**Type of Sample :-**	UDS
Client :-	MOWE	**Sample Condition:-**	Un-Disturbed
Station :-	BH 09	**Date Sampled :-**	16-01-2025
Depth :-	5.8 -6.0m	**Date Received :-**	
Sample Description:-	Clayey Gravel	**Date Tested:-**	18-01-2025
Sample Preparation Method:-	BS 1377-2:2022 Clause 25	**Date Issued:-**	

Thickness of sample, mm		23		Ring Calibration Factor(N/div)	5.265
Length of sample, mm		60		Bulk density (gm/cm^3)	1.844
Width of sample, mm		60		Dry density (gm/cm^3)	
Overburden Pressure (Kpa)		54		Acceleration Due Gravity (ms-1)	9.81
Applied Vertical Stress,Kpa	100	200	300		
Maximum Shear Stress,Kpa	46	90	119		
Mass verticle Loading (Kg)	2.0	4.0	8.0		
Force on sample (N)	196.2	392.4	784.8		
Pressure on the sample (N/M2)	54500.0	109000.0	218000.0		
Pressure (Kpa)	55	109	218		

Cohesion,C (KN/m2)	11.89
Angle of Internal Friction,ϕ	20.08





Remarks

1. These results relate to the sample tested

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer

Date 16-02-2025

GEO - CONCRETE LABORATORY

Appendix 10: Geophysical Test Results

GEO-CONCRETE LABORATORY

P.O.BOX 133448 KAMPALA,TEL:0752 202 393

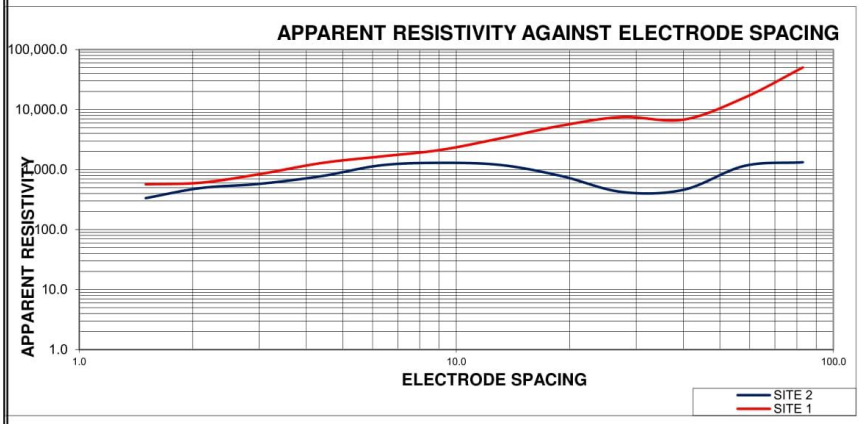
HIGHWAYS/MATERIALS LABORATORY

ELECTRICAL RESISTIVITY TEST (SCHLUMBERGER METHOD)

PROJECT	Masindi Port Bulk Water Supply
CLIENT	MOWE
LOCATION	TREATMENT PLANT AND RESERVOIR
TEST DATE	15/01/2025

TREATMENT PLANT		
AB/2 (m)	**MN/2 (m)**	**APPARENT RESISTIVITY**
1.5	0.15	567.4
2.1	0.21	603.7
3.0	0.3	836.7
4.4	0.44	1287.0
6.3	0.63	1650.9
9.1	0.91	2128.9
13.2	1.32	3348.7
19.0	1.9	5401.5
27.5	2.75	7504.9
40.0	4	6786.6
58.0	5.8	15729.8
83.0	8.3	50327.5

RESERVOIR		
AB/2 (m)	**MN/2 (m)**	**APPARENT RESISTIVITY**
1.5	0.15	334.0
2.1	0.21	492.0
3.0	0.3	576.9
4.4	0.44	779.0
6.3	0.63	1,176.5
9.1	0.91	1,295.3
13.2	1.32	1,186.6
19.0	1.9	780.2
27.5	2.75	423.2
40.0	4	459.4
58.0	5.8	1,149.0
83.0	8.3	1,323.8



Emma Kalyowa			**Eng Kagoda Fred**	Date: 16-02-2025

GEO - CONCRETE LABORATORY

Appendix 11: SPT N Bearing Capacities Test Results

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT	**Method of testing**	Water flush by single core barrel
Client	Ministry of Water and Environment	**Testing date**	14-18/Jan/2025
Site Location	Transimission liine,Treatment Plant ,Water source and Reserviour	**Borehole Diameter**	150mm
Max Depth	10.0 m	**Weight pf hammer**	63.5 kg

EVALUATION OF ALLOWABLE BEARING CAPACITY BASED ON FIELD SPT 'N' VALUES

BH No.	Depth (m)	Predominant Soil Fraction	Measured SPT 'N' Value N	Hammer Efficiency Correction E_H	Borehole Diameter Correction C_B	Sampler Correction Cs	Rod Length Correction C_R	*Corrected SPT 'N' Value* $(N_1)_{60}$	Unconfined Compressive Strength q_u (kPa)	Undrained Cohesion C_u (kPa)	Allowable Bearing Capacity By Meyhorf (1948) Q_{all} (kPa)	Allowable Bearing Capacity Terzaghi and Peck, 1967 Q_{all} (kPa)
BH01-BC	1.50	Stiff Clay	20	0.60	1.05	1.00	0.75	16	205	102	158	175
	4.50	Stiff Clay	38	0.60	1.00	1.00	0.85	32	420	210	323	360
	6.00	Stiff Clay	38	0.60	1.00	1.00	0.85	32	420	210	323	360
	7.50	Firm Clay	50	0.60	1.00	1.00	0.95	48	618	309	475	529
	9.00	Stiff Clay	50	0.60	1.00	1.00	0.95	48	618	309	475	529
BH02-BC	1.50	Stiff Clay	22	0.60	1.05	1.00	0.75	17	225	113	173	193
	4.50	Firm Clay	30	0.60	1.00	1.00	0.75	23	293	146	225	251
	6.00	Stiff Clay	39	0.60	1.00	1.00	0.75	29	380	190	293	326
	7.50	Stiff Clay	47	0.60	1.00	1.00	0.75	35	458	229	353	393
	9.00	Firm Clay	50	0.60	1.00	1.00	0.75	38	488	244	375	418
BH03-BC	1.50	Stiff Clay	20	0.60	1.05	1.00	0.75	16	205	102	158	175
	4.50	Firm Clay	24	0.60	1.05	1.00	0.75	19	246	123	189	210
	6.00	Stiff Clay	38	0.60	1.05	1.00	0.75	30	389	195	299	333
	7.50	Stiff Clay	50	0.60	1.05	1.00	0.75	39	512	256	394	439
	9.00	Stiff Clay	13	0.60	1.05	1.00	0.75	10	133	67	102	114
BH04-BC	1.50	Stiff Clay	26	0.60	1.05	1.00	0.75	20	266	133	205	228
	4.50	Firm Clay	37	0.60	1.05	1.00	0.75	29	379	189	291	324
	6.00	Stiff Clay	41	0.60	1.05	1.00	0.75	32	420	210	323	360
	7.50	Stiff Clay	50	0.60	1.05	1.00	0.75	39	512	256	394	439
BH05-BC	1.50	Dense Clayey Gravel	26	0.60	1.05	1.00	0.75	20	266	133	205	228
	4.50	Dense Clayey Gravel	37	0.60	1.05	1.00	0.75	29	379	189	291	324
	6.00	Dense Clayey Gravel	41	0.60	1.05	1.00	0.75	32	420	210	323	360
	7.50	Dense Clayey Gravel	50	0.60	1.05	1.00	0.75	39	512	256	394	439
	9.00	Dense Clayey Gravel	50	0.60	1.05	1.00	0.75	39	512	256	394	439
BH06-BC	1.50	Dense Clayey Gravel	13	0.60	1.05	1.00	0.75	10	133	67	102	114
	4.50	Dense Clayey Gravel	20	0.60	1.05	1.00	0.75	16	205	102	158	175
	6.00	Dense Clayey Gravel	22	0.60	1.05	1.00	0.75	17	225	113	173	193
	7.50	Dense Clayey Gravel	24	0.60	1.05	1.00	0.75	19	246	123	189	210
	9.00	Dense Clayey Gravel	28	0.60	1.05	1.00	0.75	22	287	143	221	246
BH07-BC	1.50	Dense Clayey Gravel	15	0.60	1.05	1.00	0.75	12	154	77	118	132
	4.50	Dense Clayey Gravel	20	0.60	1.05	1.00	0.75	16	205	102	158	175
	6.00	Dense Clayey Gravel	24	0.60	1.05	1.00	0.75	19	246	123	189	210
	7.50	Dense Clayey Gravel	27	0.60	1.05	1.00	0.75	21	276	138	213	237
	9.00	Dense Clayey Gravel	32	0.60	1.05	1.00	0.75	25	328	164	252	281
	1.50	Dense Clayey Gravel	16	0.60	1.05	1.00	0.75	13	164	82	126	140

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

Project	CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT	**Method of testing**	Water flush by single core barrel
Client	Ministry of Water and Environment	**Testing date**	14-18/Jan/2025
Site Location	Transimission liine,Treatment Plant ,Water source and Reserviour	**Borehole Diameter**	150mm
Max Depth	10.0 m	**Weight pf hammer**	63.5 kg

EVALUATION OF ALLOWABLE BEARING CAPACITY BASED ON FIELD SPT 'N' VALUES

BH No.	Depth (m)	Predominant Soil Fraction	Measured SPT 'N' Value N	Hammer Efficiency Correction E_H	Borehole Diameter Correction C_B	Sampler Correction Cs	Rod Length Correction C_R	*Corrected SPT 'N' Value* $(N_1)_{60}$	Unconfined Compressive Strength q_u (kPa)	Undrained Cohesion C_u (kPa)	Allowable Bearing Capacity By Meyhorf (1948) Q_{all} (kPa)	Allowable Bearing Capacity Terzaghi and Peck, 1967 Q_{all} (kPa)
BH08-BC	4.50	Dense Clayey Gravel	22	0.60	1.05	1.00	0.75	17	225	113	173	193
	6.00	Dense Clayey Gravel	26	0.60	1.05	1.00	0.75	20	266	133	205	228
	7.50	Dense Clayey Gravel	28	0.60	1.05	1.00	0.75	22	287	143	221	246
	9.00	Dense Clayey Gravel	35	0.60	1.05	1.00	0.75	28	358	179	276	307
BH09-BC	1.50	Dense Clayey Gravel	18	0.60	1.05	1.00	0.75	14	184	92	142	158
	4.50	Dense Clayey Gravel	24	0.60	1.05	1.00	0.75	19	246	123	189	210
	6.00	Dense Clayey Gravel	26	0.60	1.05	1.00	0.75	20	266	133	205	228
	7.50	Dense Clayey Gravel	34	0.60	1.05	1.00	0.75	27	348	174	268	298
	9.00	Dense Clayey Gravel	50	0.60	1.05	1.00	0.75	39	512	256	394	439
BH10-BC	1.50	Dense Clayey Gravel	13	0.60	1.05	1.00	0.75	10	133	67	102	114
	4.50	Dense Clayey Gravel	16	0.60	1.05	1.00	0.75	13	164	82	126	140
	6.00	Dense Clayey Gravel	26	0.60	1.05	1.00	0.75	20	266	133	205	228
	7.50	Dense Clayey Gravel	39	0.60	1.05	1.00	0.75	31	399	200	307	342
	9.00	Dense Clayey Gravel	48	0.60	1.05	1.00	0.75	38	491	246	378	421
BH11-BC	1.50	Dense Clayey Gravel	12	0.60	1.05	1.00	0.75	9	123	61	95	105
	4.50	Dense Clayey Gravel	17	0.60	1.05	1.00	0.75	13	174	87	134	149
	6.00	Dense Clayey Gravel	23	0.60	1.05	1.00	0.75	18	235	118	181	202
	7.50	Dense Clayey Gravel	31	0.60	1.05	1.00	0.75	24	317	159	244	272
	9.00	Dense Clayey Gravel	31	0.60	1.05	1.00	0.75	24	317	159	244	272
BH12-BC	1.50	Dense Clayey Gravel	4	0.60	1.05	1.00	0.75	3	41	20	32	35
	4.50	Dense Clayey Gravel	11	0.60	1.05	1.00	0.75	9	113	56	87	96
	6.00	Dense Clayey Gravel	12	0.60	1.05	1.00	0.75	9	123	61	95	105
	7.50	Dense Clayey Gravel	14	0.60	1.05	1.00	0.75	11	143	72	110	123
	9.00	Dense Clayey Gravel	15	0.60	1.05	1.00	0.75	12	154	77	118	132

Remarks

1. For cohesive soils, the relationship qu = 13.00 x Design N-value is used for evaluation of the Unconfined Compressive Strength qu, the cohesion Cu = qu/2 and qult = 5.14 x Cu. q_{all} is evaluated using a factor of safety of 3.0

2. Allowable bearing capacity with settlement assumed to not exceed 25mm for cohesionless soils and read off directly from the Chart (Published by Terzaghi and Peck, 1967). Assuming the N value on the chart is taken as (N_1) and a footing width of 2m.

3. Estimates of presumed allowable bearing capacity values for scheme design not detail design

4. Allowable bearing capacity with settlement assumed to not exceed 25mm for cohesionless soils and read off directly from the Chart (Published by Terzaghi and Peck, 1967). Assuming the N value on the chart is taken as (N_1) and a footing width of 2m.

5. Hand dropped Hammer, 150mm diameter borehole, Standard sampler and 6m rod length.

Prepared by
Kalyowa Emmanuel
Ass. Geotechnical Engineer

Approved by
Eng. Kagoda Fred
Materials Engineer 16-02-2025

GEO - CONCRETE LABORATORY

Appendix 12: DPL Test Results

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

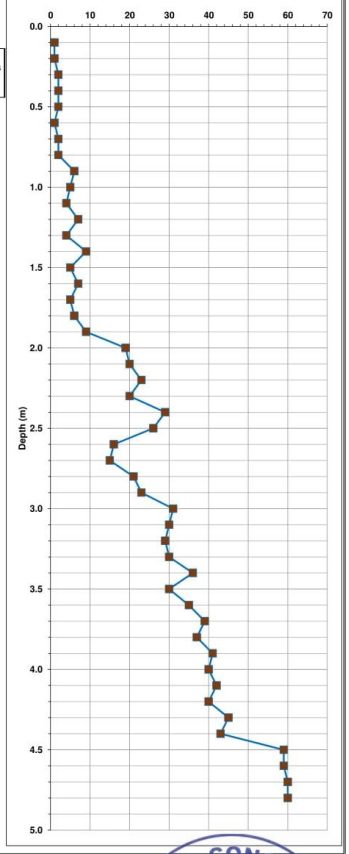
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 01**				
DPT No.:	1	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\frac{T}{10}}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	1	1	9.2	4.6	23.6	7.9	Very Soft
	0.2	1	1	9.2	4.6	23.6	7.9	Very Soft
	0.3	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.4	2	1	18.3	9.2	47.1	15.7	Very Soft
0.0	0.5	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.6	1	1	9.2	4.6	23.6	7.9	Very Soft
	0.7	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.8	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.9	6	4	55.0	27.5	141.4	47.1	Soft
	1.0	5	4	45.9	22.9	117.8	39.3	Soft
	1.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.2	7	5	64.2	32.1	165.0	55.0	Soft
	1.3	4	3	36.7	18.3	94.3	31.4	Very Soft
1.0	1.4	9	6	82.5	41.3	212.1	70.7	Firm
	1.5	5	4	45.9	22.9	117.8	39.3	Soft
	1.6	7	5	64.2	32.1	165.0	55.0	Soft
	1.7	5	4	45.9	22.9	117.8	39.3	Soft
	1.8	6	4	55.0	27.5	141.4	47.1	Soft
	1.9	9	6	82.5	41.3	212.1	70.7	Firm
	2.0	19	13	174.2	87.1	447.8	149.3	Stiff
	2.1	20	14	183.4	91.7	471.3	157.1	Stiff
	2.2	23	16	210.9	105.5	542.0	180.7	Stiff
	2.3	20	14	183.4	91.7	471.3	157.1	Stiff
	2.4	29	20	265.9	133.0	683.4	227.8	Stiff
2.0	2.5	26	18	238.4	119.2	612.7	204.2	Stiff
	2.6	16	11	146.7	73.4	377.1	125.7	Firm
	2.7	15	11	137.6	68.8	353.5	117.8	Firm
	2.8	21	15	192.6	96.3	494.9	165.0	Stiff
	2.9	23	16	210.9	105.5	542.0	180.7	Stiff
	3.0	31	22	284.3	142.1	730.6	243.5	Stiff
	3.1	30	21	275.1	137.6	707.0	235.7	Stiff
	3.2	29	20	265.9	133.0	683.4	227.8	Stiff
	3.3	30	21	275.1	137.6	707.0	235.7	Stiff
	3.4	36	25	330.1	165.1	848.4	282.8	Very Stiff
3.0	3.5	30	21	275.1	137.6	707.0	235.7	Stiff
	3.6	35	25	321.0	160.5	824.8	274.9	Very Stiff
	3.7	39	27	357.6	178.8	919.1	306.4	Very Stiff
	3.8	37	26	339.3	169.6	872.0	290.7	Very Stiff
	3.9	41	29	376.0	188.0	966.2	322.1	Very Stiff
	4.0	40	28	366.8	183.4	942.7	314.2	Very Stiff
	4.1	42	29	385.1	192.6	989.8	329.9	Very Stiff
	4.2	40	28	366.8	183.4	942.7	314.2	Very Stiff
	4.3	45	32	412.7	206.3	1060.5	353.5	Very Stiff
4.0	4.4	43	30	394.3	197.2	1013.4	337.8	Very Stiff
	4.5	59	41	541.0	270.5	1390.4	463.5	Very Stiff
	4.6	59	41	541.0	270.5	1390.4	463.5	Very Stiff
	4.7	60	42	550.2	275.1	1414.0	471.3	Very Stiff
	4.8	60	42	550.2	275.1	1414.0	471.3	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of unconfined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD
Laboratory Engineer

GEO - CONCRETE LABORATORY
Date: 16-02-2025

Checked by;

Eng. LAGODA FRED
Materials Engineer

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

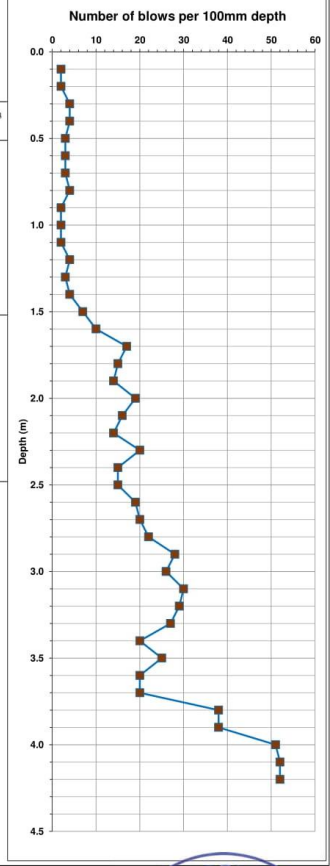
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 02**				
DPT No.:	2	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\frac{1}{3}}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.2	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.3	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.4	4	3	36.7	18.3	94.3	31.4	Very Soft
0.0	0.5	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.6	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.7	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.8	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.9	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.0	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.1	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.2	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.3	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.4	4	3	36.7	18.3	94.3	31.4	Very Soft
1.0	1.5	7	5	64.2	32.1	165.0	55.0	Soft
	1.6	10	7	91.7	45.9	235.7	78.6	Firm
	1.7	17	12	155.9	77.9	400.6	133.5	Stiff
	1.8	15	11	137.6	68.8	353.5	117.8	Firm
	1.9	14	10	128.4	64.2	329.9	110.0	Firm
	2.0	19	13	174.2	87.1	447.8	149.3	Stiff
	2.1	16	11	146.7	73.4	377.1	125.7	Firm
	2.2	14	10	128.4	64.2	329.9	110.0	Firm
	2.3	20	14	183.4	91.7	471.3	157.1	Stiff
	2.4	15	11	137.6	68.8	353.5	117.8	Firm
2.0	2.5	15	11	137.6	68.8	353.5	117.8	Firm
	2.6	19	13	174.2	87.1	447.8	149.3	Stiff
	2.7	20	14	183.4	91.7	471.3	157.1	Stiff
	2.8	22	15	201.7	100.9	518.5	172.8	Stiff
	2.9	28	20	256.8	128.4	659.9	220.0	Stiff
	3.0	26	18	238.4	119.2	612.7	204.2	Stiff
	3.1	30	21	275.1	137.6	707.0	235.7	Stiff
	3.2	29	20	265.9	133.0	683.4	227.8	Stiff
	3.3	27	19	247.6	123.8	636.3	212.1	Stiff
3.0	3.4	20	14	183.4	91.7	471.3	157.1	Stiff
	3.5	25	18	229.3	114.6	589.2	196.4	Stiff
	3.6	20	14	183.4	91.7	471.3	157.1	Stiff
	3.7	20	14	183.4	91.7	471.3	157.1	Stiff
	3.8	38	27	348.5	174.2	895.5	298.5	Very Stiff
	3.9	38	27	348.5	174.2	895.5	298.5	Very Stiff
	4.0	51	36	467.7	233.8	1201.9	400.6	Very Stiff
	4.1	52	36	476.8	238.4	1225.5	408.5	Very Stiff
4.0	4.2	52	36	476.8	238.4	1225.5	408.5	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD
Laboratory Engineer

GEO - CONCRETE LABORATORY
Date: 16-02-2025
Checked by;
Eng. KAGODA FRED
Materials Engineer

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

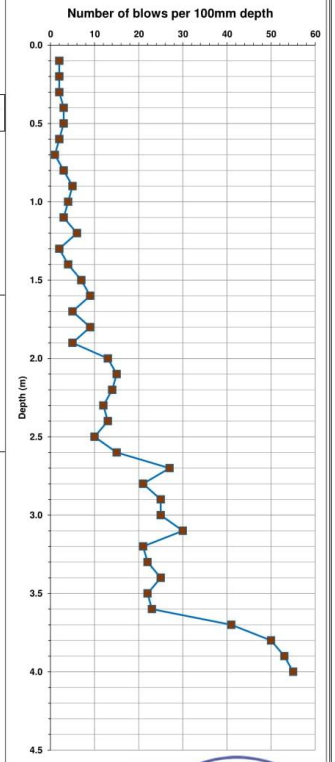
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 03**				
DPT No.:	3	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration (N_{-10})	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.2	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.3	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.4	3	2	27.5	13.8	70.7	23.6	Very Soft
0	0.5	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.6	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.7	1	1	9.2	4.6	23.6	7.9	Very Soft
	0.8	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.9	5	4	45.9	22.9	117.8	39.3	Soft
	1.0	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.1	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.2	6	4	55.0	27.5	141.4	47.1	Soft
	1.3	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.4	4	3	36.7	18.3	94.3	31.4	Very Soft
1	1.5	7	5	64.2	32.1	165.0	55.0	Soft
	1.6	9	6	82.5	41.3	212.1	70.7	Firm
	1.7	5	4	45.9	22.9	117.8	39.3	Soft
	1.8	9	6	82.5	41.3	212.1	70.7	Firm
	1.9	5	4	45.9	22.9	117.8	39.3	Soft
	2.0	13	9	119.2	59.6	306.4	102.1	Firm
	2.1	15	11	137.6	68.8	353.5	117.8	Firm
	2.2	14	10	128.4	64.2	329.9	110.0	Firm
	2.3	12	8	110.0	55.0	282.8	94.3	Firm
	2.4	13	9	119.2	59.6	306.4	102.1	Firm
2	2.5	10	7	91.7	45.9	235.7	78.6	Firm
	2.6	15	11	137.6	68.8	353.5	117.8	Firm
	2.7	27	19	247.6	123.8	636.3	212.1	Stiff
	2.8	21	15	192.6	96.3	494.9	165.0	Stiff
	2.9	25	18	229.3	114.6	589.2	196.4	Stiff
	3.0	25	18	229.3	114.6	589.2	196.4	Stiff
	3.1	30	21	275.1	137.6	707.0	235.7	Stiff
	3.2	21	15	192.6	96.3	494.9	165.0	Stiff
	3.3	22	15	201.7	100.9	518.5	172.8	Stiff
	3.4	25	18	229.3	114.6	589.2	196.4	Stiff
3	3.5	22	15	201.7	100.9	518.5	172.8	Stiff
	3.6	23	16	210.9	105.5	542.0	180.7	Stiff
	3.7	41	29	376.0	188.0	966.2	322.1	Very Stiff
	3.8	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	3.9	53	37	486.0	243.0	1249.0	416.3	Very Stiff
	4.0	55	39	504.4	252.2	1296.2	432.1	Very Stiff
4								

Depth against Number of blows per 100mm



1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The lavers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD
Laboratory Engineer

Checked by:

Eng. BAGODA FRED
Materials Engineer

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

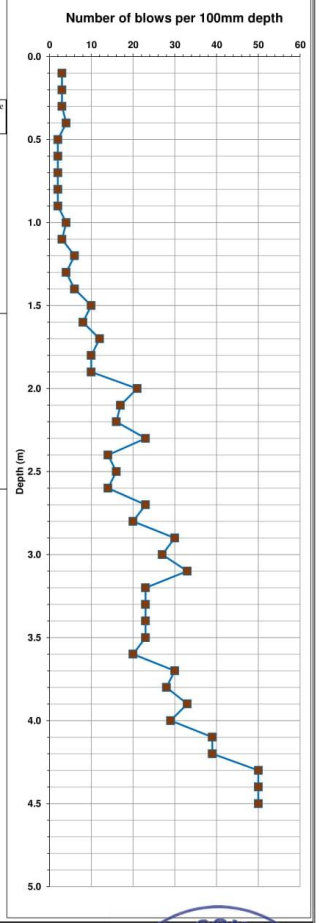
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 03**				
DPT No.:	4	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration (N_{10})	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.4	4	3	36.7	18.3	94.3	31.4	Very Soft
0	0.5	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.6	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.7	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.8	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.9	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.0	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.1	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.2	6	4	55.0	27.5	141.4	47.1	Soft
	1.3	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.4	6	4	55.0	27.5	141.4	47.1	Soft
1	1.5	10	7	91.7	45.9	235.7	78.6	Firm
	1.6	8	6	73.4	36.7	188.5	62.8	Soft
	1.7	12	8	110.0	55.0	282.8	94.3	Firm
	1.8	10	7	91.7	45.9	235.7	78.6	Firm
	1.9	10	7	91.7	45.9	235.7	78.6	Firm
	2.0	21	15	192.6	96.3	494.9	165.0	Stiff
	2.1	17	12	155.9	77.9	400.6	133.5	Stiff
	2.2	16	11	146.7	73.4	377.1	125.7	Firm
	2.3	23	16	210.9	105.5	542.0	180.7	Stiff
2	2.4	14	10	128.4	64.2	329.9	110.0	Firm
	2.5	16	11	146.7	73.4	377.1	125.7	Firm
	2.6	14	10	128.4	64.2	329.9	110.0	Firm
	2.7	23	16	210.9	105.5	542.0	180.7	Stiff
	2.8	20	14	183.4	91.7	471.3	157.1	Stiff
	2.9	30	21	275.1	137.6	707.0	235.7	Stiff
	3.0	27	19	247.6	123.8	636.3	212.1	Stiff
	3.1	33	23	302.6	151.3	777.7	259.2	Very Stiff
	3.2	23	16	210.9	105.5	542.0	180.7	Stiff
	3.3	23	16	210.9	105.5	542.0	180.7	Stiff
3	3.4	23	16	210.9	105.5	542.0	180.7	Stiff
	3.5	23	16	210.9	105.5	542.0	180.7	Stiff
	3.6	20	14	183.4	91.7	471.3	157.1	Stiff
	3.7	30	21	275.1	137.6	707.0	235.7	Stiff
	3.8	28	20	256.8	128.4	659.9	220.0	Stiff
	3.9	33	23	302.6	151.3	777.7	259.2	Very Stiff
	4.0	29	20	265.9	133.0	683.4	227.8	Stiff
	4.1	39	27	357.6	178.8	919.1	306.4	Very Stiff
	4.2	39	27	357.6	178.8	919.1	306.4	Very Stiff
4	4.3	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	4.4	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	4.5	50	35	458.5	229.3	1178.3	392.8	Very Stiff

Depth against Number of blows per 100mm



Remarks

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohesion Cu = qu/2 and Ultimate bearing capacity = 5.14xCu ,Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)

3. The weather was Sunny

4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD
Laboratory Engineer

GEO - CONCRETE LABORATORY

Date: 16-02-2025

Checked by;

Eng. LAGOJA FRED
Materials Engineer

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

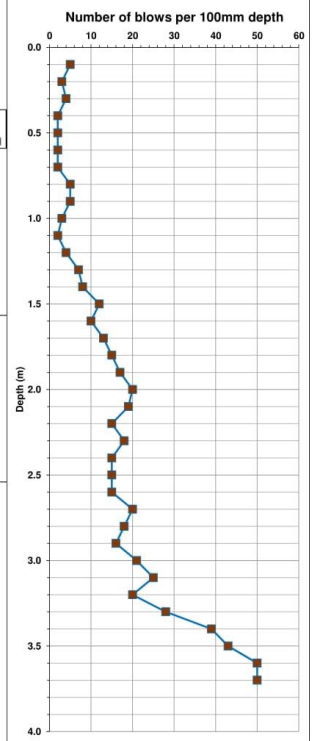
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 05**				
DPT No.:	5	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration (N_{T10})	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	5	4	45.9	22.9	117.8	39.3	Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.4	2	2	20.2	10.1	51.8	17.3	Very Soft
0.0	0.5	2	2	20.2	10.1	51.8	17.3	Very Soft
	0.6	2	2	20.2	10.1	51.8	17.3	Very Soft
	0.7	2	2	20.2	10.1	51.8	17.3	Very Soft
	0.8	5	4	50.4	25.2	129.6	43.2	Soft
	0.9	5	4	50.4	25.2	129.6	43.2	Soft
	1.0	3	2	30.3	15.1	77.8	25.9	Very Soft
	1.1	2	2	20.2	10.1	51.8	17.3	Very Soft
	1.2	4	3	40.3	20.2	103.7	34.6	Soft
	1.3	7	5	70.6	35.3	181.5	60.5	Soft
1.0	1.4	8	6	80.7	40.3	207.4	69.1	Firm
	1.5	12	9	121.0	60.5	311.1	103.7	Firm
	1.6	10	8	100.9	50.4	259.2	86.4	Firm
	1.7	13	10	131.1	65.6	337.0	112.3	Firm
	1.8	15	12	151.3	75.7	388.9	129.6	Stiff
	1.9	17	13	171.5	85.7	440.7	146.9	Stiff
	2.0	20	15	201.7	100.9	518.5	172.8	Stiff
	2.1	19	15	191.7	95.8	492.5	164.2	Stiff
	2.2	15	12	151.3	75.7	388.9	129.6	Stiff
	2.3	18	14	181.6	90.8	466.6	155.5	Stiff
2.0	2.4	15	12	151.3	75.7	388.9	129.6	Stiff
	2.5	15	12	151.3	75.7	388.9	129.6	Stiff
	2.6	15	12	151.3	75.7	388.9	129.6	Stiff
	2.7	20	15	201.7	100.9	518.5	172.8	Stiff
	2.8	18	14	181.6	90.8	466.6	155.5	Stiff
	2.9	16	12	161.4	80.7	414.8	138.3	Stiff
	3.0	21	16	211.8	105.9	544.4	181.5	Stiff
	3.1	25	19	252.2	126.1	648.1	216.0	Stiff
	3.2	20	15	201.7	100.9	518.5	172.8	Stiff
	3.3	28	22	282.4	141.2	725.9	242.0	Stiff
3.0	3.4	39	30	393.4	196.7	1011.0	337.0	Very Stiff
	3.5	43	33	433.7	216.9	1114.7	371.6	Very Stiff
	3.6	50	39	504.4	252.2	1296.2	432.1	Very Stiff
	3.7	50	39	504.4	252.2	1296.2	432.1	Very Stiff

Depth against Number of blows per 100mm



Remarks

1. For cohesive soils, the relationship qu = 13.1s Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)

3. The weather was Sunny

4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD
Laboratory Engineer

GEO - CONCRETE LABORATORY

Date: 16-02-2025

Checked by:

Eng. K. GODA FRED
Materials Engineer

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

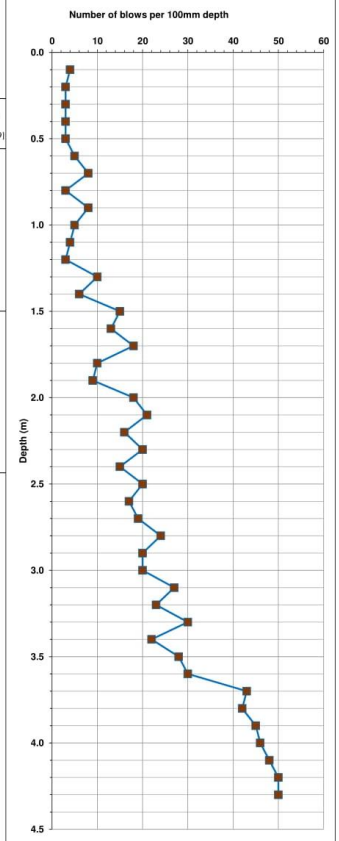
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 06**				
DPT No.:	6	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jun-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\gamma(z)}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.4	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.5	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.6	5	4	45.9	22.9	117.8	39.3	Soft
	0.7	8	6	73.4	36.7	188.5	62.8	Soft
	0.8	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.9	8	6	73.4	36.7	188.5	62.8	Soft
	1.0	5	4	45.9	22.9	117.8	39.3	Soft
	1.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.3	10	7	91.7	45.9	235.7	78.6	Firm
	1.4	6	4	55.0	27.5	141.4	47.1	Soft
	1.5	15	11	137.6	68.8	353.5	117.8	Firm
	1.6	13	9	119.2	59.6	306.4	102.1	Firm
	1.7	18	13	165.1	82.5	424.2	141.4	Stiff
	1.8	10	7	91.7	45.9	235.7	78.6	Firm
	1.9	9	6	82.5	41.3	212.1	70.7	Firm
	2.0	18	13	165.1	82.5	424.2	141.4	Stiff
	2.1	21	15	192.6	96.3	494.9	165.0	Stiff
	2.2	16	11	146.7	73.4	377.1	125.7	Firm
	2.3	20	14	183.4	91.7	471.3	157.1	Stiff
	2.4	15	11	137.6	68.8	353.5	117.8	Firm
	2.5	20	14	183.4	91.7	471.3	157.1	Stiff
	2.6	17	12	155.9	77.9	400.6	133.5	Stiff
	2.7	19	13	174.2	87.1	447.8	149.3	Stiff
	2.8	24	17	220.1	110.0	565.6	188.5	Stiff
	2.9	20	14	183.4	91.7	471.3	157.1	Stiff
	3.0	20	14	183.4	91.7	471.3	157.1	Stiff
	3.1	27	19	247.6	123.8	636.3	212.1	Stiff
	3.2	23	16	210.9	105.5	542.0	180.7	Stiff
	3.3	30	21	275.1	137.6	707.0	235.7	Stiff
	3.4	22	15	201.7	100.9	518.5	172.8	Stiff
	3.5	28	20	256.8	128.4	659.9	220.0	Stiff
	3.6	30	21	275.1	137.6	707.0	235.7	Stiff
	3.7	43	30	394.3	197.2	1013.4	337.8	Very Stiff
	3.8	42	29	385.1	192.6	989.8	329.9	Very Stiff
	3.9	45	32	412.7	206.3	1060.5	353.5	Very Stiff
	4.0	46	32	421.8	210.9	1084.1	361.4	Very Stiff
	4.1	48	34	440.2	220.1	1131.2	377.1	Very Stiff
	4.2	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	4.3	50	35	458.5	229.3	1178.3	392.8	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)

3. The weather was Sunny

4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD
Laboratory Engineer

Checked by:

Eng. SAGODA FRED
Materials Engineer

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

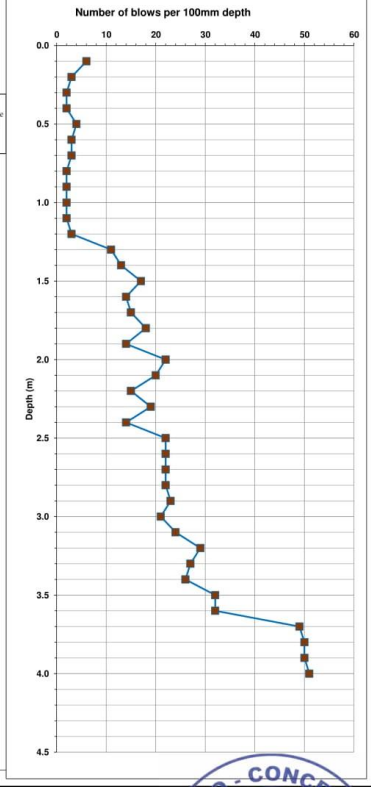
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 07**				
DPT No.:	7	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\pm 10}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	6	4	55.0	27.5	141.4	47.1	Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.4	2	1	18.3	9.2	47.1	15.7	Very Soft
0	0.5	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.6	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.7	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.8	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.9	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.0	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.1	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.3	11	8	100.9	50.4	259.2	86.4	Firm
1	1.4	13	9	119.2	59.6	306.4	102.1	Firm
	1.5	17	12	155.9	77.9	400.6	133.5	Stiff
	1.6	14	10	128.4	64.2	329.9	110.0	Firm
	1.7	15	11	137.6	68.8	353.5	117.8	Firm
	1.8	18	13	165.1	82.5	424.2	141.4	Stiff
	1.9	14	10	128.4	64.2	329.9	110.0	Firm
	2.0	22	15	201.7	100.9	518.5	172.8	Stiff
	2.1	20	14	183.4	91.7	471.3	157.1	Stiff
	2.2	15	11	137.6	68.8	353.5	117.8	Firm
	2.3	19	13	174.2	87.1	447.8	149.3	Stiff
2	2.4	14	10	128.4	64.2	329.9	110.0	Firm
	2.5	22	15	201.7	100.9	518.5	172.8	Stiff
	2.6	22	15	201.7	100.9	518.5	172.8	Stiff
	2.7	22	15	201.7	100.9	518.5	172.8	Stiff
	2.8	22	15	201.7	100.9	518.5	172.8	Stiff
	2.9	23	16	210.9	105.5	542.0	180.7	Stiff
	3.0	21	15	192.6	96.3	494.9	165.0	Stiff
	3.1	24	17	220.1	110.0	565.6	188.5	Stiff
	3.2	29	20	265.9	133.0	683.4	227.8	Stiff
	3.3	27	19	247.6	123.8	636.3	212.1	Stiff
3	3.4	26	18	238.4	119.2	612.7	204.2	Stiff
	3.5	32	22	293.4	146.7	754.1	251.4	Stiff
	3.6	32	22	293.4	146.7	754.1	251.4	Stiff
	3.7	49	34	449.3	224.7	1154.8	384.9	Very Stiff
	3.8	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	3.9	50	35	458.5	229.3	1178.3	392.8	Very Stiff
4	4.0	51	36	467.7	233.8	1201.9	400.6	Very Stiff

Depth against Number of blows per 100mm



NOTE

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of unconfined compressive strength qu, the cohesion Cu = qu/2 and Ultimate bearing capacity = 5.14xCu Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD
Laboratory Engineer

Checked by:

Eng. KAGODA Fred
Materials Engineer

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

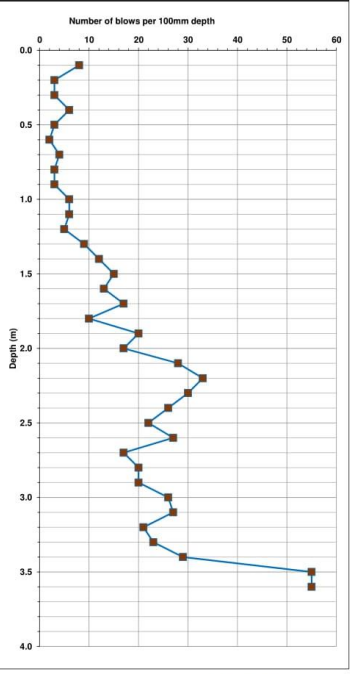
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 08**				
DPT No.:	8	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\gamma,10}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	8	6	73.4	36.7	188.5	62.8	Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.4	6	4	55.0	27.5	141.4	47.1	Soft
	0.5	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.6	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.7	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.8	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.9	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.0	6	4	55.0	27.5	141.4	47.1	Soft
	1.1	6	4	55.0	27.5	141.4	47.1	Soft
	1.2	5	4	45.9	22.9	117.8	39.3	Soft
	1.3	9	6	82.5	41.3	212.1	70.7	Firm
	1.4	12	8	110.0	55.0	282.8	94.3	Firm
	1.5	15	11	137.6	68.8	353.5	117.8	Firm
	1.6	13	9	119.2	59.6	306.4	102.1	Firm
	1.7	17	12	155.9	77.9	400.6	133.5	Stiff
	1.8	10	7	91.7	45.9	235.7	78.6	Firm
	1.9	20	14	183.4	91.7	471.3	157.1	Stiff
	2.0	17	12	155.9	77.9	400.6	133.5	Stiff
	2.1	28	20	256.8	128.4	659.9	220.0	Stiff
	2.2	33	23	302.6	151.3	777.7	259.2	Very Stiff
	2.3	30	21	275.1	137.6	707.0	235.7	Stiff
	2.4	26	18	238.4	119.2	612.7	204.2	Stiff
	2.5	22	15	201.7	100.9	518.5	172.8	Stiff
	2.6	27	19	247.6	123.8	636.3	212.1	Stiff
	2.7	17	12	155.9	77.9	400.6	133.5	Stiff
	2.8	20	14	183.4	91.7	471.3	157.1	Stiff
	2.9	20	14	183.4	91.7	471.3	157.1	Stiff
	3.0	26	18	238.4	119.2	612.7	204.2	Stiff
	3.1	27	19	247.6	123.8	636.3	212.1	Stiff
	3.2	21	15	192.6	96.3	494.9	165.0	Stiff
	3.3	23	16	210.9	105.5	542.0	180.7	Stiff
	3.4	29	20	265.9	133.0	683.4	227.8	Stiff
	3.5	55	39	504.4	252.2	1296.2	432.1	Very Stiff
	3.6	55	39	504.4	252.2	1296.2	432.1	Very Stiff

Depth against Number of blows per 100mm



1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny.
4. The lavers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD
Laboratory Engineer

Checked by;

Eng. KACUNDA FRED
Material Engineer

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

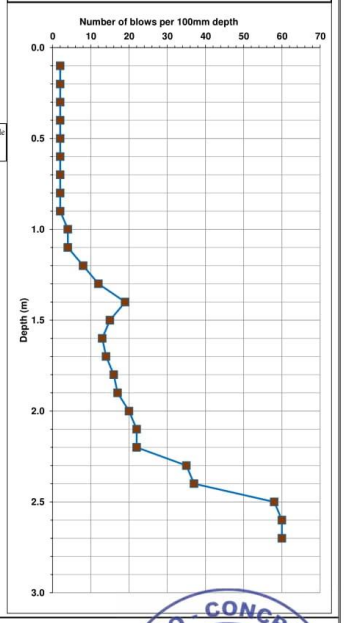
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 09**				
DPT No.:	9	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	15-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\gamma 10}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.2	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.3	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.4	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.5	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.6	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.7	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.8	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.9	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.0	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.2	8	6	73.4	36.7	188.5	62.8	Soft
	1.3	12	8	110.0	55.0	282.8	94.3	Firm
	1.4	19	13	174.2	87.1	447.8	149.3	Stiff
	1.5	15	11	137.6	68.8	353.5	117.8	Firm
	1.6	13	9	119.2	59.6	306.4	102.1	Firm
	1.7	14	10	128.4	64.2	329.9	110.0	Firm
	1.8	16	11	146.7	73.4	377.1	125.7	Firm
	1.9	17	12	155.9	77.9	400.6	133.5	Stiff
	2.0	20	14	183.4	91.7	471.3	157.1	Stiff
	2.1	22	15	201.7	100.9	518.5	172.8	Stiff
	2.2	22	15	201.7	100.9	518.5	172.8	Stiff
	2.3	35	25	321.0	160.5	824.8	274.9	Very Stiff
	2.4	37	26	339.3	169.6	872.0	290.7	Very Stiff
	2.5	58	41	531.9	265.9	1366.9	455.6	Very Stiff
	2.6	60	42	550.2	275.1	1414.0	471.3	Very Stiff
	2.7	60	42	550.2	275.1	1414.0	471.3	Very Stiff

Depth against Number of blows per 100mm



Remarks

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD
Laboratory Engineer

GEO - CONCRETE LABORATORY
Date: 16-02-2025

Checked by;

Eng. [illegible]
Materials Engineer

CONSULTANT | CLIENT | TESTING LAB

SEGAMU 14 CONSULTS LTD

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

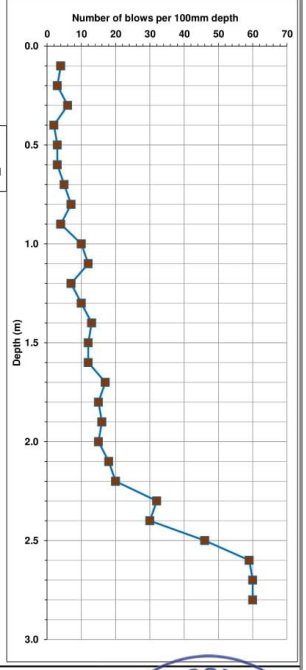
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 10**				
DPT No.:	10	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\gamma 11}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	6	4	55.0	27.5	141.4	47.1	Soft
	0.4	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.5	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.6	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.7	5	4	45.9	22.9	117.8	39.3	Soft
	0.8	7	5	64.2	32.1	165.0	55.0	Soft
	0.9	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.0	10	7	91.7	45.9	235.7	78.6	Firm
	1.1	12	8	110.0	55.0	282.8	94.3	Firm
	1.2	7	5	64.2	32.1	165.0	55.0	Soft
	1.3	10	7	91.7	45.9	235.7	78.6	Firm
	1.4	13	9	119.2	59.6	306.4	102.1	Firm
	1.5	12	8	110.0	55.0	282.8	94.3	Firm
	1.6	12	8	110.0	55.0	282.8	94.3	Firm
	1.7	17	12	155.9	77.9	400.6	133.5	Stiff
	1.8	15	11	137.6	68.8	353.5	117.8	Firm
	1.9	16	11	146.7	73.4	377.1	125.7	Firm
	2.0	15	11	137.6	68.8	353.5	117.8	Firm
	2.1	18	13	165.1	82.5	424.2	141.4	Stiff
	2.2	20	14	183.4	91.7	471.3	157.1	Stiff
	2.3	32	22	293.4	146.7	754.1	251.4	Stiff
	2.4	30	21	275.1	137.6	707.0	235.7	Stiff
	2.5	46	32	421.8	210.9	1084.1	361.4	Very Stiff
	2.6	59	41	541.0	270.5	1390.4	463.5	Very Stiff
	2.7	60	42	550.2	275.1	1414.0	471.3	Very Stiff
	2.8	60	42	550.2	275.1	1414.0	471.3	Very Stiff

Depth against Number of blows per 100mm



nema

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD

GEO - CONCRETE LABORATORY
Date: 16-02-2025

Checked by;

Eng. K. GODA FRED

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

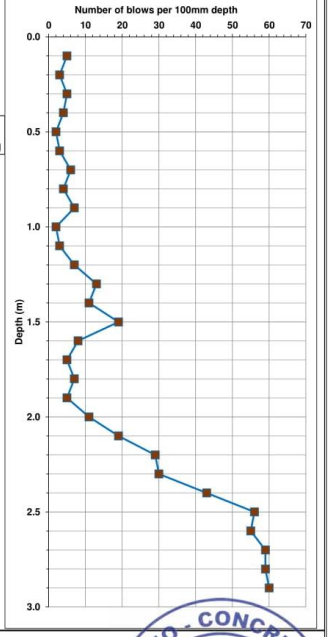
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 11**				
DPT No.:	11	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration (N_{CT})	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	5	4	45.9	22.9	117.8	39.3	Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	5	4	45.9	22.9	117.8	39.3	Soft
	0.4	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.5	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.6	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.7	6	4	55.0	27.5	141.4	47.1	Soft
	0.8	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.9	7	5	64.2	32.1	165.0	55.0	Soft
	1.0	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.1	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.2	7	5	64.2	32.1	165.0	55.0	Soft
	1.3	13	9	119.2	59.6	306.4	102.1	Firm
	1.4	11	8	100.9	50.4	259.2	86.4	Firm
	1.5	19	13	174.2	87.1	447.8	149.3	Stiff
	1.6	8	6	73.4	36.7	188.5	62.8	Soft
	1.7	5	4	45.9	22.9	117.8	39.3	Soft
	1.8	7	5	64.2	32.1	165.0	55.0	Soft
	1.9	5	4	45.9	22.9	117.8	39.3	Soft
	2.0	11	8	100.9	50.4	259.2	86.4	Firm
	2.1	19	13	174.2	87.1	447.8	149.3	Stiff
	2.2	29	20	265.9	133.0	683.4	227.8	Stiff
	2.3	30	21	275.1	137.6	707.0	235.7	Stiff
	2.4	43	30	394.3	197.2	1013.4	337.8	Very Stiff
	2.5	56	39	513.5	256.8	1319.7	439.9	Very Stiff
	2.6	55	39	504.4	252.2	1296.2	432.1	Very Stiff
	2.7	59	41	541.0	270.5	1390.4	463.5	Very Stiff
	2.8	59	41	541.0	270.5	1390.4	463.5	Very Stiff
	2.9	60	42	550.2	275.1	1414.0	471.3	Very Stiff

Depth against Number of blows per 100mm



Remarks

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)

3. The weather was Sunny

4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD

GEO - CONCRETE LABORATORY

Date: 16-02-2025

Checked by;

Eng. K. GOLOLA FRED

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

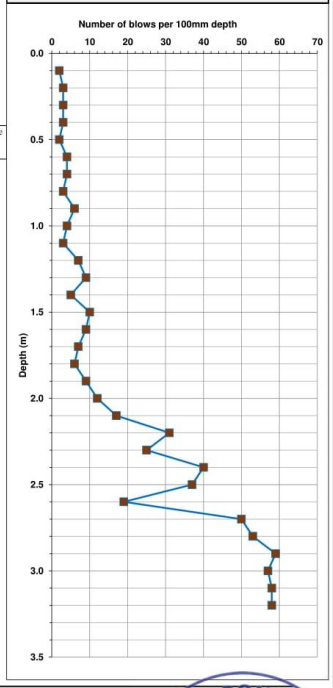
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 12**				
DPT No.:	12	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\gamma 10}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.4	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.5	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.6	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.7	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.8	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.9	6	4	55.0	27.5	141.4	47.1	Soft
	1.0	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.1	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.2	7	5	64.2	32.1	165.0	55.0	Soft
	1.3	9	6	82.5	41.3	212.1	70.7	Firm
	1.4	5	4	45.9	22.9	117.8	39.3	Soft
	1.5	10	7	91.7	45.9	235.7	78.6	Firm
	1.6	9	6	82.5	41.3	212.1	70.7	Firm
	1.7	7	5	64.2	32.1	165.0	55.0	Soft
	1.8	6	4	55.0	27.5	141.4	47.1	Soft
	1.9	9	6	82.5	41.3	212.1	70.7	Firm
	2.0	12	8	110.0	55.0	282.8	94.3	Firm
	2.1	17	12	155.9	77.9	400.6	133.5	Stiff
	2.2	31	22	284.3	142.1	730.6	243.5	Stiff
	2.3	25	18	229.3	114.6	589.2	196.4	Stiff
	2.4	40	28	366.8	183.4	942.7	314.2	Very Stiff
	2.5	37	26	339.3	169.6	872.0	290.7	Very Stiff
	2.6	19	13	174.2	87.1	447.8	149.3	Stiff
	2.7	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	2.8	53	37	486.0	243.0	1249.0	416.3	Very Stiff
	2.9	59	41	541.0	270.5	1390.4	463.5	Very Stiff
	3.0	57	40	522.7	261.3	1343.3	447.8	Very Stiff
	3.1	58	41	531.9	265.9	1366.9	455.6	Very Stiff
	3.2	58	41	531.9	265.9	1366.9	455.6	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD

Checked by:

Eng. KAGOLA FRED

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT	CLIENT	TESTING LAB
SEGAMU 14 CONSULTS LTD	THE REPUBLIC OF UGANDA Ministry of Water and Environment	Geo-concrete Laboratory TEST & QUALITY CONTROL ENGINEERS

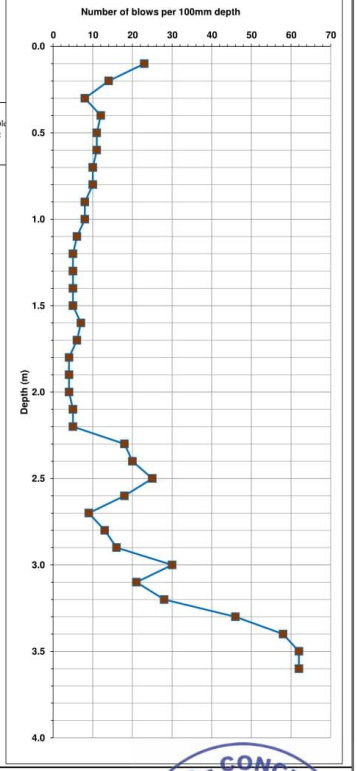
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 13**				
DPT No.:	13	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\gamma(1)}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	23	16	210.9	105.5	542.0	180.7	Stiff
	0.2	14	10	128.4	64.2	329.9	110.0	Firm
	0.3	8	6	73.4	36.7	188.5	62.8	Soft
	0.4	12	8	110.0	55.0	282.8	94.3	Firm
	0.5	11	8	100.9	50.4	259.2	86.4	Firm
	0.6	11	8	100.9	50.4	259.2	86.4	Firm
	0.7	10	7	91.7	45.9	235.7	78.6	Firm
	0.8	10	7	91.7	45.9	235.7	78.6	Firm
	0.9	8	6	73.4	36.7	188.5	62.8	Soft
	1.0	8	6	73.4	36.7	188.5	62.8	Soft
	1.1	6	4	55.0	27.5	141.4	47.1	Soft
	1.2	5	4	45.9	22.9	117.8	39.3	Soft
	1.3	5	4	45.9	22.9	117.8	39.3	Soft
	1.4	5	4	45.9	22.9	117.8	39.3	Soft
	1.5	5	4	45.9	22.9	117.8	39.3	Soft
	1.6	7	5	64.2	32.1	165.0	55.0	Soft
	1.7	6	4	55.0	27.5	141.4	47.1	Soft
	1.8	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.9	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.0	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.1	5	4	45.9	22.9	117.8	39.3	Soft
	2.2	5	4	45.9	22.9	117.8	39.3	Soft
	2.3	18	13	165.1	82.5	424.2	141.4	Stiff
	2.4	20	14	183.4	91.7	471.3	157.1	Stiff
	2.5	25	18	229.3	114.6	589.2	196.4	Stiff
	2.6	18	13	165.1	82.5	424.2	141.4	Stiff
	2.7	9	6	82.5	41.3	212.1	70.7	Firm
	2.8	13	9	119.2	59.6	306.4	102.1	Firm
	2.9	16	11	146.7	73.4	377.1	125.7	Firm
	3.0	30	21	275.1	137.6	707.0	235.7	Stiff
	3.1	21	15	192.6	96.3	494.9	165.0	Stiff
	3.2	28	20	256.8	128.4	659.9	220.0	Stiff
	3.3	46	32	421.8	210.9	1084.1	361.4	Very Stiff
	3.4	58	41	531.9	265.9	1366.9	455.6	Very Stiff
	3.5	62	43	568.5	284.3	1461.1	487.0	Very Stiff
	3.6	62	43	568.5	284.3	1461.1	487.0	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1s Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD

Checked by:

Eng. KAGIMU FRED

GEO - CONCRETE LABORATORY Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

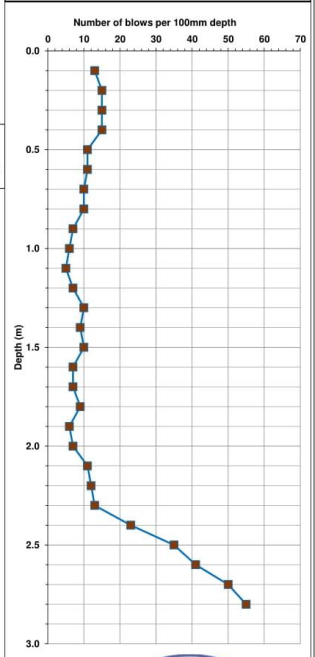
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 14**				
DPT No.:	14	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{(10)}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
	0.1	13	9	119.2	59.6	306.4	102.1	Firm
	0.2	15	11	137.6	68.8	353.5	117.8	Firm
	0.3	15	11	137.6	68.8	353.5	117.8	Firm
	0.4	15	11	137.6	68.8	353.5	117.8	Firm
0	0.5	11	8	100.9	50.4	259.2	86.4	Firm
	0.6	11	8	100.9	50.4	259.2	86.4	Firm
	0.7	10	7	91.7	45.9	235.7	78.6	Firm
	0.8	10	7	91.7	45.9	235.7	78.6	Firm
	0.9	7	5	64.2	32.1	165.0	55.0	Soft
	1.0	6	4	55.0	27.5	141.4	47.1	Soft
	1.1	5	4	45.9	22.9	117.8	39.3	Soft
	1.2	7	5	64.2	32.1	165.0	55.0	Soft
	1.3	10	7	91.7	45.9	235.7	78.6	Firm
	1.4	9	6	82.5	41.3	212.1	70.7	Firm
1	1.5	10	7	91.7	45.9	235.7	78.6	Firm
	1.6	7	5	64.2	32.1	165.0	55.0	Soft
	1.7	7	5	64.2	32.1	165.0	55.0	Soft
	1.8	9	6	82.5	41.3	212.1	70.7	Firm
	1.9	6	4	55.0	27.5	141.4	47.1	Soft
	2.0	7	5	64.2	32.1	165.0	55.0	Soft
	2.1	11	8	100.9	50.4	259.2	86.4	Firm
	2.2	12	8	110.0	55.0	282.8	94.3	Firm
	2.3	13	9	119.2	59.6	306.4	102.1	Firm
2	2.4	23	16	210.9	105.5	542.0	180.7	Stiff
	2.5	35	25	321.0	160.5	824.8	274.9	Very Stiff
	2.6	41	29	376.0	188.0	966.2	322.1	Very Stiff
	2.7	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	2.8	55	39	504.4	252.2	1296.2	432.1	Very Stiff

Depth against Number of blows per 100mm



Remarks

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohesion Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)

3. The weather was Sunny

4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD

GEO - CONCRETE LABORATORY

Date: 16-02-2025

Checked by:

ENG. KAGOBA FRED

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

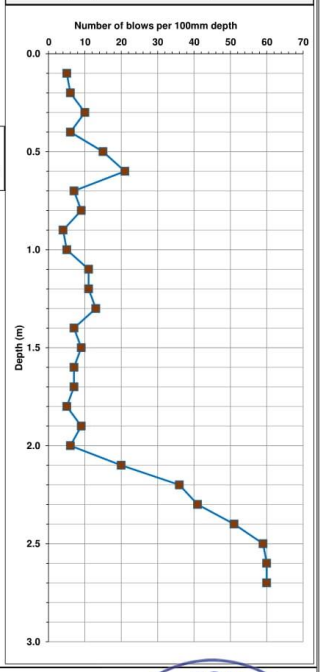
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 15**				
DPT No.:	15	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{(10)}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	5	4	45.9	22.9	117.8	39.3	Soft
	0.2	6	4	55.0	27.5	141.4	47.1	Soft
	0.3	10	7	91.7	45.9	235.7	78.6	Firm
	0.4	6	4	55.0	27.5	141.4	47.1	Soft
	0.5	15	11	137.6	68.8	353.5	117.8	Firm
	0.6	21	15	192.6	96.3	494.9	165.0	Stiff
	0.7	7	5	64.2	32.1	165.0	55.0	Soft
	0.8	9	6	82.5	41.3	212.1	70.7	Firm
	0.9	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.0	5	4	45.9	22.9	117.8	39.3	Soft
	1.1	11	8	100.9	50.4	259.2	86.4	Firm
	1.2	11	8	100.9	50.4	259.2	86.4	Firm
	1.3	13	9	119.2	59.6	306.4	102.1	Firm
	1.4	7	5	64.2	32.1	165.0	55.0	Soft
	1.5	9	6	82.5	41.3	212.1	70.7	Firm
	1.6	7	5	64.2	32.1	165.0	55.0	Soft
	1.7	7	5	64.2	32.1	165.0	55.0	Soft
	1.8	5	4	45.9	22.9	117.8	39.3	Soft
	1.9	9	6	82.5	41.3	212.1	70.7	Firm
	2.0	6	4	55.0	27.5	141.4	47.1	Soft
	2.1	20	14	183.4	91.7	471.3	157.1	Stiff
	2.2	36	25	330.1	165.1	848.4	282.8	Very Stiff
	2.3	41	29	376.0	188.0	966.2	322.1	Very Stiff
	2.4	51	36	467.7	233.8	1201.9	400.6	Very Stiff
	2.5	59	41	541.0	270.5	1390.4	463.5	Very Stiff
	2.6	60	42	550.2	275.1	1414.0	471.3	Very Stiff
	2.7	60	42	550.2	275.1	1414.0	471.3	Very Stiff

Depth against Number of blows per 100mm



Remarks

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of unconfined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD

GEO - CONCRETE LABORATORY
Date: 16-02-2025

Checked by:

Eng. SAGODA FRED

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

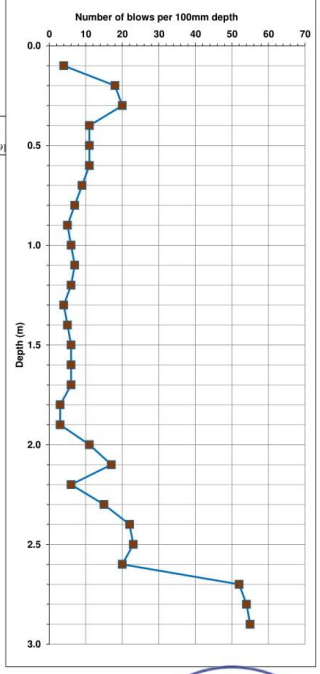
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 16**				
DPT No.:	16	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{T(1)}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.2	18	13	165.1	82.5	424.2	141.4	Stiff
	0.3	20	14	183.4	91.7	471.3	157.1	Stiff
	0.4	11	8	100.9	50.4	259.2	86.4	Firm
	0.5	11	8	100.9	50.4	259.2	86.4	Firm
	0.6	11	8	100.9	50.4	259.2	86.4	Firm
	0.7	9	6	82.5	41.3	212.1	70.7	Firm
	0.8	7	5	64.2	32.1	165.0	55.0	Soft
	0.9	5	4	45.9	22.9	117.8	39.3	Soft
	1.0	6	4	55.0	27.5	141.4	47.1	Soft
	1.1	7	5	64.2	32.1	165.0	55.0	Soft
	1.2	6	4	55.0	27.5	141.4	47.1	Soft
	1.3	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.4	5	4	45.9	22.9	117.8	39.3	Soft
	1.5	6	4	55.0	27.5	141.4	47.1	Soft
	1.6	6	4	55.0	27.5	141.4	47.1	Soft
	1.7	6	4	55.0	27.5	141.4	47.1	Soft
	1.8	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.9	3	2	27.5	13.8	70.7	23.6	Very Soft
	2.0	11	8	100.9	50.4	259.2	86.4	Firm
	2.1	17	12	155.9	77.9	400.6	133.5	Stiff
	2.2	6	4	55.0	27.5	141.4	47.1	Soft
	2.3	15	11	137.6	68.8	353.5	117.8	Firm
	2.4	22	15	201.7	100.9	518.5	172.8	Stiff
	2.5	23	16	210.9	105.5	542.0	180.7	Stiff
	2.6	20	14	183.4	91.7	471.3	157.1	Stiff
	2.7	52	36	476.8	238.4	1225.5	408.5	Very Stiff
	2.8	54	38	495.2	247.6	1272.6	424.2	Very Stiff
	2.9	55	39	504.4	252.2	1296.2	432.1	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)

3. The weather was Sunny

4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD

Checked by:

Eng. KAZORA FRED

GEO - CONCRETE LABORATORY

Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

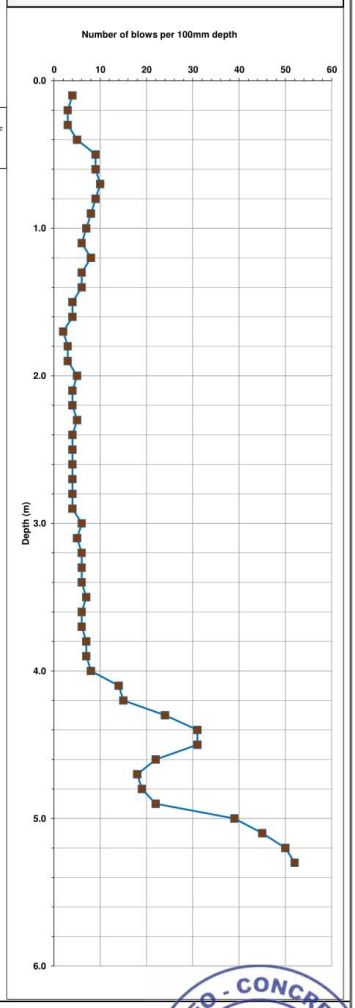
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 17**				
DPT No.:	17	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration (N_{10cm})	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.3	3	2	27.5	13.8	70.7	23.6	Very Soft
	0.4	5	4	45.9	22.9	117.8	39.3	Soft
	0.5	9	6	82.5	41.3	212.1	70.7	Firm
	0.6	9	6	82.5	41.3	212.1	70.7	Firm
	0.7	10	7	91.7	45.9	235.7	78.6	Firm
	0.8	9	6	82.5	41.3	212.1	70.7	Firm
	0.9	8	6	73.4	36.7	188.5	62.8	Soft
	1.0	7	5	64.2	32.1	165.0	55.0	Soft
	1.1	6	4	55.0	27.5	141.4	47.1	Soft
	1.2	8	6	73.4	36.7	188.5	62.8	Soft
	1.3	6	4	55.0	27.5	141.4	47.1	Soft
	1.4	6	4	55.0	27.5	141.4	47.1	Soft
	1.5	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.6	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.7	2	1	18.3	9.2	47.1	15.7	Very Soft
	1.8	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.9	3	2	27.5	13.8	70.7	23.6	Very Soft
	2.0	5	4	45.9	22.9	117.8	39.3	Soft
	2.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.2	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.3	5	4	45.9	22.9	117.8	39.3	Soft
	2.4	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.5	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.6	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.7	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.8	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.9	4	3	36.7	18.3	94.3	31.4	Very Soft
	3.0	6	4	55.0	27.5	141.4	47.1	Soft
	3.1	5	4	45.9	22.9	117.8	39.3	Soft
	3.2	6	4	55.0	27.5	141.4	47.1	Soft
	3.3	6	4	55.0	27.5	141.4	47.1	Soft
	3.4	6	4	55.0	27.5	141.4	47.1	Soft
	3.5	7	5	64.2	32.1	165.0	55.0	Soft
	3.6	6	4	55.0	27.5	141.4	47.1	Soft
	3.7	6	4	55.0	27.5	141.4	47.1	Soft
	3.8	7	5	64.2	32.1	165.0	55.0	Soft
	3.9	7	5	64.2	32.1	165.0	55.0	Soft
	4.0	8	6	73.4	36.7	188.5	62.8	Soft
	4.1	14	10	128.4	64.2	329.9	110.0	Firm
	4.2	15	11	137.6	68.8	353.5	117.8	Firm
	4.3	24	17	220.1	110.0	565.6	188.5	Stiff
	4.4	31	22	284.3	142.1	730.6	243.5	Stiff
	4.5	31	22	284.3	142.1	730.6	243.5	Stiff
	4.6	22	15	201.7	100.9	518.5	172.8	Stiff
	4.7	18	13	165.1	82.5	424.2	141.4	Stiff
	4.8	19	13	174.2	87.1	447.8	149.3	Stiff
	4.9	22	15	201.7	100.9	518.5	172.8	Stiff
	5.0	39	27	357.6	178.8	919.1	306.4	Very Stiff
	5.1	45	32	412.7	206.3	1060.5	353.5	Very Stiff
	5.2	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	5.3	52	36	476.8	238.4	1225.5	408.5	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu Allowable bearing capacity is evaluated using a factor of safety 3
2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD

Checked by;

Eng. KAGODA FRED

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

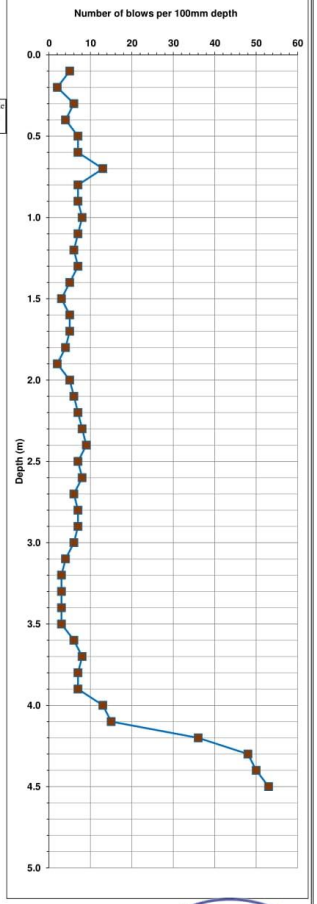
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 18**				
DPT No.:	19	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration (N_{cone})	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	5	4	45.9	22.9	117.8	39.3	Soft
	0.2	2	1	18.3	9.2	47.1	15.7	Very Soft
	0.3	6	4	55.0	27.5	141.4	47.1	Soft
	0.4	4	3	36.7	18.3	94.3	31.4	Very Soft
	0.5	7	5	64.2	32.1	165.0	55.0	Soft
	0.6	7	5	64.2	32.1	165.0	55.0	Soft
	0.7	13	9	119.2	59.6	306.4	102.1	Firm
	0.8	7	5	64.2	32.1	165.0	55.0	Soft
	0.9	7	5	64.2	32.1	165.0	55.0	Soft
	1.0	8	6	73.4	36.7	188.5	62.8	Soft
	1.1	7	5	64.2	32.1	165.0	55.0	Soft
	1.2	6	4	55.0	27.5	141.4	47.1	Soft
	1.3	7	5	64.2	32.1	165.0	55.0	Soft
	1.4	5	4	45.9	22.9	117.8	39.3	Soft
	1.5	3	2	27.5	13.8	70.7	23.6	Very Soft
	1.6	5	4	45.9	22.9	117.8	39.3	Soft
	1.7	5	4	45.9	22.9	117.8	39.3	Soft
	1.8	4	3	36.7	18.3	94.3	31.4	Very Soft
	1.9	2	1	18.3	9.2	47.1	15.7	Very Soft
	2.0	5	4	45.9	22.9	117.8	39.3	Soft
	2.1	6	4	55.0	27.5	141.4	47.1	Soft
	2.2	7	5	64.2	32.1	165.0	55.0	Soft
	2.3	8	6	73.4	36.7	188.5	62.8	Soft
	2.4	9	6	82.5	41.3	212.1	70.7	Firm
	2.5	7	5	64.2	32.1	165.0	55.0	Soft
	2.6	8	6	73.4	36.7	188.5	62.8	Soft
	2.7	6	4	55.0	27.5	141.4	47.1	Soft
	2.8	7	5	64.2	32.1	165.0	55.0	Soft
	2.9	7	5	64.2	32.1	165.0	55.0	Soft
	3.0	6	4	55.0	27.5	141.4	47.1	Soft
	3.1	4	3	36.7	18.3	94.3	31.4	Very Soft
	3.2	3	2	27.5	13.8	70.7	23.6	Very Soft
	3.3	3	2	27.5	13.8	70.7	23.6	Very Soft
	3.4	3	2	27.5	13.8	70.7	23.6	Very Soft
	3.5	3	2	27.5	13.8	70.7	23.6	Very Soft
	3.6	6	4	55.0	27.5	141.4	47.1	Soft
	3.7	8	6	73.4	36.7	188.5	62.8	Soft
	3.8	7	5	64.2	32.1	165.0	55.0	Soft
	3.9	7	5	64.2	32.1	165.0	55.0	Soft
	4.0	13	9	119.2	59.6	306.4	102.1	Firm
	4.1	15	11	137.6	68.8	353.5	117.8	Firm
	4.2	36	25	330.1	165.1	848.4	282.8	Very Stiff
	4.3	48	34	440.2	220.1	1131.2	377.1	Very Stiff
	4.4	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	4.5	53	37	486.0	243.0	1249.0	416.3	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of unconfined compressive strength qu, the cohesion Cu = qu/2 and Ultimate bearing capacity = 5.14xCu .Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD

Checked by:

Eng. KAGOLA PETER

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

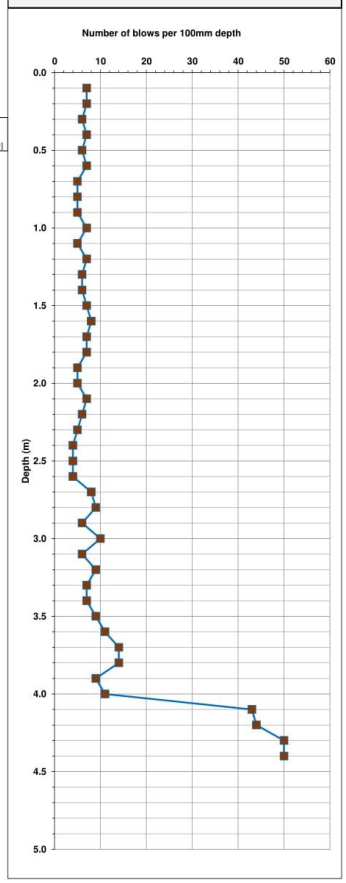
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 19**				
DPT No.:	19	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration ($N_{\gamma 10}$)	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	7	5	64.2	32.1	165.0	55.0	Soft
	0.2	7	5	64.2	32.1	165.0	55.0	Soft
	0.3	6	4	55.0	27.5	141.4	47.1	Soft
	0.4	7	5	64.2	32.1	165.0	55.0	Soft
	0.5	6	4	55.0	27.5	141.4	47.1	Soft
	0.6	7	5	64.2	32.1	165.0	55.0	Soft
	0.7	5	4	45.9	22.9	117.8	39.3	Soft
	0.8	5	4	45.9	22.9	117.8	39.3	Soft
	0.9	5	4	45.9	22.9	117.8	39.3	Soft
	1.0	7	5	64.2	32.1	165.0	55.0	Soft
	1.1	5	4	45.9	22.9	117.8	39.3	Soft
	1.2	7	5	64.2	32.1	165.0	55.0	Soft
	1.3	6	4	55.0	27.5	141.4	47.1	Soft
	1.4	6	4	55.0	27.5	141.4	47.1	Soft
	1.5	7	5	64.2	32.1	165.0	55.0	Soft
	1.6	8	6	73.4	36.7	188.5	62.8	Soft
	1.7	7	5	64.2	32.1	165.0	55.0	Soft
	1.8	7	5	64.2	32.1	165.0	55.0	Soft
	1.9	5	4	45.9	22.9	117.8	39.3	Soft
	2.0	5	4	45.9	22.9	117.8	39.3	Soft
	2.1	7	5	64.2	32.1	165.0	55.0	Soft
	2.2	6	4	55.0	27.5	141.4	47.1	Soft
	2.3	5	4	45.9	22.9	117.8	39.3	Soft
	2.4	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.5	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.6	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.7	8	6	73.4	36.7	188.5	62.8	Soft
	2.8	9	6	82.5	41.3	212.1	70.7	Firm
	2.9	6	4	55.0	27.5	141.4	47.1	Soft
	3.0	10	7	91.7	45.9	235.7	78.6	Firm
	3.1	6	4	55.0	27.5	141.4	47.1	Soft
	3.2	9	6	82.5	41.3	212.1	70.7	Firm
	3.3	7	5	64.2	32.1	165.0	55.0	Soft
	3.4	7	5	64.2	32.1	165.0	55.0	Soft
	3.5	9	6	82.5	41.3	212.1	70.7	Firm
	3.6	11	8	100.9	50.4	259.2	86.4	Firm
	3.7	14	10	128.4	64.2	329.9	110.0	Firm
	3.8	14	10	128.4	64.2	329.9	110.0	Firm
	3.9	9	6	82.5	41.3	212.1	70.7	Firm
	4.0	11	8	100.9	50.4	259.2	86.4	Firm
	4.1	43	30	394.3	197.2	1013.4	337.8	Very Stiff
	4.2	44	31	403.5	201.7	1036.9	345.6	Very Stiff
	4.3	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	4.4	50	35	458.5	229.3	1178.3	392.8	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu. Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)
3. The weather was Sunny
4. The layers were assumed to be cohesive soils.

Prepared by;

KAWISO BENARD

Checked by;

Eng. KAGODA FRED

GEO - CONCRETE LABORATORY
Date: 16-02-2025

CONSULTANT

SEGAMU 14 CONSULTS LTD

CLIENT

THE REPUBLIC OF UGANDA
Ministry of Water and Environment

TESTING LAB

Geo-concrete Laboratory
TEST & QUALITY CONTROL ENGINEERS

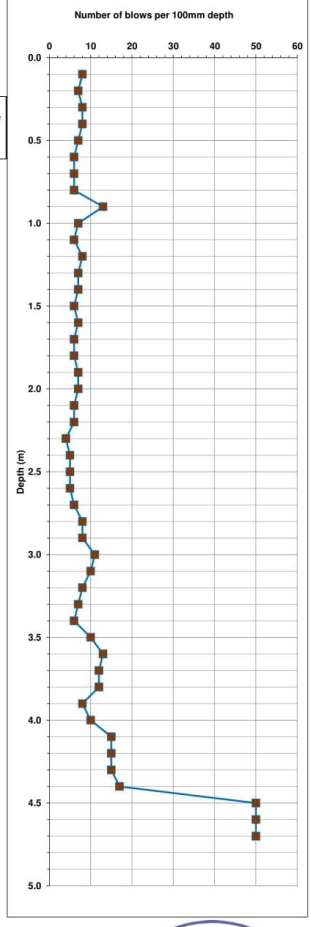
DYNAMIC PENETRATION TEST (DPT) REPORT

Project:	GEOTECHNICAL INVESTIGATIONS FOR PROPOSED MASINDI PORT BULK WATER SUPPLY PROJECT				
Site Location:	**DPL 20**				
DPT No.:	20	**GPS Location**	0.371821, 32.956598	**Weight of hammer (kg):**	10.0
Depth of test (m):	4.8			**Testing date:**	16-Jan-25
Job ref No.:	**MASINDI PORT**			**Technician:**	LABORATORY TEAM
Test Method.:	BS EN-ISO-22476-Part 2				

EVALUATION OF BEARING CAPACITY BASED ON FIELD DYNAMIC PENETROMETER TEST RESULTS

Test No.:	Depth (m)	Blow counts for 10cm penetration (N_{10})	N-SPT	Unconfined Compressive Strength qu (kPa)	Undrained Cohesion Cu (kPa)	Ultimate bearing capacity (Kpa)	Allowable bearing capacity (Kpa)	Consistency, Table 13 [BS: 5930:1999]
1	0.1	8	6	73.4	36.7	188.5	62.8	Soft
	0.2	7	5	64.2	32.1	165.0	55.0	Soft
	0.3	8	6	73.4	36.7	188.5	62.8	Soft
	0.4	8	6	73.4	36.7	188.5	62.8	Soft
	0.5	7	5	64.2	32.1	165.0	55.0	Soft
	0.6	6	4	55.0	27.5	141.4	47.1	Soft
	0.7	6	4	55.0	27.5	141.4	47.1	Soft
	0.8	6	4	55.0	27.5	141.4	47.1	Soft
	0.9	13	9	119.2	59.6	306.4	102.1	Firm
	1.0	7	5	64.2	32.1	165.0	55.0	Soft
	1.1	6	4	55.0	27.5	141.4	47.1	Soft
	1.2	8	6	73.4	36.7	188.5	62.8	Soft
	1.3	7	5	64.2	32.1	165.0	55.0	Soft
	1.4	7	5	64.2	32.1	165.0	55.0	Soft
	1.5	6	4	55.0	27.5	141.4	47.1	Soft
	1.6	7	5	64.2	32.1	165.0	55.0	Soft
	1.7	6	4	55.0	27.5	141.4	47.1	Soft
	1.8	6	4	55.0	27.5	141.4	47.1	Soft
	1.9	7	5	64.2	32.1	165.0	55.0	Soft
	2.0	7	5	64.2	32.1	165.0	55.0	Soft
	2.1	6	4	55.0	27.5	141.4	47.1	Soft
	2.2	6	4	55.0	27.5	141.4	47.1	Soft
	2.3	4	3	36.7	18.3	94.3	31.4	Very Soft
	2.4	5	4	45.9	22.9	117.8	39.3	Soft
	2.5	5	4	45.9	22.9	117.8	39.3	Soft
	2.6	5	4	45.9	22.9	117.8	39.3	Soft
	2.7	6	4	55.0	27.5	141.4	47.1	Soft
	2.8	8	6	73.4	36.7	188.5	62.8	Soft
	2.9	8	6	73.4	36.7	188.5	62.8	Soft
	3.0	11	8	100.9	50.4	259.2	86.4	Firm
	3.1	10	7	91.7	45.9	235.7	78.6	Firm
	3.2	8	6	73.4	36.7	188.5	62.8	Soft
	3.3	7	5	64.2	32.1	165.0	55.0	Soft
	3.4	6	4	55.0	27.5	141.4	47.1	Soft
	3.5	10	7	91.7	45.9	235.7	78.6	Firm
	3.6	13	9	119.2	59.6	306.4	102.1	Firm
	3.7	12	8	110.0	55.0	282.8	94.3	Firm
	3.8	12	8	110.0	55.0	282.8	94.3	Firm
	3.9	8	6	73.4	36.7	188.5	62.8	Soft
	4.0	10	7	91.7	45.9	235.7	78.6	Firm
	4.1	15	11	137.6	68.8	353.5	117.8	Firm
	4.2	15	11	137.6	68.8	353.5	117.8	Firm
	4.3	15	11	137.6	68.8	353.5	117.8	Firm
	4.4	17	12	155.9	77.9	400.6	133.5	Stiff
	4.5	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	4.6	50	35	458.5	229.3	1178.3	392.8	Very Stiff
	4.7	50	35	458.5	229.3	1178.3	392.8	Very Stiff

Depth against Number of blows per 100mm



Remarks:

1. For cohesive soils, the relationship qu = 13.1x Design N-value is used for evaluation of uncofined compressive strength qu, the cohession Cu = qu/2 and Ultimate bearing capacity = 5.14xCu. Allowable bearing capacity is evaluated using a factor of safety 3

2. Allowable Bearing capacity with settlement limited to approximately 25 mm for cohesionless soils read off directly from the chart (Publised by Terzaghi and peck 1967)

3. The weather was Sunny

4. The layers were assumed to be cohesive soils.

Prepared by:

KAWISO BENARD

GEO - CONCRETE LABORATORY
Date: 16-02-2025

Checked by:

Eng. KAGOMA FRED

Appendix 13: BOREHOLE PICTURES


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14/01/2025, MoWE
BH 01 0.0-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14/01/2025, MoWE
BH 01 5.0-9.0


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14th/01/2025, MoWE
BH 02, 0.0-5.0


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14th/01/2025, MoWE
BH 02, 5.0-9.0


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14/01/2025, MoWE
BH 03 0.0-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14/01/2025, MoWE
BH 03, 5.0-10.0m


SOIL INVESTIGATION
MASINDI BULK WATER SUPPLY
14/01/2025, MoWE
BH 04, 0.0-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER SUPPLY
14/01/2025, MoWE
BH 04, 5.0-8.5m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14/01/2025, MoWE
BH05 00-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14/01/2025, MoWE
BH05 5.0-8.5m


SOIL WVESTIGATION
MASINDI BULK WATER
SUPPLY
14*/01/2025, MOWE
BH06 0.0-5.0M


SOIL WVESTIGATION
MASINDI BULK WATER
SUPPLY
14*/01/2025, MOWE
BH06. 5.0-10M


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14th/01/2025, MoWE
BH07 0.0-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
14th/01/2025, MoWE
BH07. 5.0-10m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15/01/2025, MOWE
BH08. 00-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15/01/2025, MOWE
BH08. 5.0-10.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15/01/2025, MoWE
BH09. 00-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15/01/2025, MoWE
BH09. 50-100m


SOIL INVESTIGATION
MASINDI BULK WATER SUPPLY
15/01/2025, MoWE
BH10, 0.0-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER SUPPLY
15/01/2025, MoWE
BH10, 50-100m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15TH/01/2025, MOWE
BH11, 00-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15TH/01/2025, MOWE
BH11, 5.0-10.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15th/01/2025, MoWE
BH12, 0.0-5.0m


SOIL INVESTIGATION
MASINDI BULK WATER
SUPPLY
15th/01/2025, MoWE
BH12, 5.0-10.0m

APPENDIX G: PROJECT LAYOUT DRAWINGS

AFRICAN DEVELOPMENT BANK GROUP

Republic of Uganda

MINISTRY OF WATER AND ENVOIRNMENT

PROJECT REFRENCE ID: AHAI/2024/3/SERIAL NUMBER

CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

ANNEX 1 PROJECT DRAWINGS

PROJECT CONSULTANT:
TECHNITAL S.p.A, in JV with BETA Studio, and Segamu 14 Consults Ltd and Tawi Research Limited as local consultants

Project Deliverable: Draft Feasibility Study

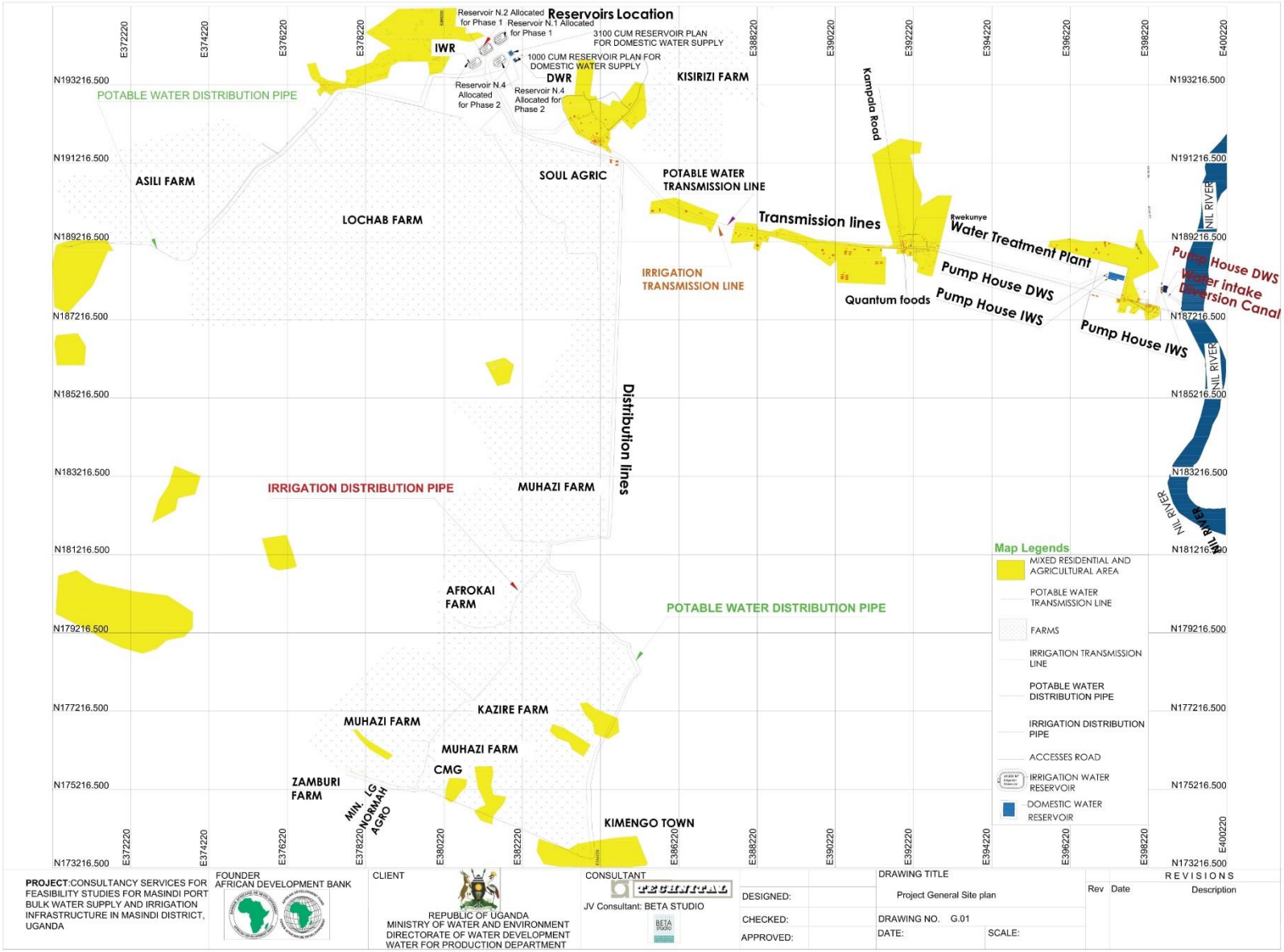
March -07- 2025

TECHNITAL S.P. A
Adress: via Carlo Cattaneo, 20 - 37121 VERONA- - Ph. +39 045 8053611- Fax +39 045 8011558- E-Mail: technital@technital.it Quality System Certificates ISO 9001:2015 - ISO 14001:2015 - ISO 45001:2018 - SA 8000:20

Consultancy Services for Feasibility Studies for Masindi Port Bulk Water Supply and Irrigation Infrastructure project in Masindi District,

List of drawings

0. General drawings	**G.01**	Project General Site plan
	G.02	Project Location plan
	I.01	Water Intake Location plan
	I.02	Water Intake and Pump Station Concept Plan
1. Water intake and pumpstation	**I.03**	Water intake and Pump Station Foundation Plan
	I.04	Water intake Floor Plan
	I.05	Water Intake and Pump station Plan
	I.06	Section A 1-A 1 & A 2-A 2
	I.07	Section A 2-A 2 & B 2-B 2
	I.08	Water Intake Roof Plan
	I.09	Diversion Canal Plan
	I.10	Diversion Canal Section and Profile
2. Water Treatment plant compound	**P.01**	WTP Location Plan
	P.02	WTP General Plan
	P.03	WTP Site Plan
	P.04	Irrigation and Potable Water Treatment Process
3. Water transmission and distribution lines	**TL.01**	General plan
	TL.02	Pipeline profile
4. Irrigation and Domestic Water reservoirs	**R.01**	Reservoirs General Location Plan
	R.02	24,000 Cubic Meters Irrigation Reservoir Plan
	R.03	24,000 Cubic Meters Irrigation Reservoir Foundation Plan
	R.04	Irrigation water reservoirs plan
	R.05	Irrigation water reservoirs Sections
	R.06.1	Valve Chamber - Plan
	R.06.2	Valve Chamber - SectionPlan
	R.07	Domestic Water tank 3100 CUM plan
	R.08	Domestic Water tank 3100 CUM plan and sections
	R.09	Domestic Water tank 3100 CUM Floor Plan
	R.10	Domestic Water tank 3100 CUM Floor Formwork plan
	R.11	Domestic Water tank 3100 CUM Drainge plan
	R.12	Domestic Water tank 3100 CUM Wall Details
	R.13	Domestic Water tank 1000 CUM plan
	R.14	Domestic Water tank 1000 CUM Roof plan
	R.15	Domestic Water tank 1000 CUM Floor Formwork plan
	R.16	Domestic Water tank 1000 CUM Dainage plan
	R.17	Domestic Water tank 1000 CUM Sections
	R.18	Domestic Water tank 1000 CUM wall details
	R.19	24,000 Cubic Meters Irrigation Project Grading Plan
	R.20	24,000 Cubic Meters Irrigation Reservoir 1-2 Grading Cross Sections
	R.21	24,000 Cubic Meters Irrigation Reservoir 3-4 Grading Cross Sections
5. Water supply (domestic use) distribution networ	**WD.01**	Water supply distribution network general plan
6. Typical drawings	**TD.01**	Trench and gate valves
	TD.02	Air valves and washout valves
	TD.03/4/5	Thrust blocks



PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

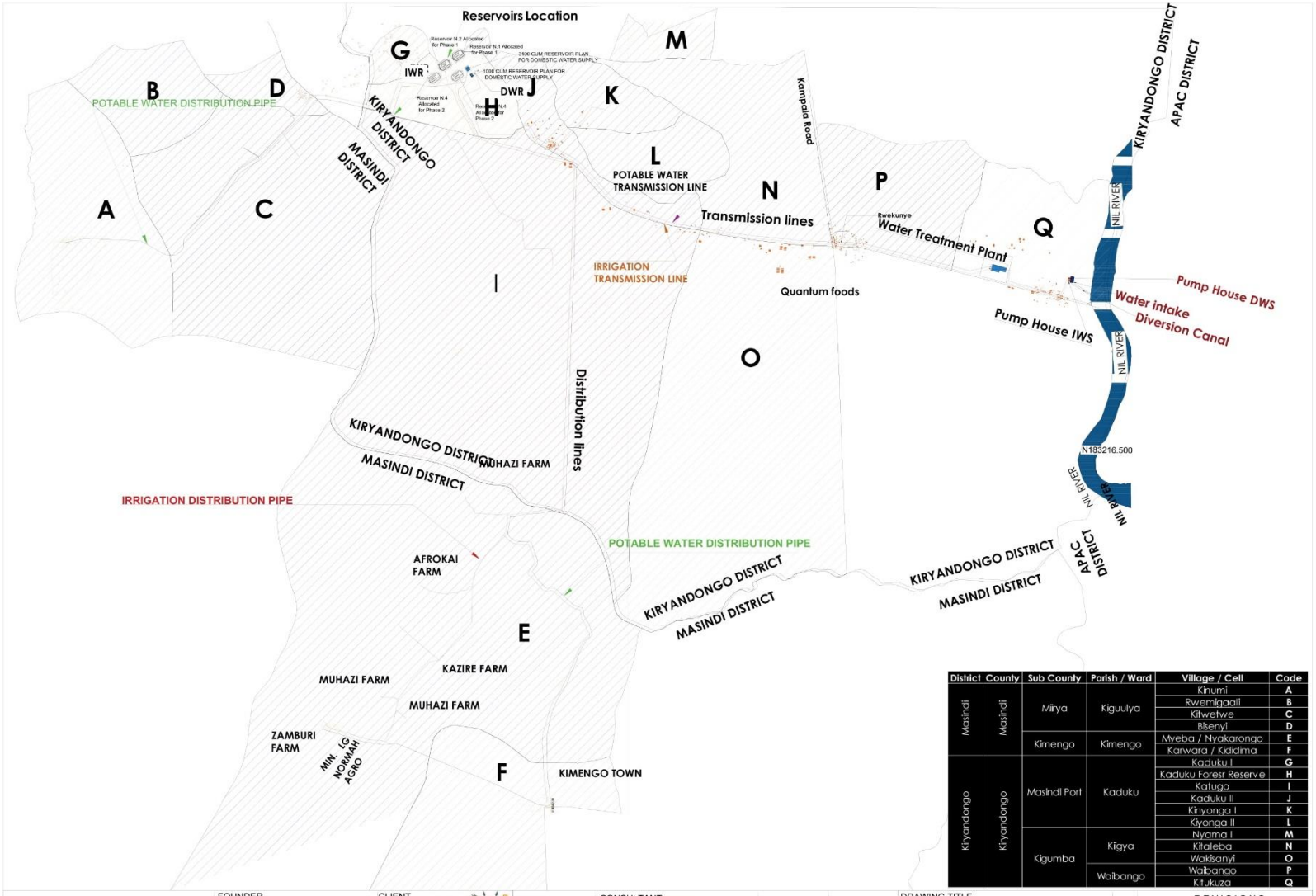
CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
JV Consultant: BETA STUDIO

DESIGNED:
CHECKED:
APPROVED:

DRAWING TITLE
Project General Site plan
DRAWING NO. G.01
DATE:
SCALE:

REVISIONS
Rev Date Description



District	County	Sub County	Parish / Ward	Village / Cell	Code
Masindi	Masindi	Miirya	Kiguulya	Kinumi	A
				Rwemigaali	B
				Kifwetwe	C
				Bisenyi	D
		Kimengo	Kimengo	Myeba / Nyakarongo	E
				Karwara / Kididima	F
Kiryandongo	Kiryandongo	Masindi Port	Kaduku	Kaduku I	G
				Kaduku Foresr Reserve	H
				Katugo	I
				Kaduku II	J
				Kinyonga I	K
				Kiyonga II	L
		Kigumba	Kigya	Nyama I	M
				Kitaleba	N
				Wakisanyi	O
			Waibango	Waibango	P
				Kitukuza	Q

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
JV Consultant: BETA STUDIO

DESIGNED:
CHECKED:
APPROVED:

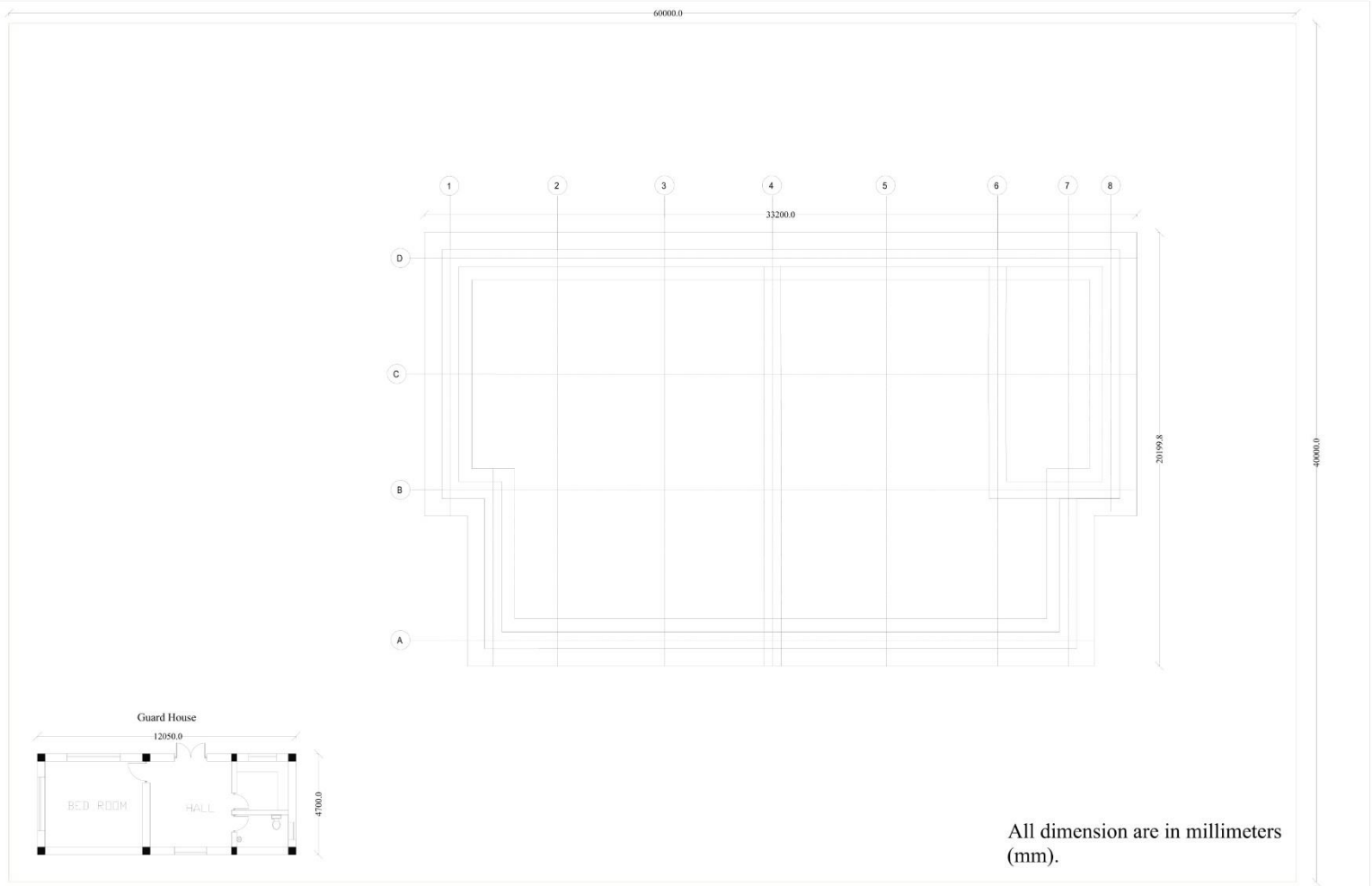
DRAWING TITLE
Project Location plan
DRAWING NO. G.02
DATE:
SCALE:

REVISIONS

Rev	Date	Description

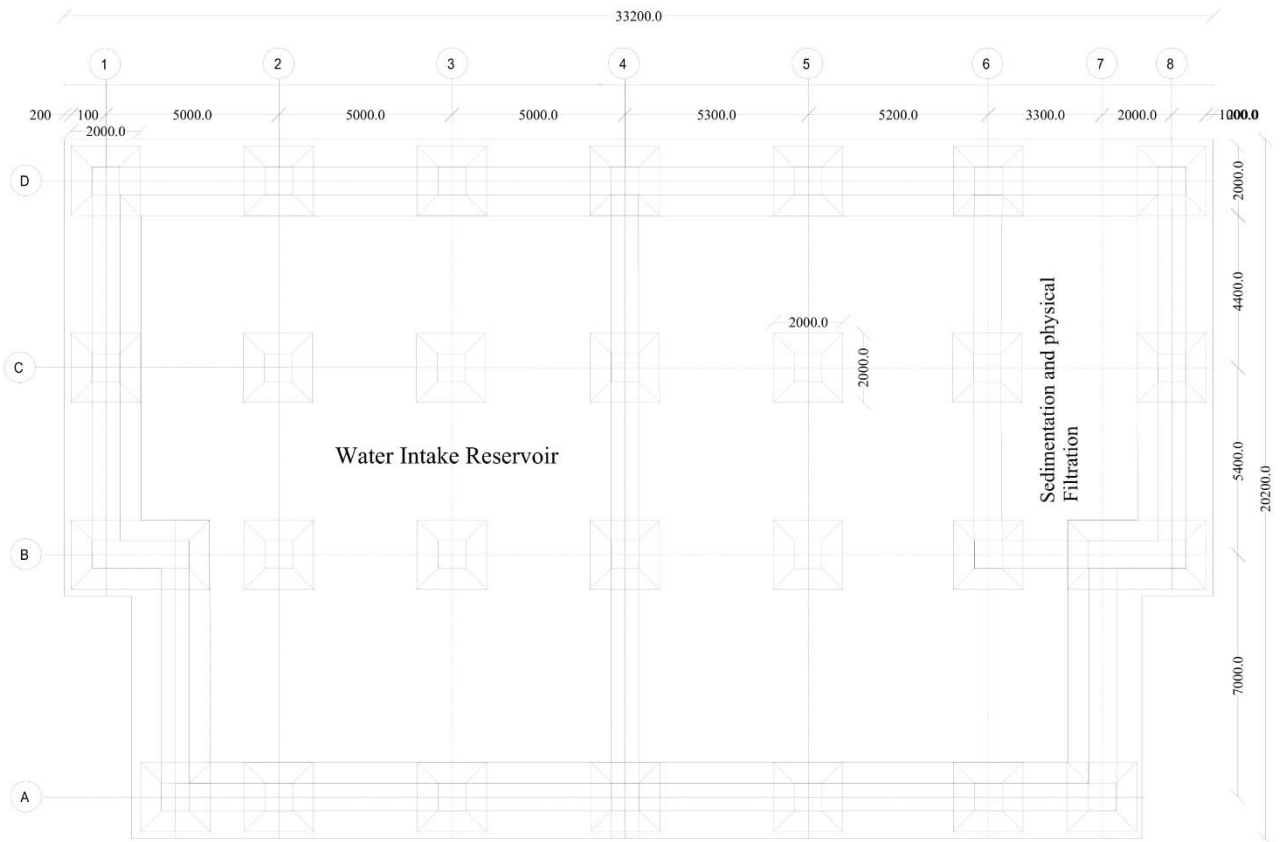


PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE Water Intake Location plan DRAWING NO. I.01 DATE: SCALE:	REVISIONS Rev Date Description



All dimension are in millimeters (mm).

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE Water Intake and Pump Station Concept Plan DRAWING NO. I.02 DATE: SCALE:	REVISIONS Rev Date Description



All dimension are in millimeters (mm).

Water Intake Reservoir
Capacity 2,800 Cum

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

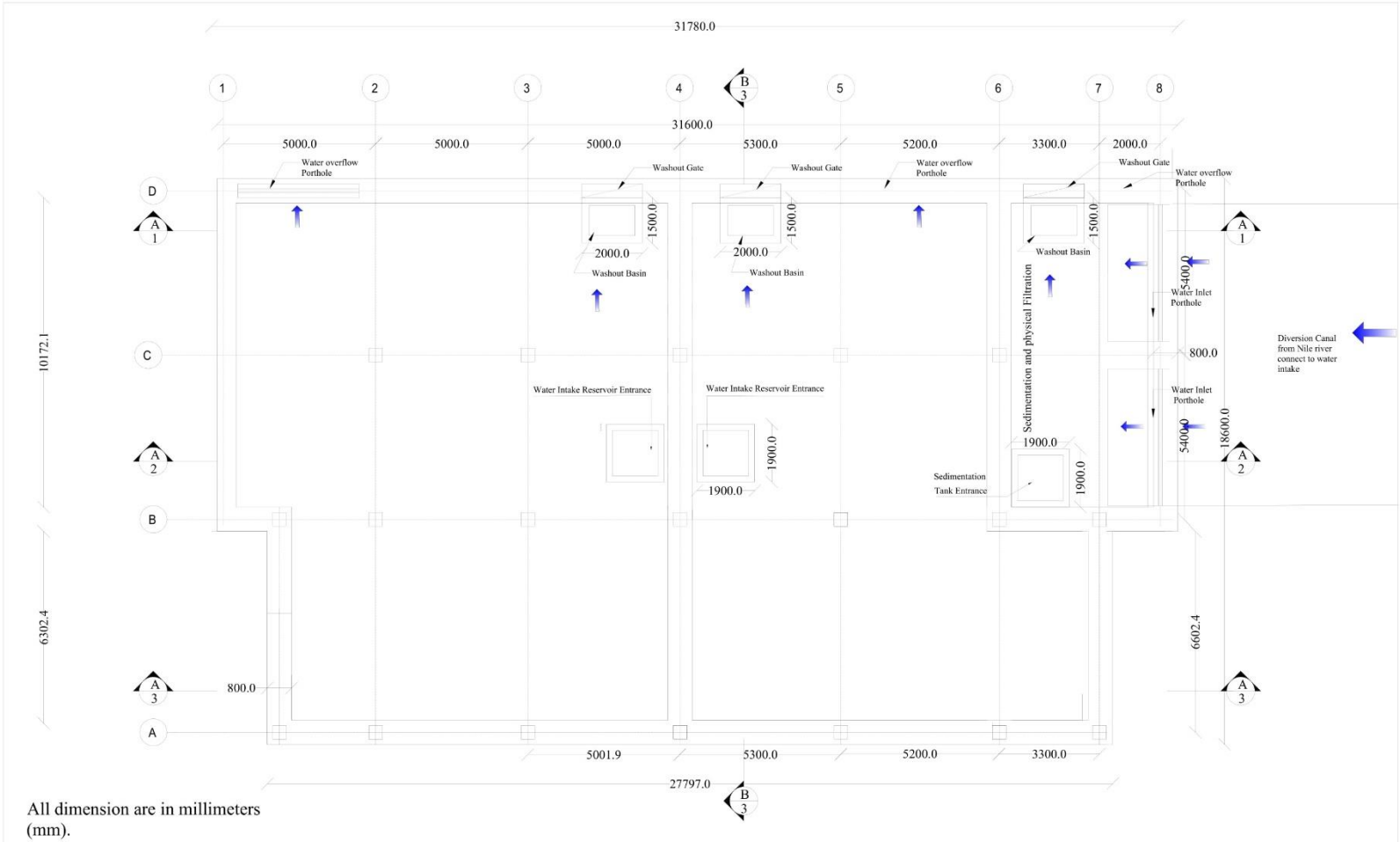
CONSULTANT
JV Consultant: BETA STUDIO

DESIGNED:
CHECKED:
APPROVED:

DRAWING TITLE
Water Intake and m Station Foundation Plan
DRAWING NO. I.03
DATE:
SCALE:

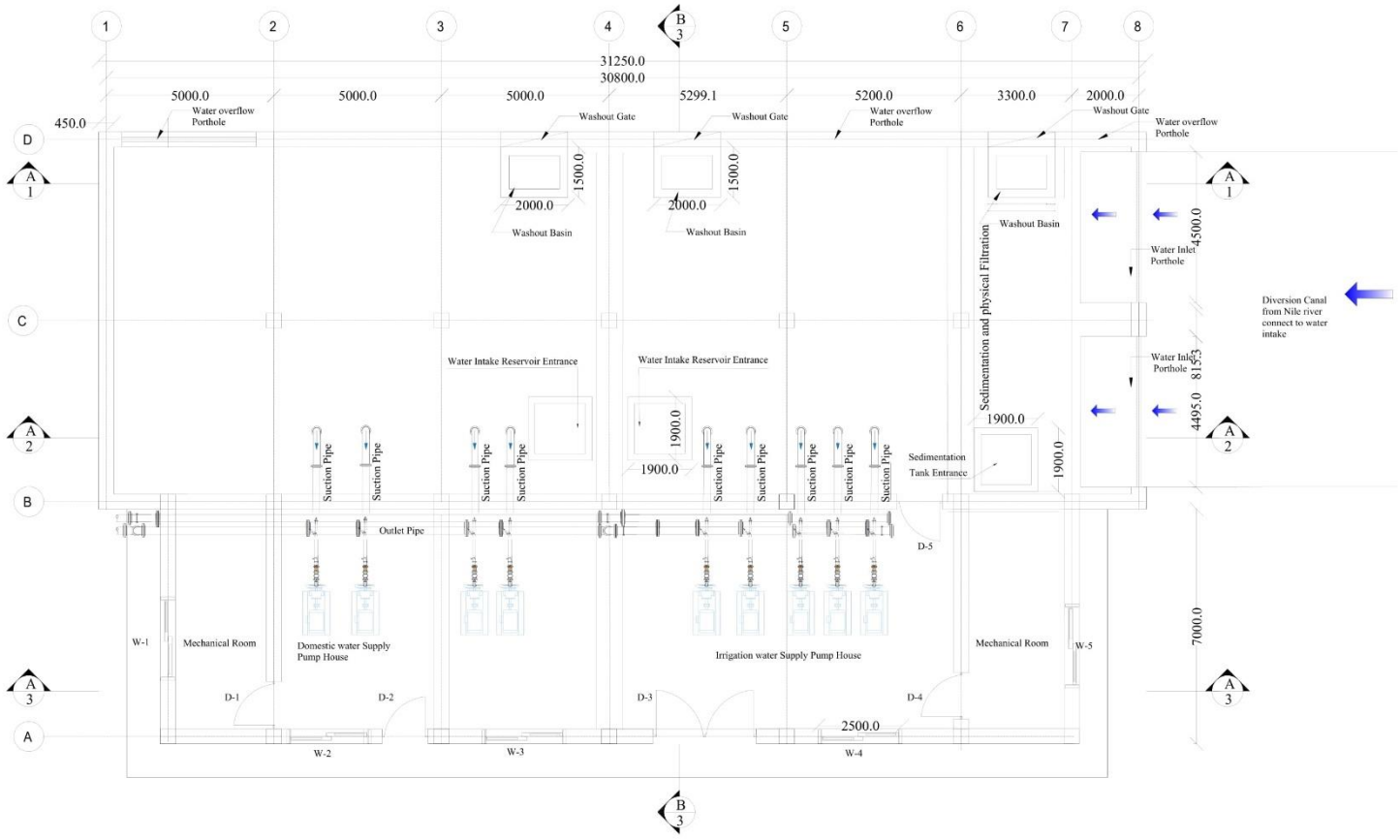
REVISIONS

Rev	Date	Description



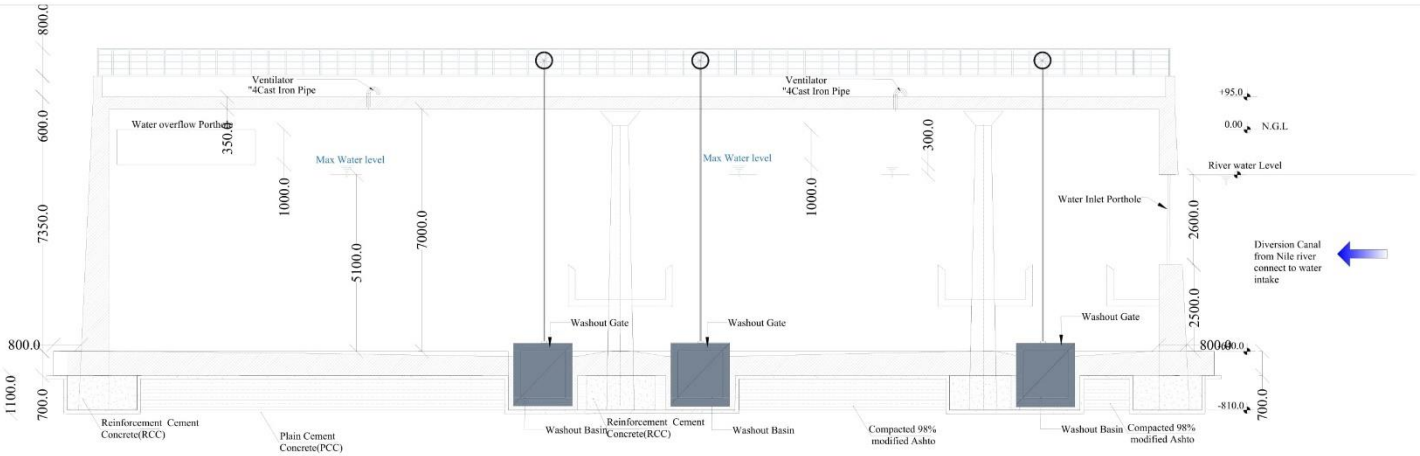
All dimension are in millimeters (mm).

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED:		DRAWING TITLE Water IIntake loor Plan	REVISIONS Rev Date Description
				CHECKED:		DRAWING NO. I.04	
				APPROVED:		DATE: SCALE:	

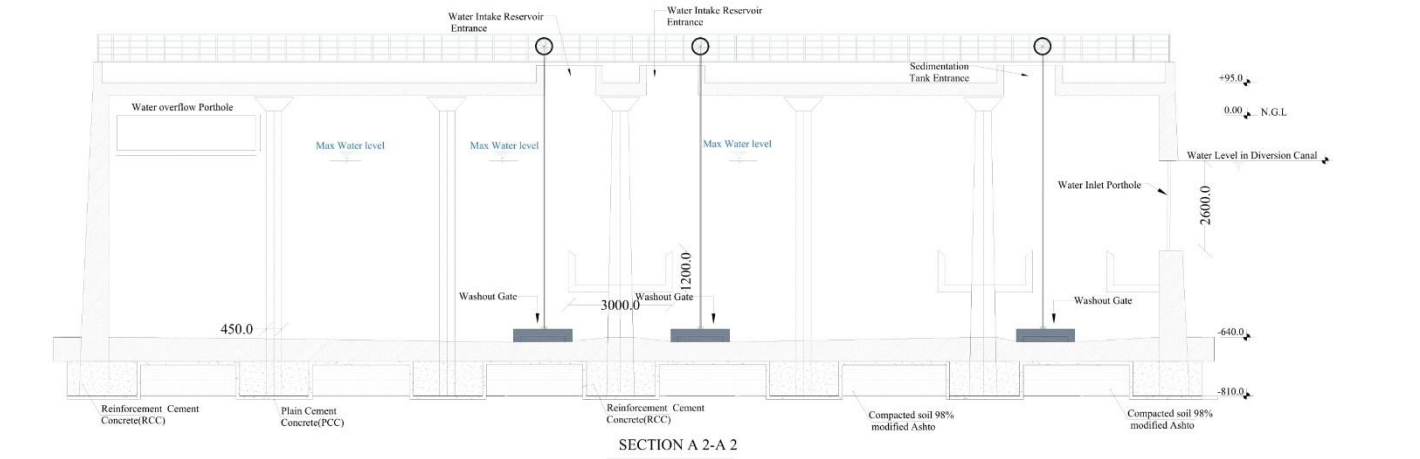


PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE Water Intake and Pump station Plan DRAWING NO. I.05 DATE: SCALE:

REVISIONS		
Rev	Date	Description



SECTION A 1-A 1



SECTION A 2-A 2

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

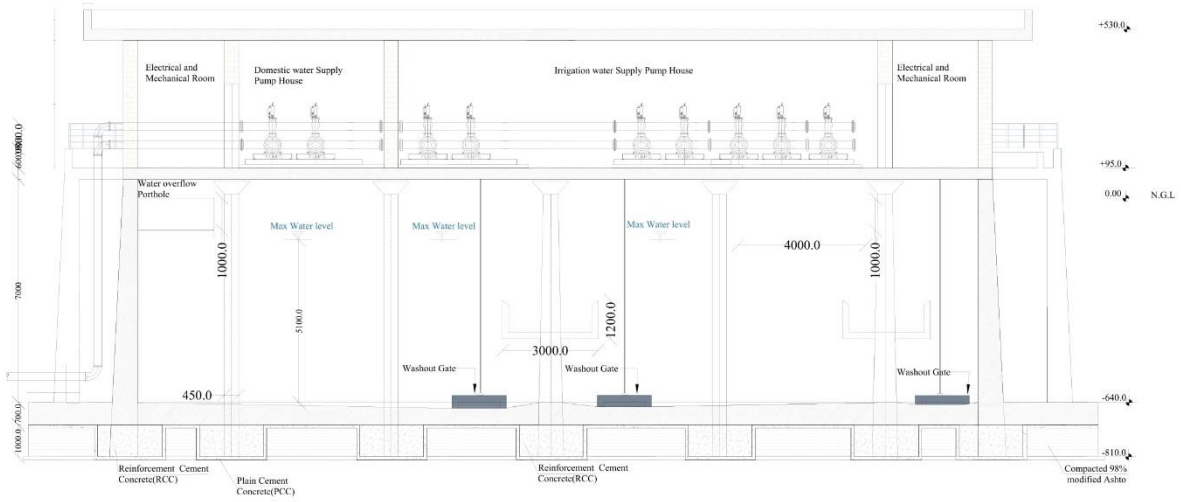
CONSULTANT
JV Consultant: BETA STUDIO

DESIGNED:
CHECKED:
APPROVED:

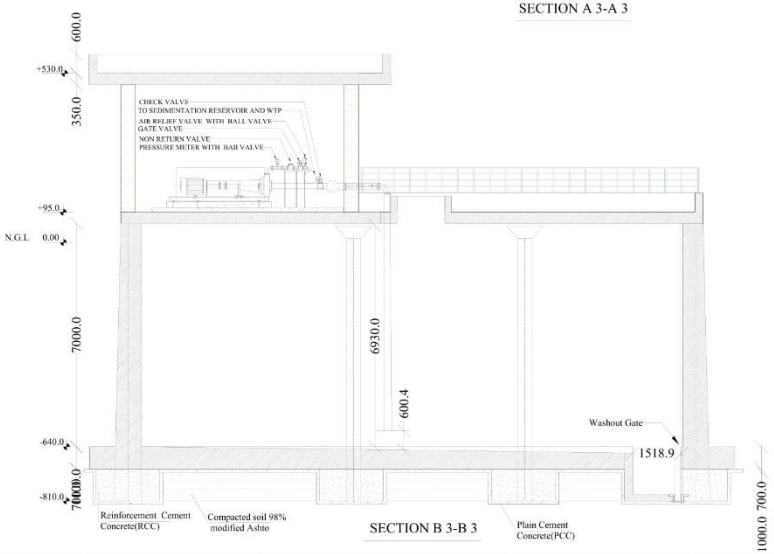
DRAWING TITLE
SECTION A 1-A 1 & SECTION A 2-A 2
DRAWING NO. 1.06
DATE:
SCALE:

REVISIONS

Rev	Date	Description

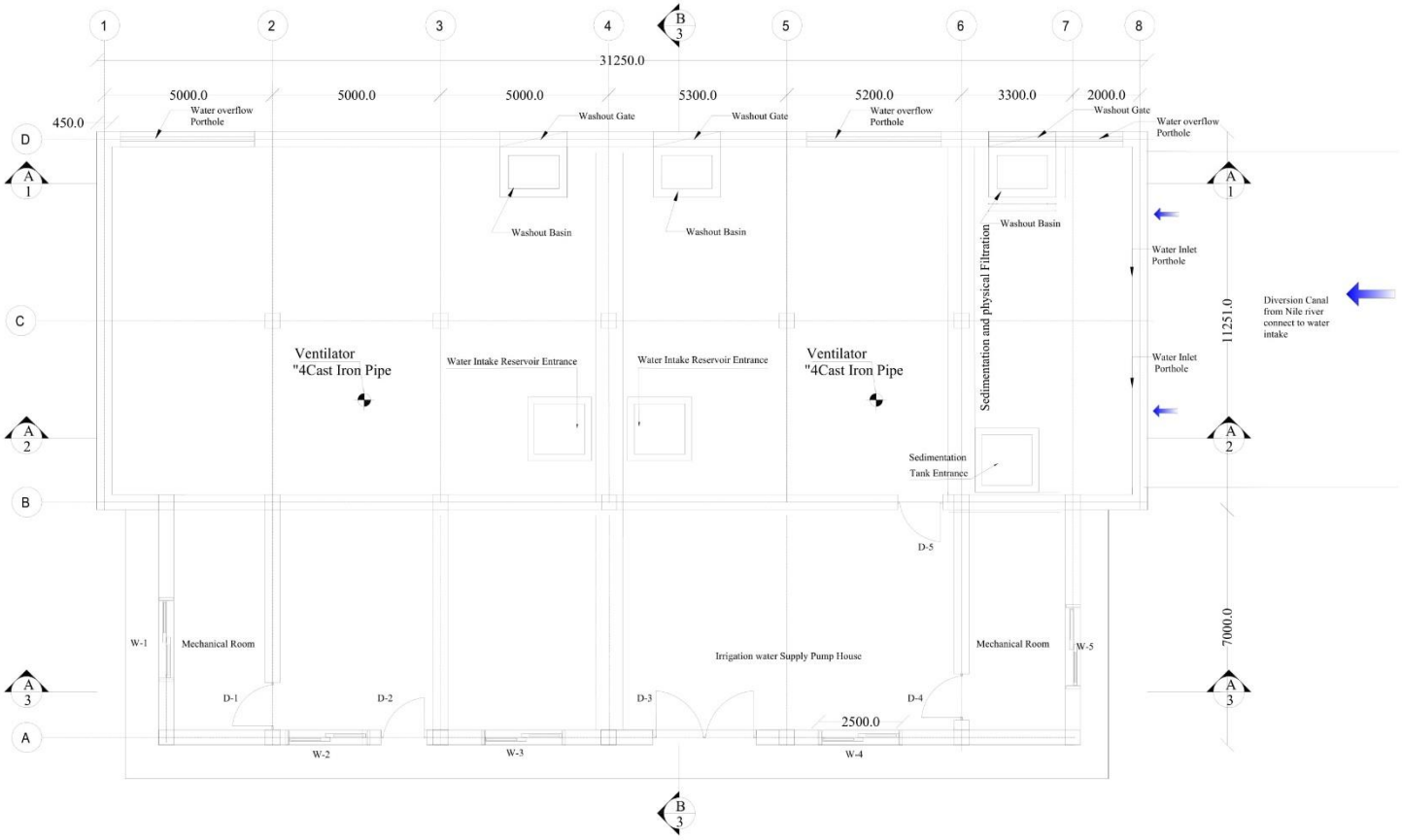


SECTION A 3-A 3



SECTION B 3-B 3

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE SECTION A 3-A 3 & SECTION B 3-B 3 DRAWING NO. I.07 DATE: SCALE:	REVISIONS Rev Date Description



PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
JV Consultant: BETA STUDIO

DESIGNED:
CHECKED:
APPROVED:

DRAWING TITLE
Water Intake Roof Plan
DRAWING NO. I.08
DATE:
SCALE:

REVISIONS

Rev	Date	Description



Generated: 27/02/2025

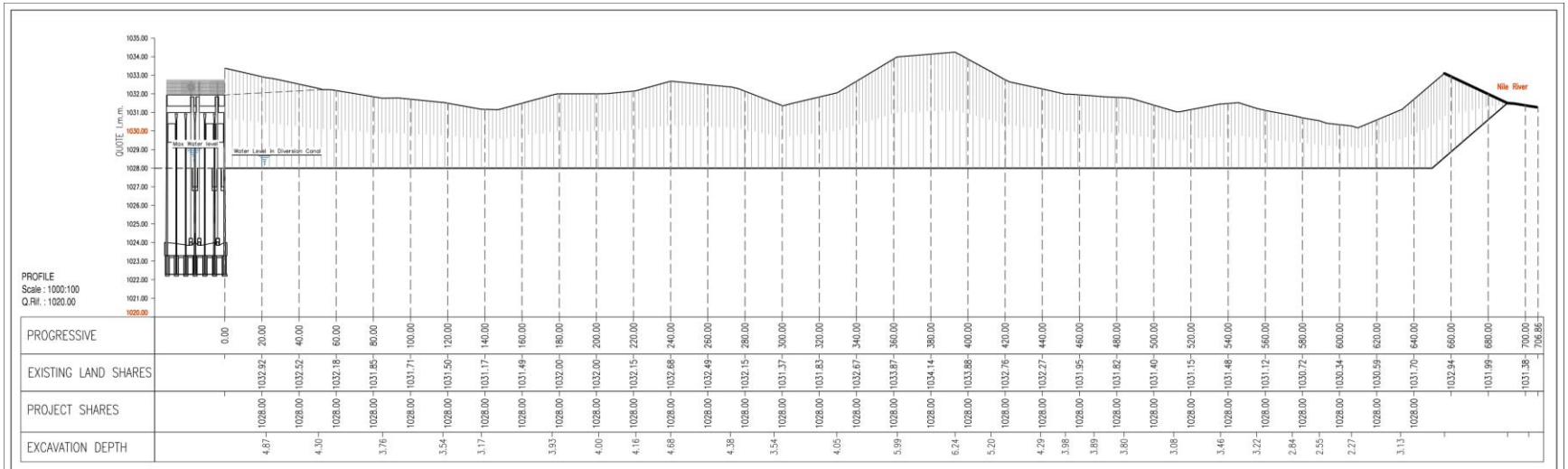
Volume Summary

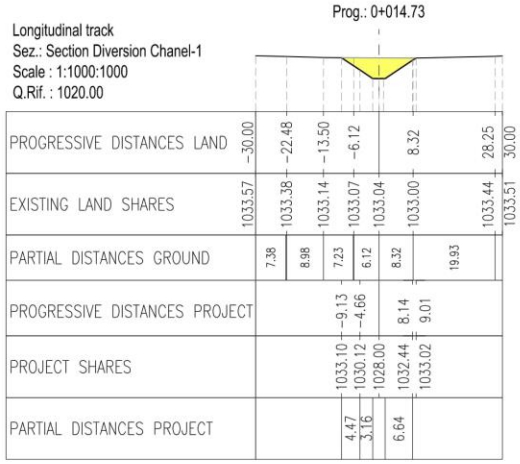
Name	Type	Cut Factor	Fill Factor	2d Area (m quad.)	Cut (M. cub.)	Fill (M. cub.)	Net (M. cub.)
Bilancio volumi canale	full	1.000	1.000	9719.97	24122.68	0.00	24122.68<Cut>

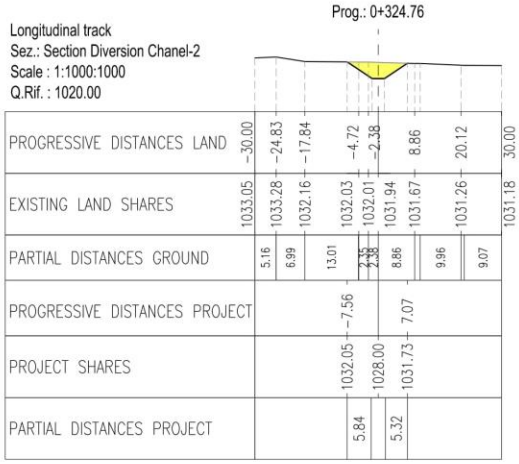
Totals

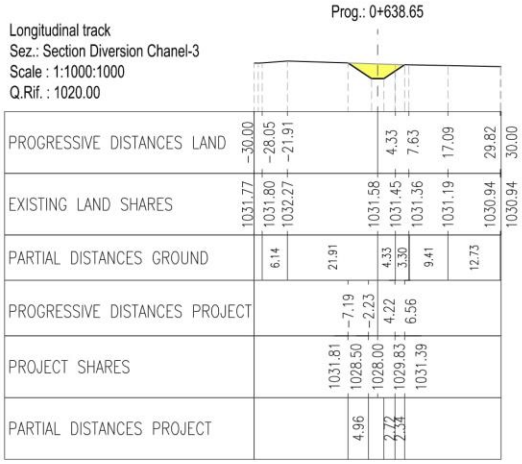
	2d Area (m quad.)	Cut (M. cub.)	Fill (M. cub.)	Net (M. cub.)
Total	9719.97	24122.68	0.00	24122.68<Cut>

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:		DRAWING TITLE Diversion Canal Ian DRAWING NO. I.0 DATE: SCALE:	REVISIONS Rev Date Description



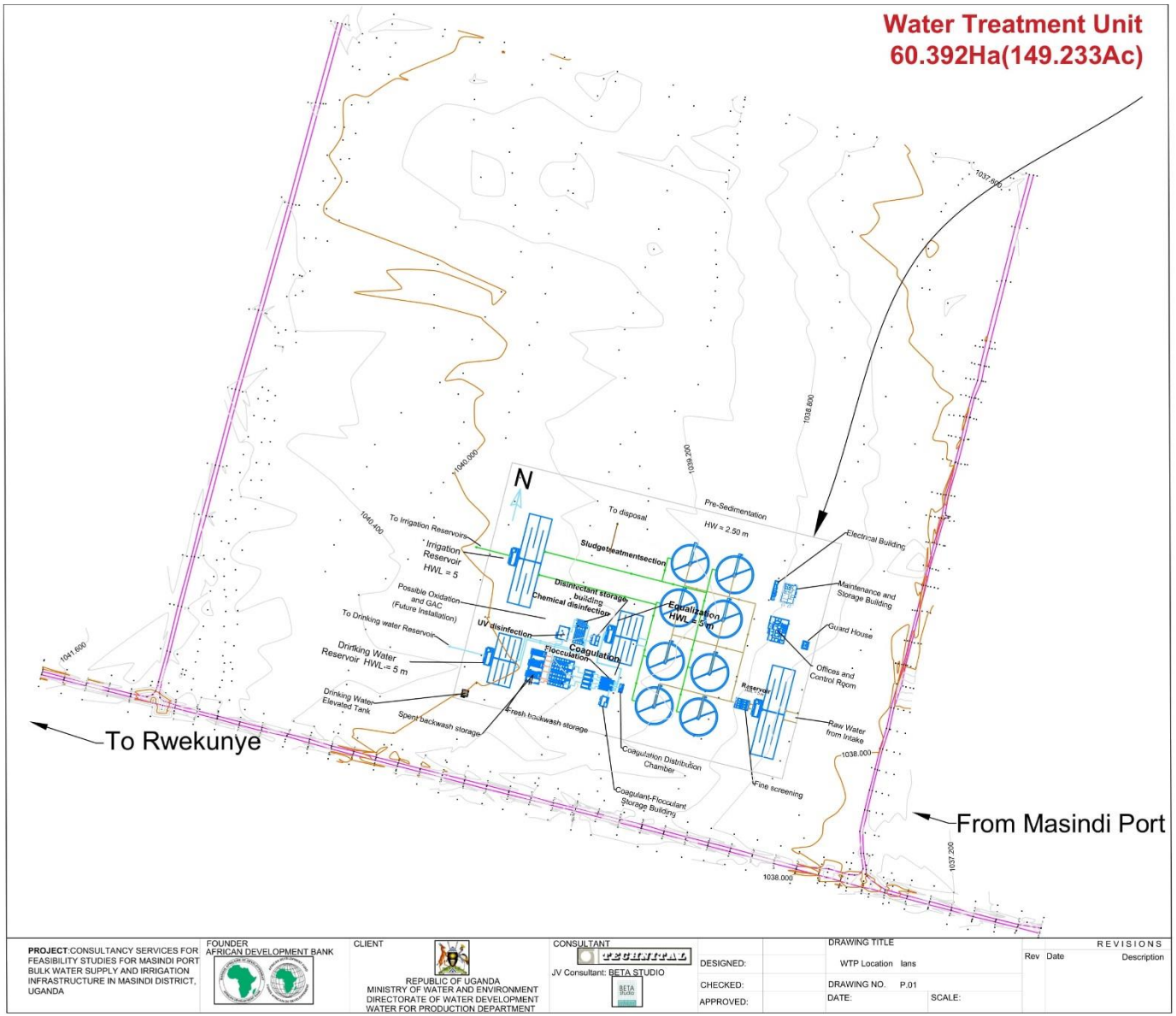






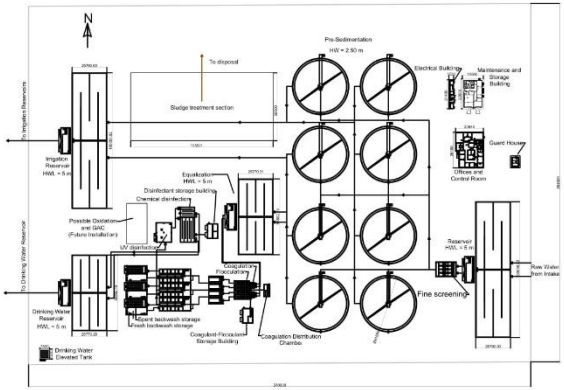


PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE Diversion Canal Section and ro ile DRAWING NO. I.10 DATE: SCALE:	REVISIONS Rev / Date / Description

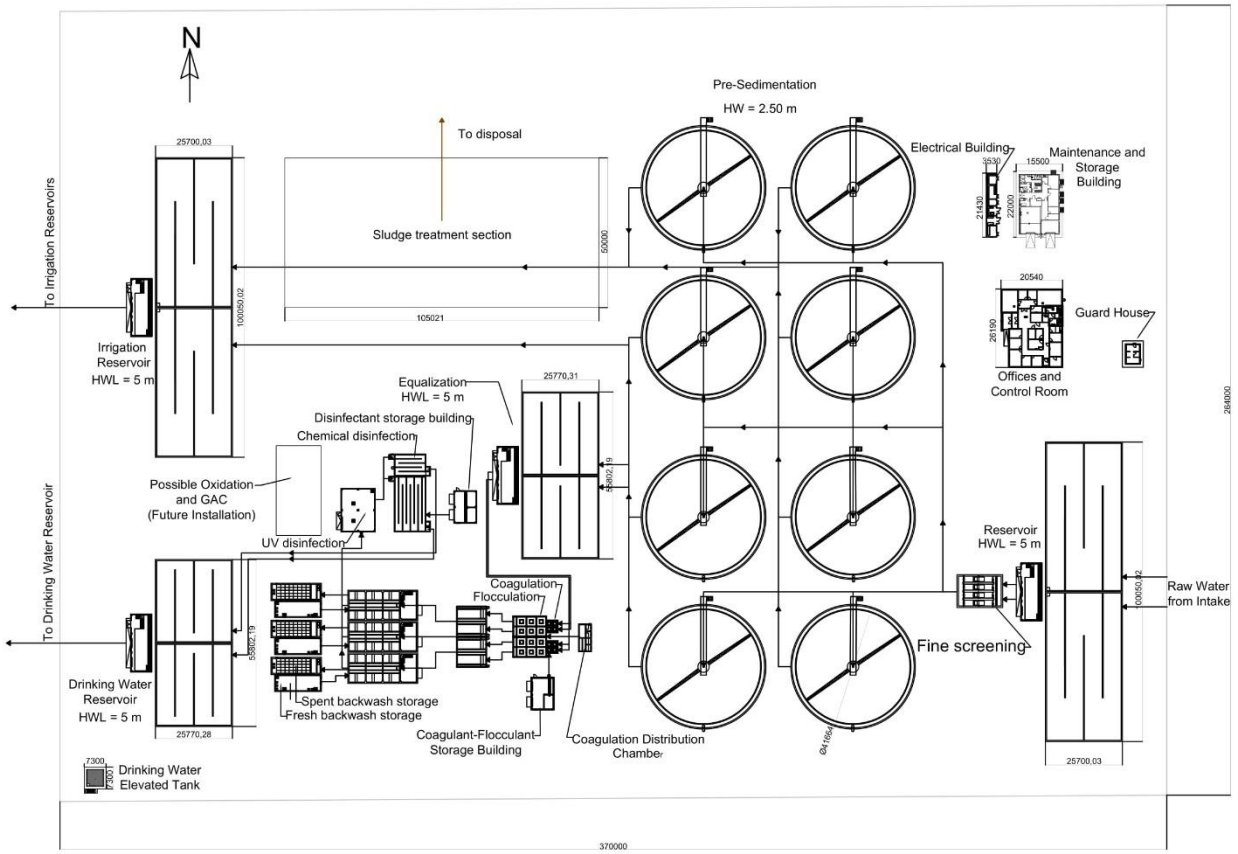

Water Treatment Unit
60.392Ha(149.233Ac)
N
To Rwekunye
From Masindi Port
To disposal
Pre-Sedimentation
HW = 2.50 m
Sludge treatment section
To Irrigation Reservoirs
Irrigation Reservoir HWL = 5
Possible Oxidation and GAC (Future Installation)
Disinfectant storage building
Chemical disinfection
UV disinfection
Equalization HWL = 5 m
To Drinking water Reservoir
Drirtking Water Reservoir HWL = 5 m
Flocculation
Coagulation
Drinking Water Elevated Tank
Spent backwash storage
Fresh backwash storage
Coagulation Distribution Chamber
Coagulant-Flocculant Storage Building
Fine screening
Raw Water from Intake
Reservoir
Offices and Control Room
Guard House
Maintenance and Storage Building
Electrical Building
1041.600
1040.400
1040.000
1039.200
1038.800
1038.000
1037.800
1037.200
PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA
FOUNDER
AFRICAN DEVELOPMENT BANK
CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT
CONSULTANT
JV Consultant: BETA STUDIO
DESIGNED:
CHECKED:
APPROVED:
DRAWING TITLE
WTP Location lans
DRAWING NO. P.01
DATE:
SCALE:
REVISIONS
Rev Date Description

800000

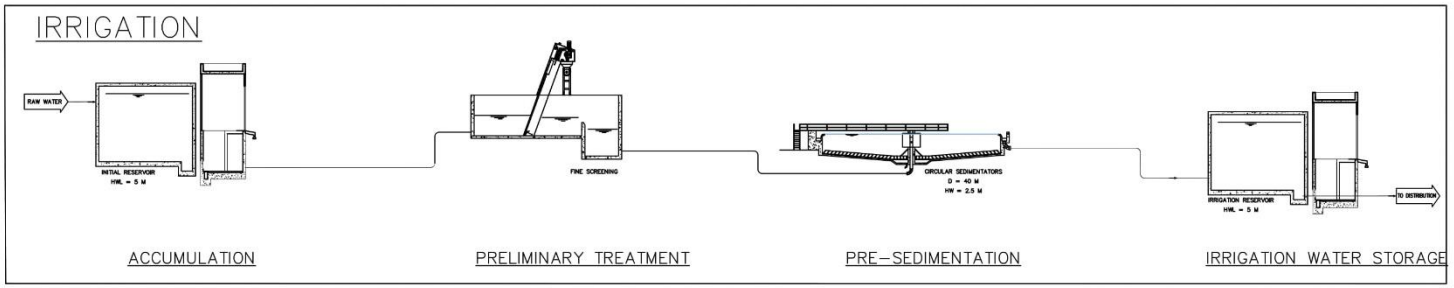
740000

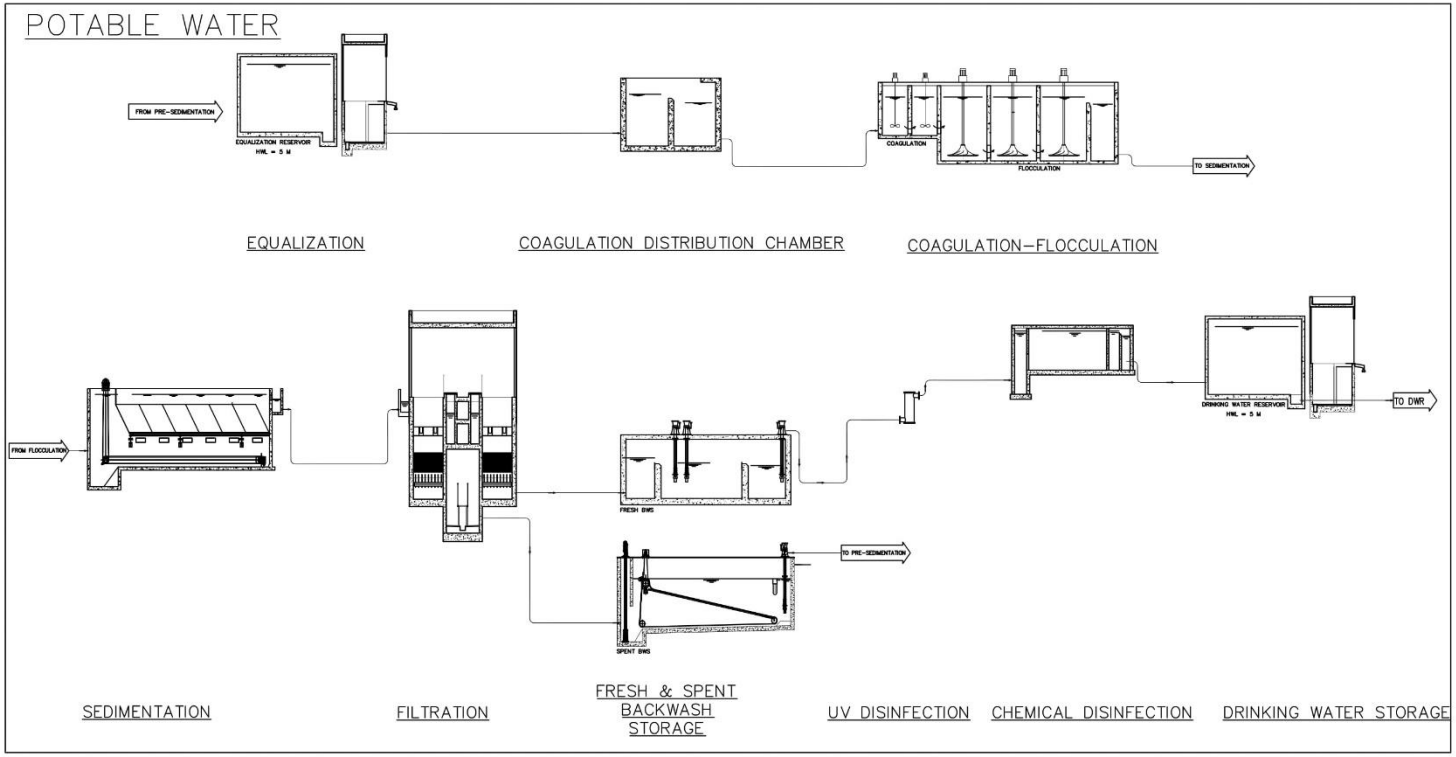


PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED:		DRAWING TITLE WT General lan	REVISIONS Rev Date Description
				CHECKED:		DRAWING NO. P.02	
				APPROVED:		DATE: SCALE:	

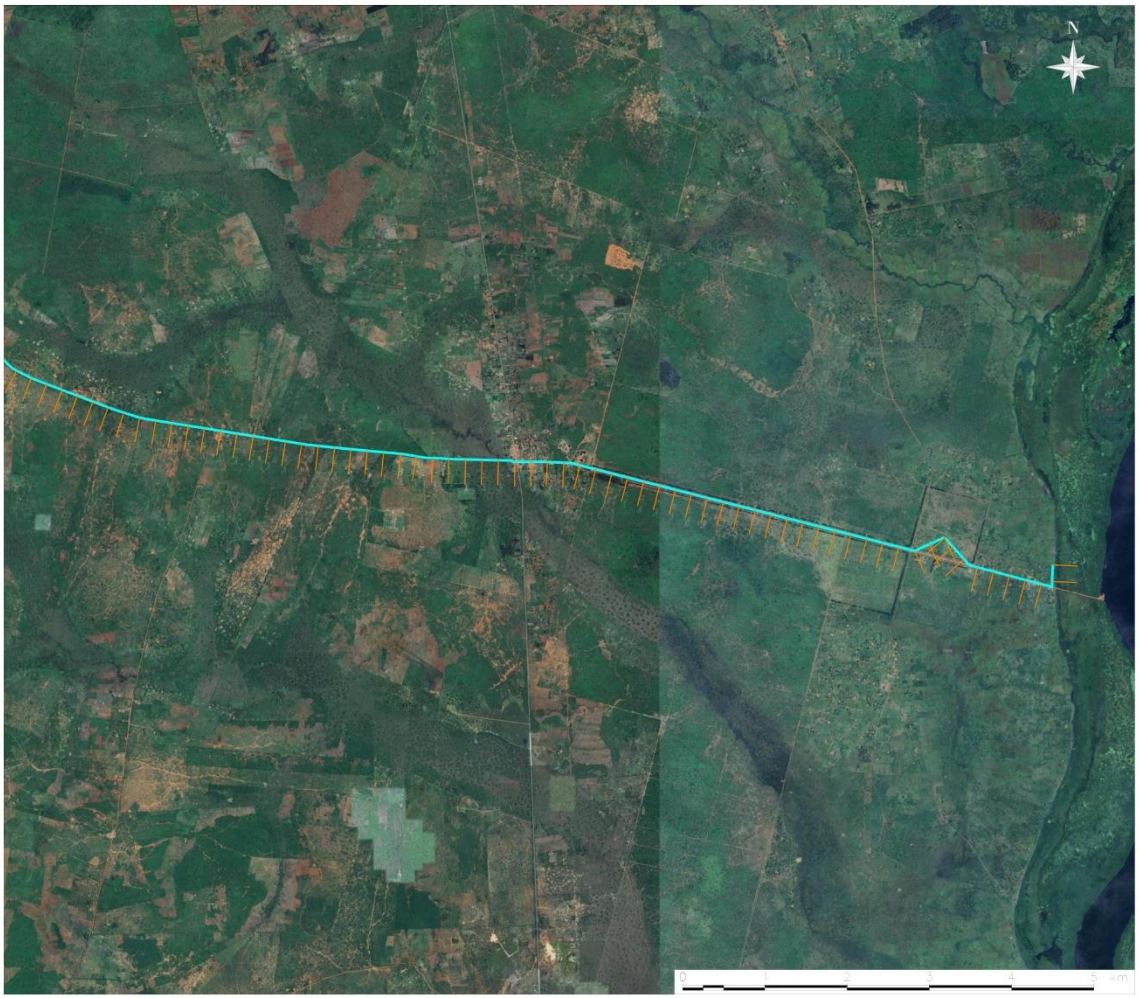


PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO			DRAWING TITLE WTP Site Plan	REVISIONS Rev / Date / Description
				DESIGNED:			
				CHECKED:		DRAWING NO. P.03	
				APPROVED:		DATE: / SCALE:	





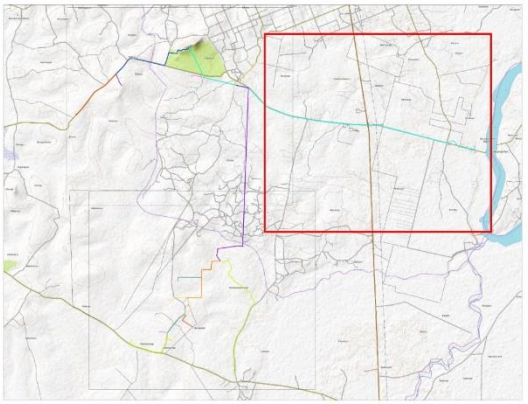
PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:		DRAWING TITLE Irrigation and Potable Water Treatment Process DRAWING NO. P.04 DATE: SCALE:	REVISIONS Rev Date Description



LEGEND

- PIPE DN 1600 mm
- PIPE DN 1200 mm
- PIPE DN 1100 mm
- PIPE DN 1000 mm
- PIPE DN 900 mm
- PIPE DN 800 mm
- PIPE DN 700 mm
- PIPE DN 650 mm
- PIPE DN 600 mm
- PIPE DN 500 mm
- PIPE DN 400 mm
- PIPE DN 300 mm

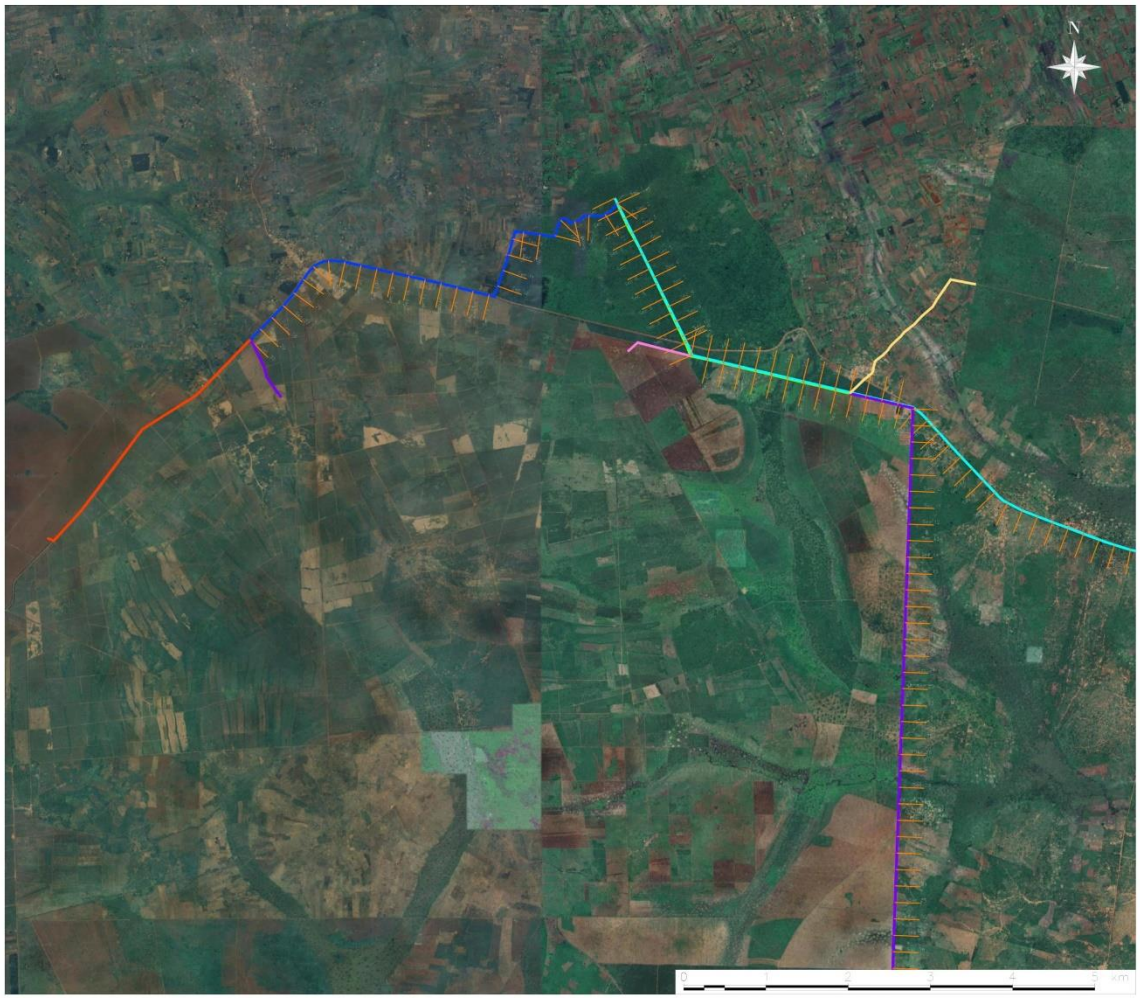
KEY PLAN



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER: AFRICAN DEVELOPMENT BANK	CLIENT: REPUBLIC OF UGANDA, MINISTRY OF WATER AND ENVIRONMENT, DIRECTORATE OF WATER DEVELOPMENT, **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT: TECHNITAL; JV Consultant: BETA STUDIO

DESIGNED:	MZ	DRAWING TITLE: Water Transmission Line, Transmission line general plan	
CHECKED:	AT	DRAWING NO.	TL.01.01
APPROVED:	AC	DATE: March 2025	SCALE: 1:10,000

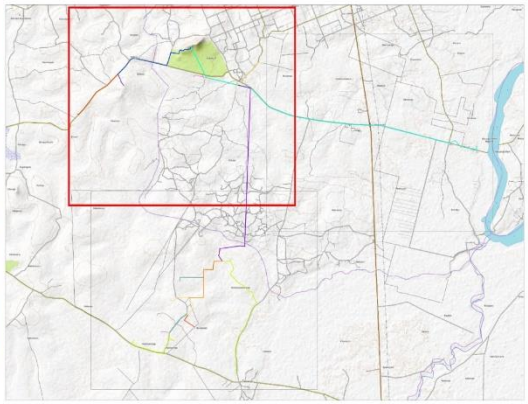
REVISIONS		
Rev	Date	Description



LEGEND

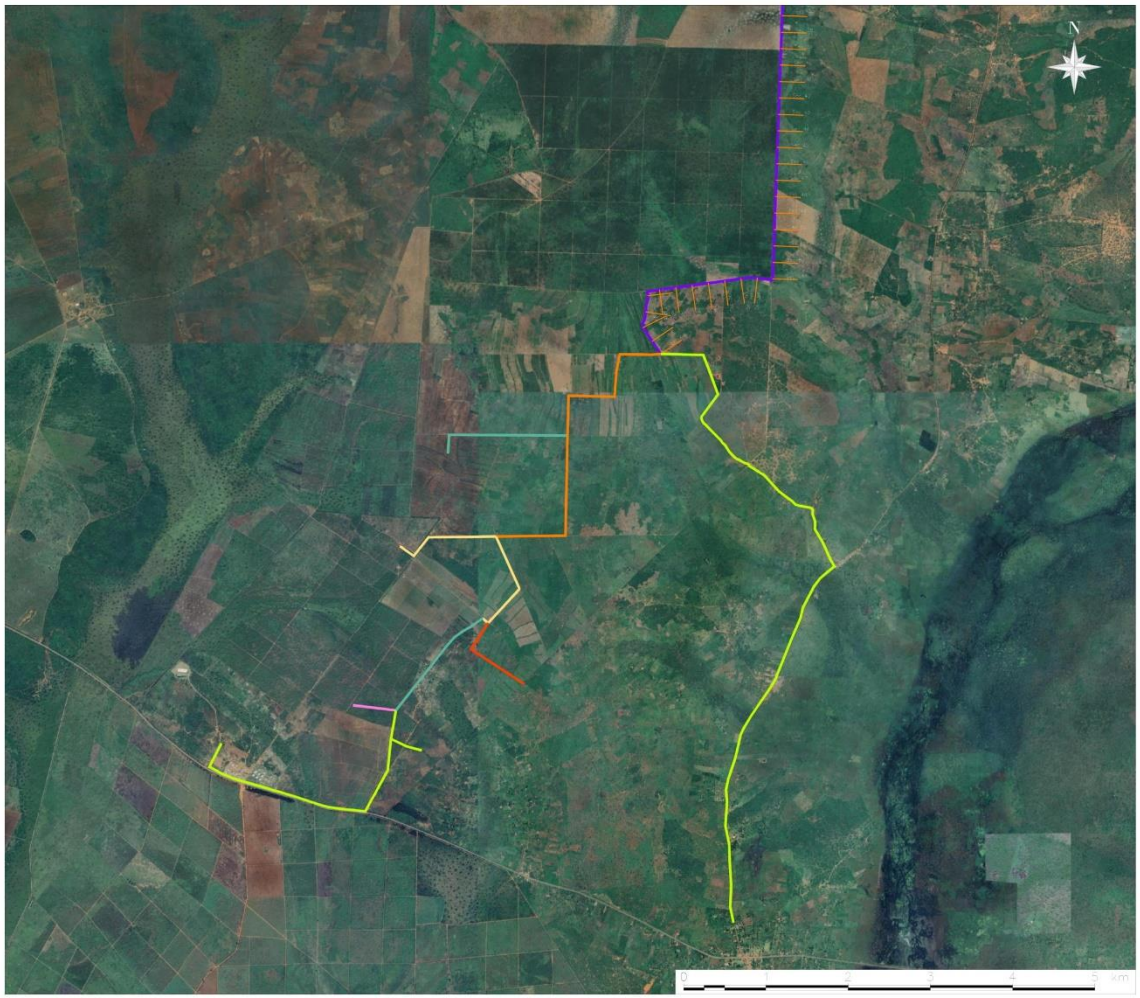
- PIPE DN 1600 mm
- PIPE DN 1200 mm
- PIPE DN 1100 mm
- PIPE DN 1000 mm
- PIPE DN 900 mm
- PIPE DN 800 mm
- PIPE DN 700 mm
- PIPE DN 650 mm
- PIPE DN 600 mm
- PIPE DN 500 mm
- PIPE DN 400 mm
- PIPE DN 300 mm

KEY PLAN



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE: Water Transmission Line Transmission line general plan DRAWING NO. TL.01.02 DATE: March 2025 SCALE: 1:10,000

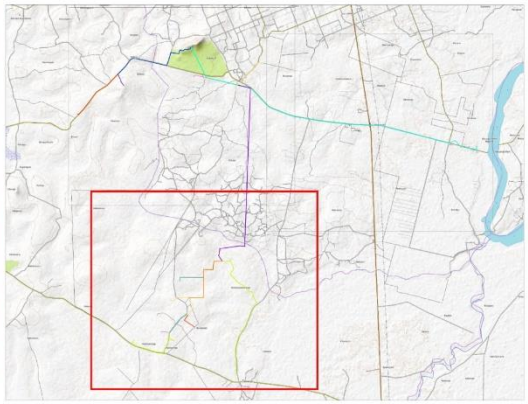
REVISIONS		
Rev	Date	Description



LEGEND

- PIPE DN 1600 mm
- PIPE DN 1200 mm
- PIPE DN 1100 mm
- PIPE DN 1000 mm
- PIPE DN 900 mm
- PIPE DN 800 mm
- PIPE DN 700 mm
- PIPE DN 650 mm
- PIPE DN 600 mm
- PIPE DN 500 mm
- PIPE DN 400 mm
- PIPE DN 300 mm

KEY PLAN



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC

DRAWING TITLE: Water Transmission Line
Transmission line general plan

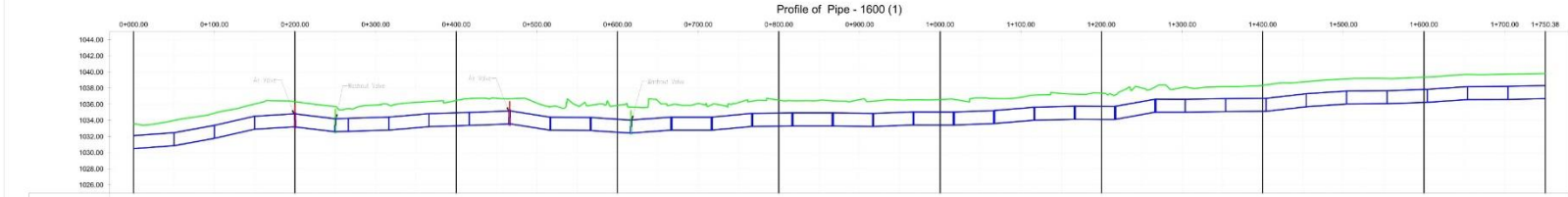
DRAWING NO. TL.01.03

DATE: March 2025

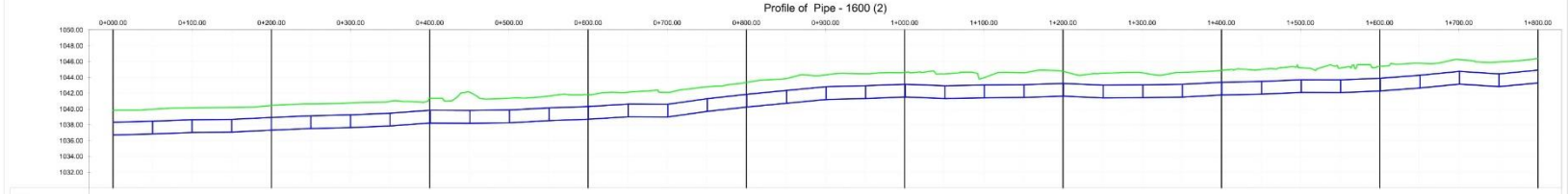
SCALE: 1:10,000

REVISIONS

Rev	Date	Description


Profile of Pipe - 1600 (1)
0+000.00
0+100.00
0+200.00
0+300.00
0+400.00
0+500.00
0+600.00
0+700.00
0+800.00
0+900.00
1+000.00
1+100.00
1+200.00
1+300.00
1+400.00
1+500.00
1+600.00
1+700.00
1+750.38
1044.00
1042.00
1040.00
1038.00
1036.00
1034.00
1032.00
1030.00
1028.00
1026.00
Air Valve
Scour Valve
Air Valve
Scour Valve

| | | |



Chainage [m]	Sec. 1	Sec. 2	Sec. 3	Sec. 4	Sec. 5	Sec. 6	Sec. 7	Sec. 8	Sec. 9	Sec. 10
Ground level [masl]	1039.82	1040.42	1041.33	1041.81	1043.35	1044.62	1044.75	1044.87	1045.39	1046.41
Pipe soffit depth [m]	1.50	1.50	1.50	1.50	1.50	1.49	1.52	1.50	1.50	1.51
DN [mm]		1600			1600					
Lenght [m]		400.77			3399.38					

Bottom Slope [%]		0.3%	0.4%	0.1%	0.5%	0.4%	0.2%	0.4%	0.7%	-0.0%	0.1%	0.5%	0.3%	0.6%	-0.0%	1.4%	1.1%	1.0%	1.0%	0.3%	0.4%	-0.4%	0.2%	0.1%	0.3%	-0.4%	0.1%	0.1%	0.5%	0.2%	0.4%	-0.0%	0.4%	0.8%	1.0%	-0.6%	1.0%

PROJECT:
CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
TECHNITAL
JV Consultant: BETA STUDIO

DESIGNED:	MZ
CHECKED:	AT
APPROVED:	AC

DRAWING TITLE
Water Transmission Line
Pipeline profile

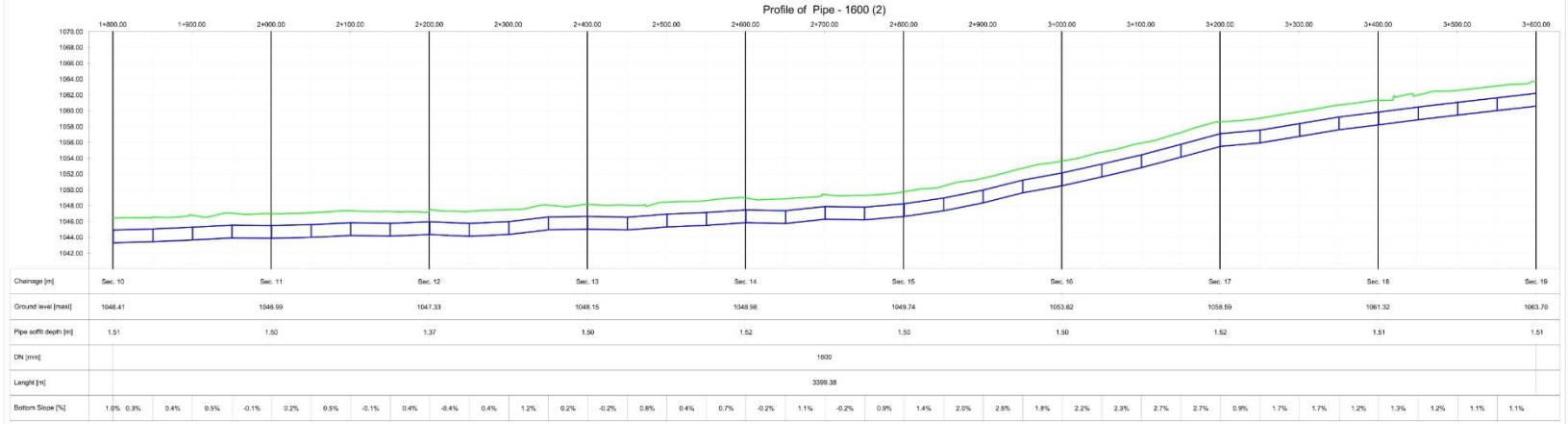
DRAWING NO. TL.02.02

DATE: March 2025

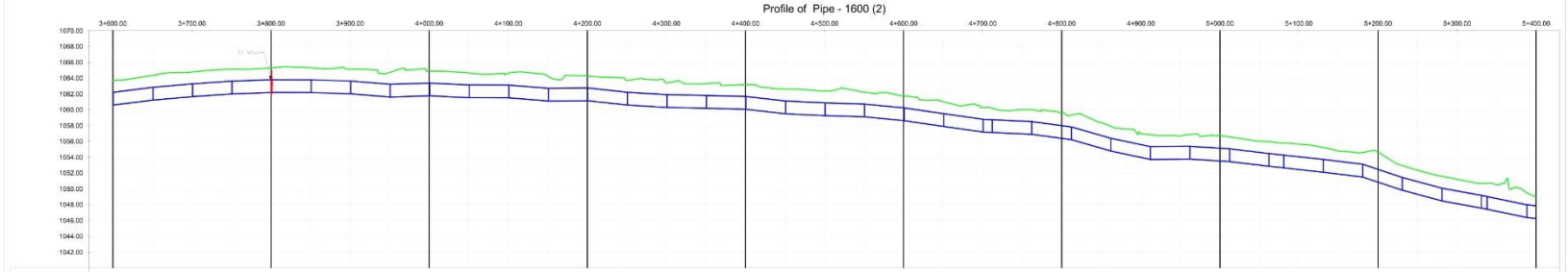
SCALE: 1:5,000 Horizontal
1:500 Vertical

REVISIONS

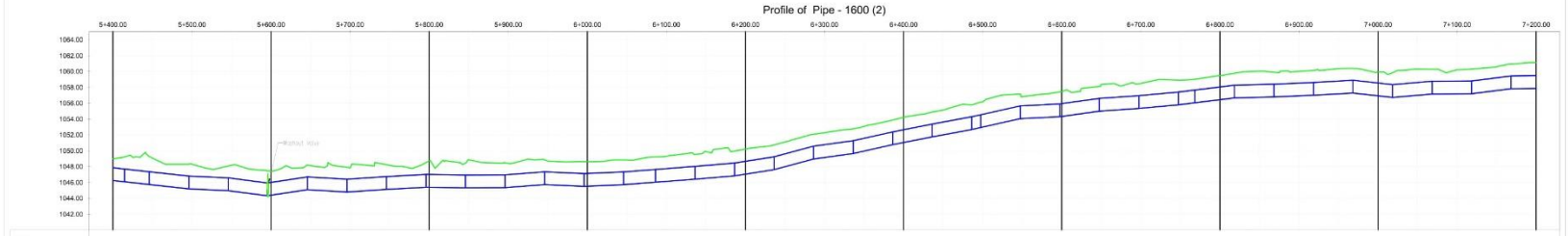
Rev	Date	Description


Profile of Pipe - 1600 (2)
1+800.00
1+900.00
2+000.00
2+100.00
2+200.00
2+300.00
2+400.00
2+500.00
2+600.00
2+700.00
2+800.00
2+900.00
3+000.00
3+100.00
3+200.00
3+300.00
3+400.00
3+500.00
3+600.00
1070.00
1068.00
1066.00
1064.00
1062.00
1060.00
1058.00
1056.00
1054.00
1052.00
1050.00
1048.00
1046.00
1044.00
1042.00

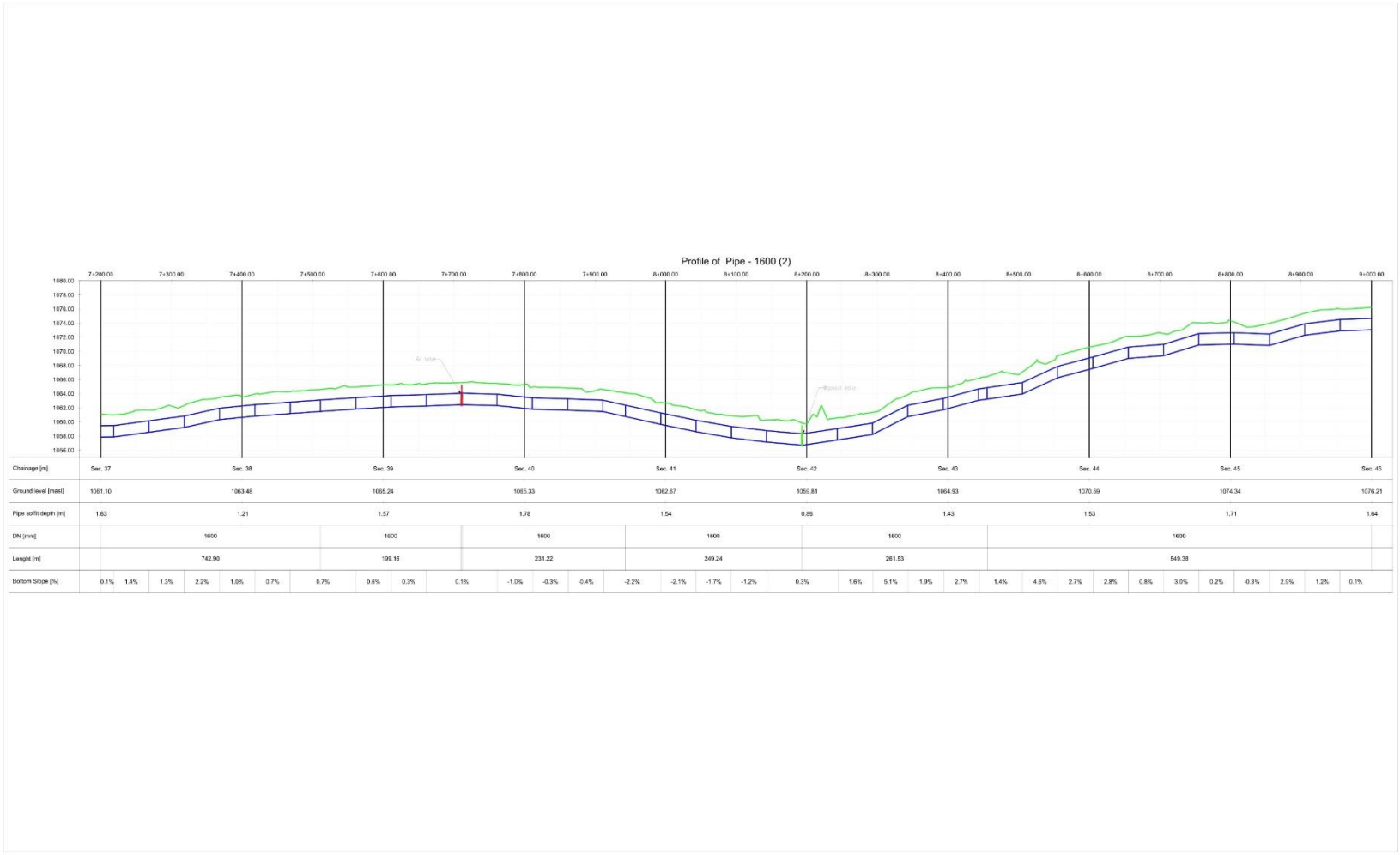
| | | |


Profile of Pipe - 1600 (2)
3+600.00
3+700.00
3+800.00
3+900.00
4+000.00
4+100.00
4+200.00
4+300.00
4+400.00
4+500.00
4+600.00
4+700.00
4+800.00
4+900.00
5+000.00
5+100.00
5+200.00
5+300.00
5+400.00
1070.00
1068.00
1066.00
1064.00
1062.00
1060.00
1058.00
1056.00
1054.00
1052.00
1050.00
1048.00
1046.00
1044.00
1042.00
Air Valve

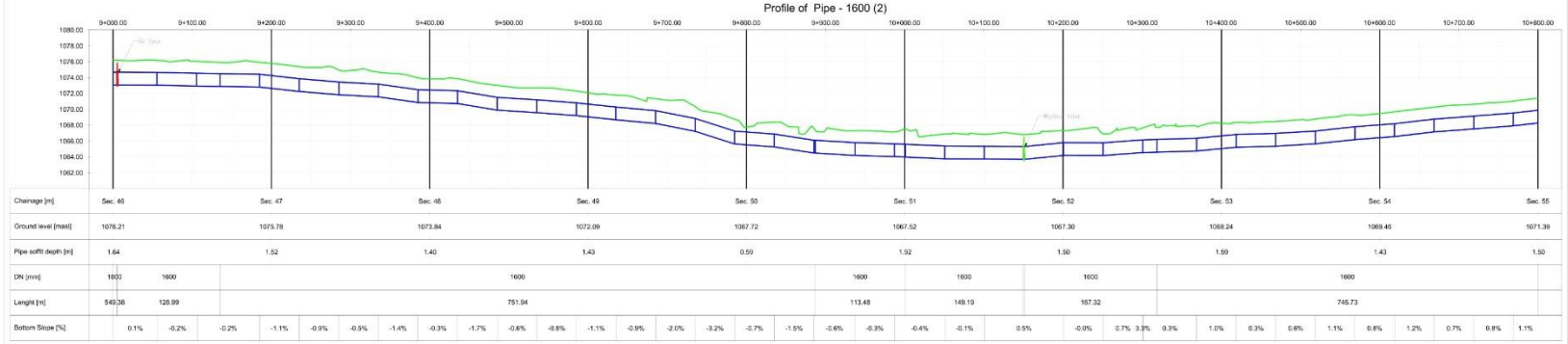
| | | |


Profile of Pipe - 1600 (2)
5+400.00
5+500.00
5+600.00
5+700.00
5+800.00
5+900.00
6+000.00
6+100.00
6+200.00
6+300.00
6+400.00
6+500.00
6+600.00
6+700.00
6+800.00
6+900.00
7+000.00
7+100.00
7+200.00
1064.00
1062.00
1060.00
1058.00
1056.00
1054.00
1052.00
1050.00
1048.00
1046.00
1044.00
1042.00

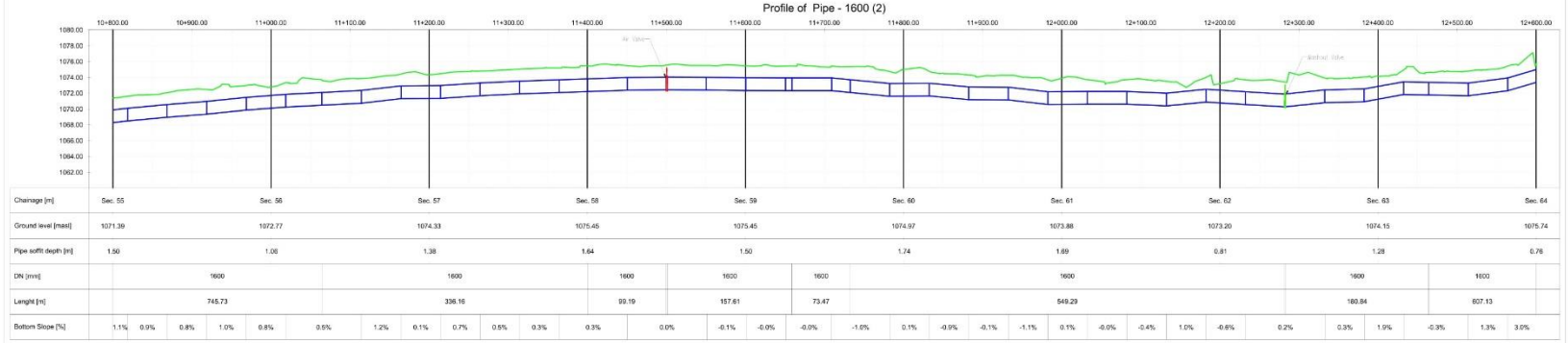
| | | |



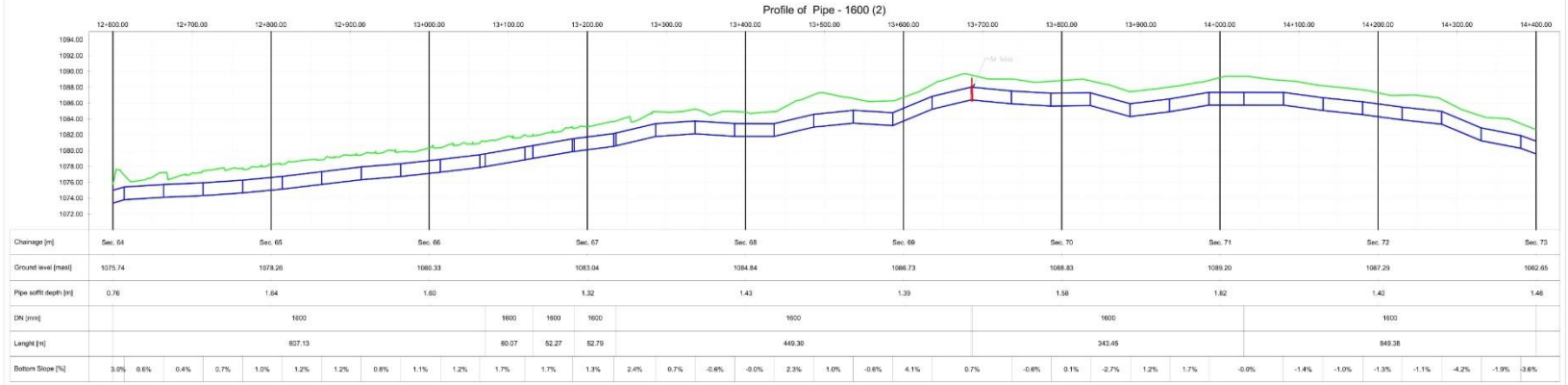
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.06 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.07 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.08 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev / Date / Description	



PROJECT:
CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
TECHNITAL
JV Consultant: BETA STUDIO

DESIGNED:	MZ
CHECKED:	AT
APPROVED:	AC

DRAWING TITLE
Water Transmission Line
Pipeline profile

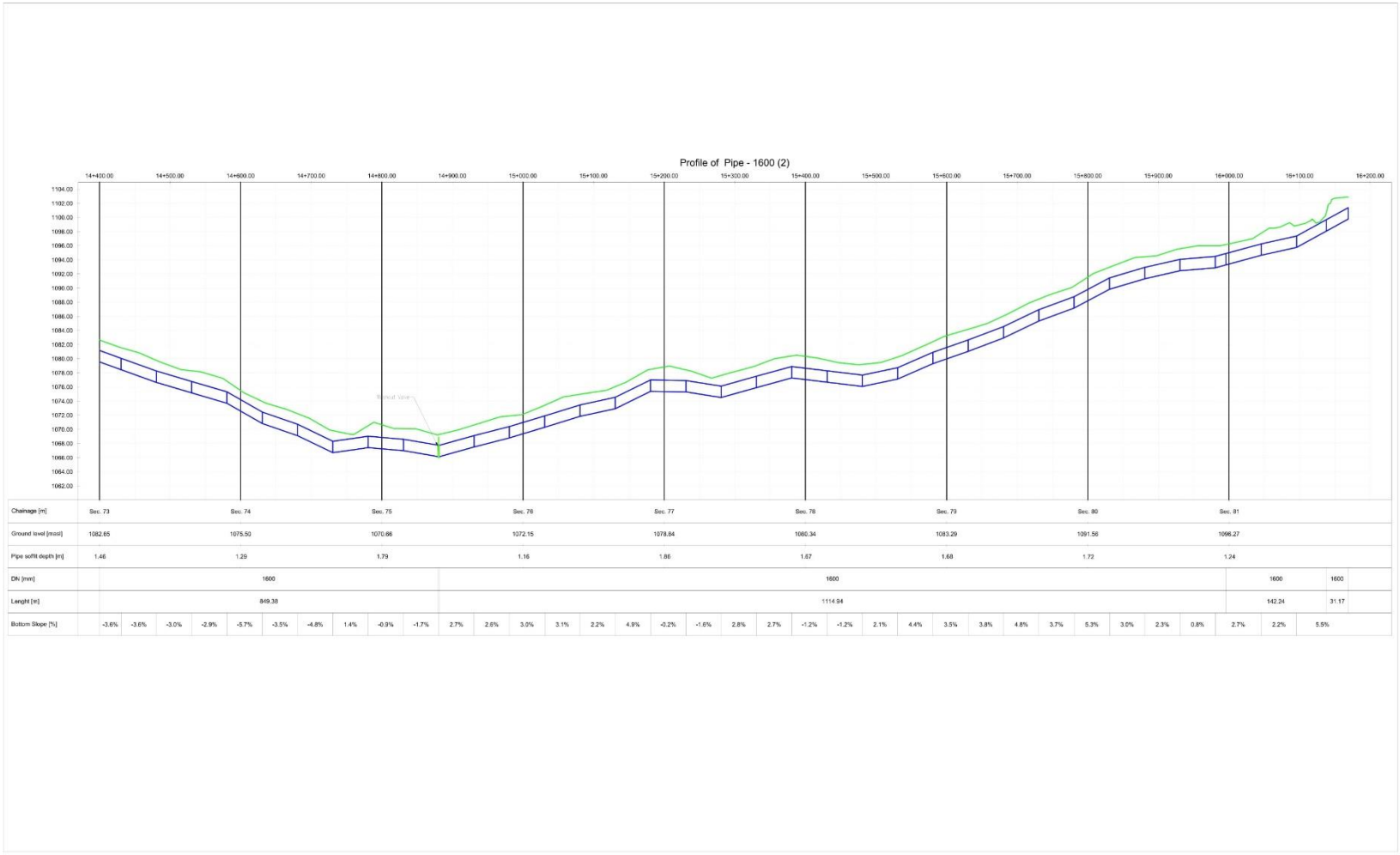
DRAWING NO. TL.02.09

DATE: March 2025

SCALE:
1:5,000 Horizontal
1:500 Vertical

REVISIONS

Rev	Date	Description



PROJECT:
CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
JV Consultant: BETA STUDIO

DESIGNED:	MZ
CHECKED:	AT
APPROVED:	AC

DRAWING TITLE
Water Transmission Line
Pipeline profile

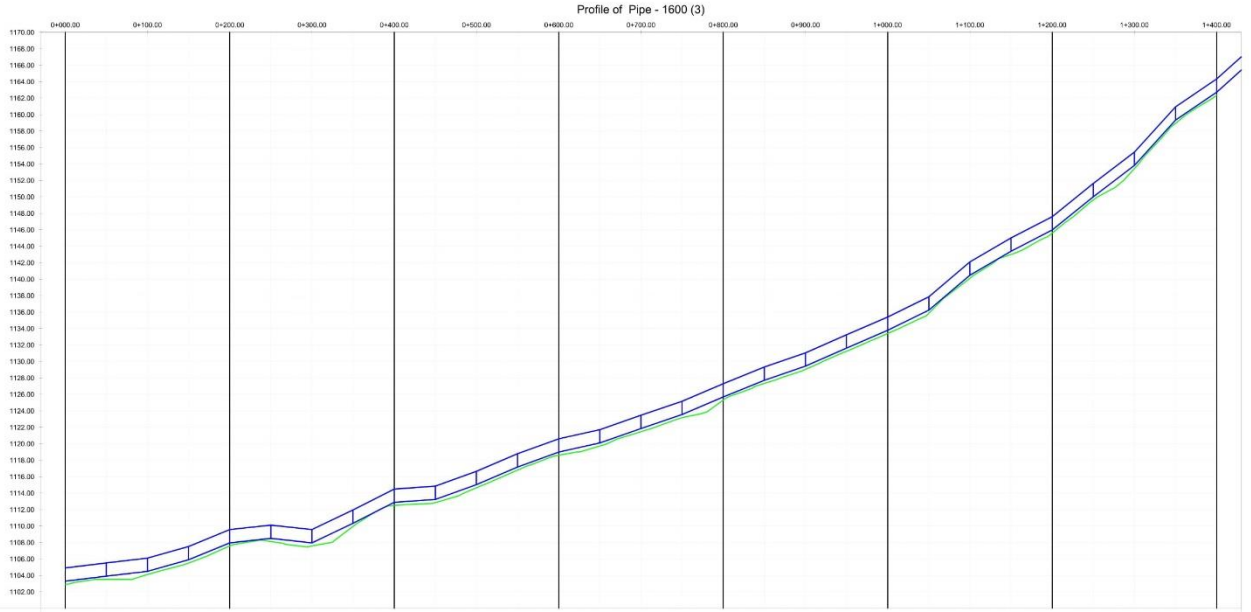
DRAWING NO. TL.02.10

DATE: March 2025

SCALE: 1:5,000 Horizontal
1:500 Vertical

REVISIONS

Rev	Date	Description



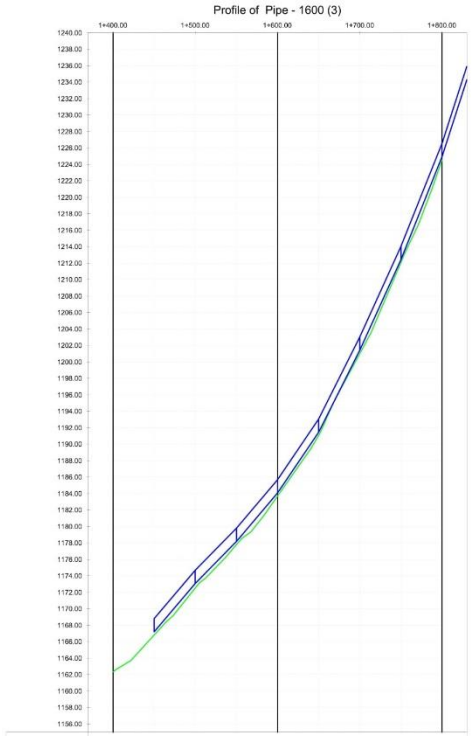
Chainage [m]	Sec. 1	Sec. 2	Sec. 3	Sec. 4	Sec. 5	Sec. 6	Sec. 7	Sec. 8
Ground level [masl]	1102.91	1107.57	1112.50	1118.60	1125.30	1133.40	1145.60	1162.35
Pipe soffit depth [m]	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00
DN [mm]	1600							
Lenght [m]	1970.35							

Bottom Slope [%]		1.2%	1.2%	2.8%	4.1%	1.1%	-1.1%	4.8%	5.1%	0.7%	3.6%	4.3%	3.6%	2.2%	3.8%	3.4%	4.3%	4.1%	3.4%	4.4%	4.3%	4.9%	8.5%	5.8%	5.2%	8.1%	7.6%	11.0%	6.8%	8.9%

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO

DESIGNED:	MZ	DRAWING TITLE: Water Transmission Line Pipeline profile	
CHECKED:	AT	DRAWING NO.	TL.02.11
APPROVED:	AC	DATE: March 2025	SCALE: 1:5,000 Horizontal 1:500 Vertical

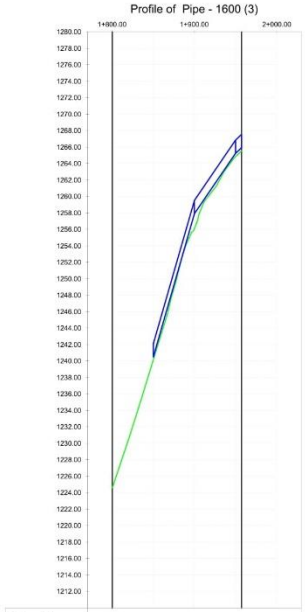
REVISIONS		
Rev	Date	Description



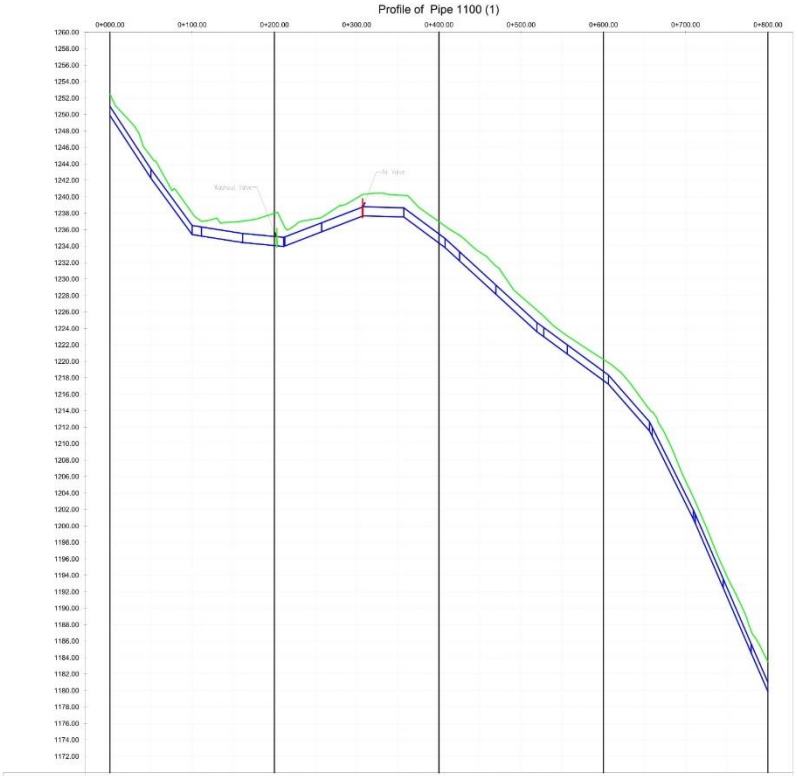
Chainage [m]	Sec. 8				Sec. 9				Sec. 10	
Ground level [masl]	1162.35				1183.69				1224.57	
Pipe soffit depth [m]	-2.00				-2.00				-2.00	
DN [mm]	1600									
Lenght [m]	1970.35									
Bottom Slope [%]	6.8%	8.9%	11.7%	10.2%	11.8%	14.7%	19.9%	22.1%	25.0%	31.1%

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.12 DATE: March 2025 SCALE: 1:5,000 Horizontal 1:500 Vertical

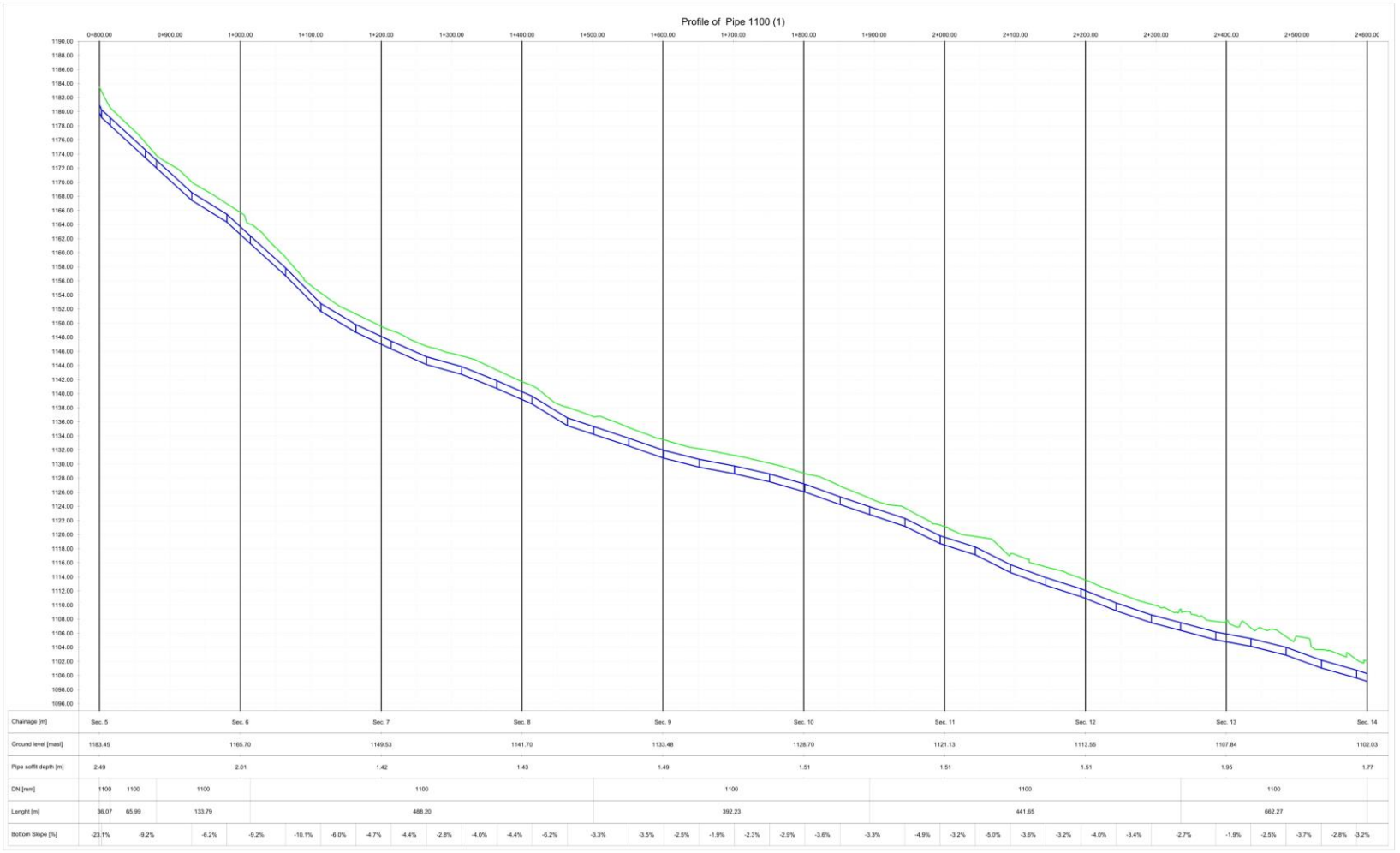
REVISIONS		
Rev	Date	Description



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.13 DATE: March 2025 SCALE: 1:5,000 Horizontal 1:500 Vertical	REVISIONS Rev Date Description



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.14 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description



PROJECT:
CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
JV Consultant: BETA STUDIO

DESIGNED:	MZ
CHECKED:	AT
APPROVED:	AC

DRAWING TITLE
Water Transmission Line
Pipeline profile

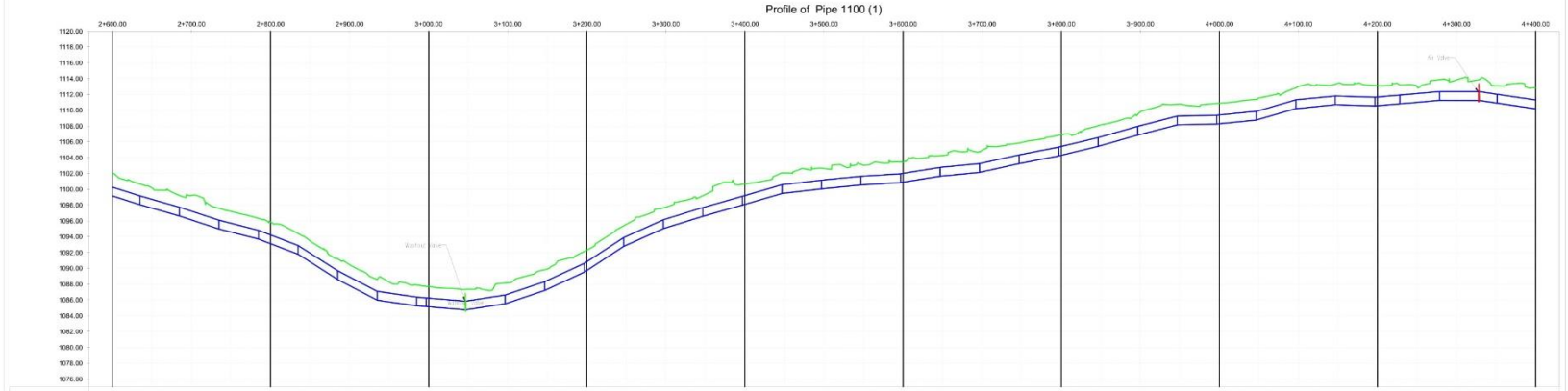
DRAWING NO. TL.02.15

DATE: March 2025

SCALE: 1:5,000 Horizontal
1:500 Vertical

REVISIONS

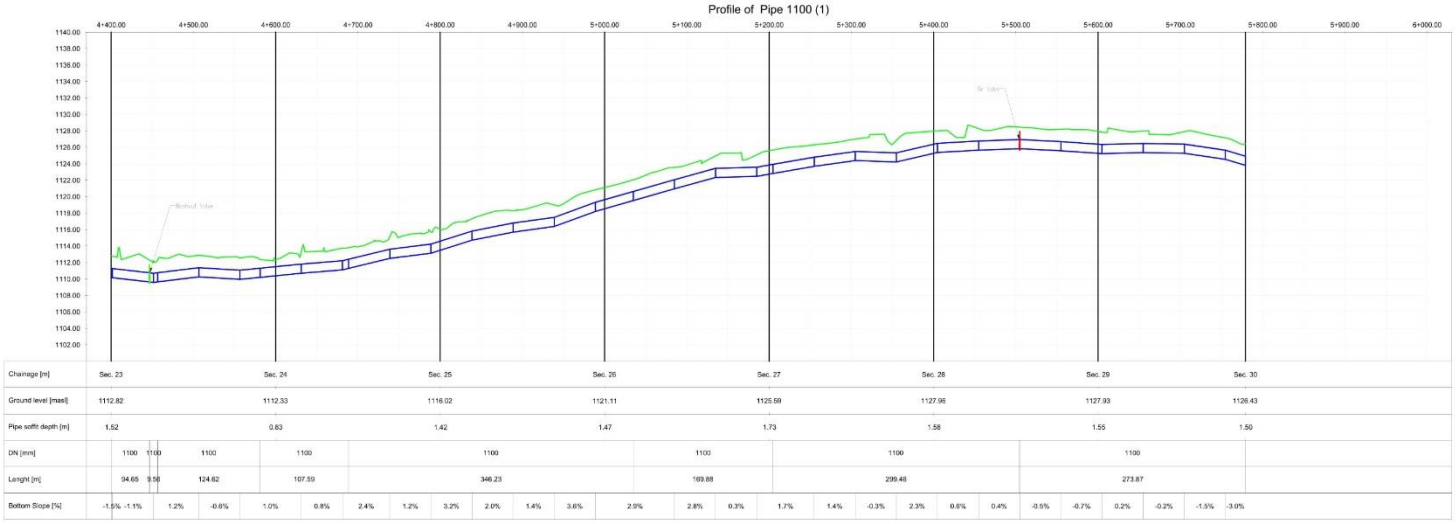
Rev	Date	Description



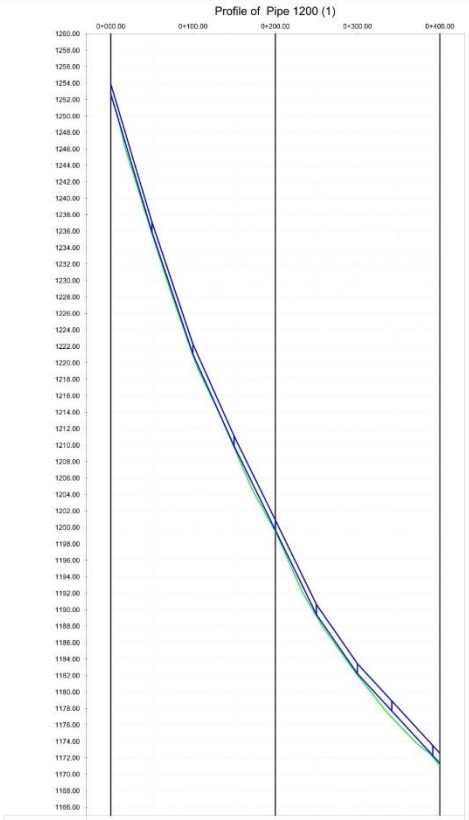
Chainage [m]	Sec. 14	Sec. 15	Sec. 16	Sec. 17	Sec. 18	Sec. 19	Sec. 20	Sec. 21	Sec. 22	Sec. 23
Ground level [mast]	1102.03	1095.85	1087.70	1092.28	1100.67	1103.43	1106.90	1110.90	1113.10	1112.82
Pipe soffit depth [m]	1.77	1.83	1.46	1.45	1.46	1.42	1.49	1.50	1.42	1.52
DN [mm]		1100	1100		1100				1100	1100 1100
Lenght [m]		862.27	49.33		1181.62				99.32	22.86 94.65
Bottom Slope [%]	-3.2% -2.9% -3.3% -2.6% -3.8% -6.4% -5.2% -1.5% -0.8%	1.6% 3.4% 4.6% 6.5% 4.5% 3.1% 2.9% 2.9% 1.2% 1.0% 0.6% 1.6% 1.0% 2.2% 2.0% 2.4% 2.9% 2.6% 0.2% 1.0% 2.9% 1.0% -0.3%							0.9% -6.0%	-1.5%

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE: Water Transmission Line Pipeline profile DRAWING NO. TL.02.16 DATE: March 2025 SCALE: 1:5,000 Horizontal 1:500 Vertical

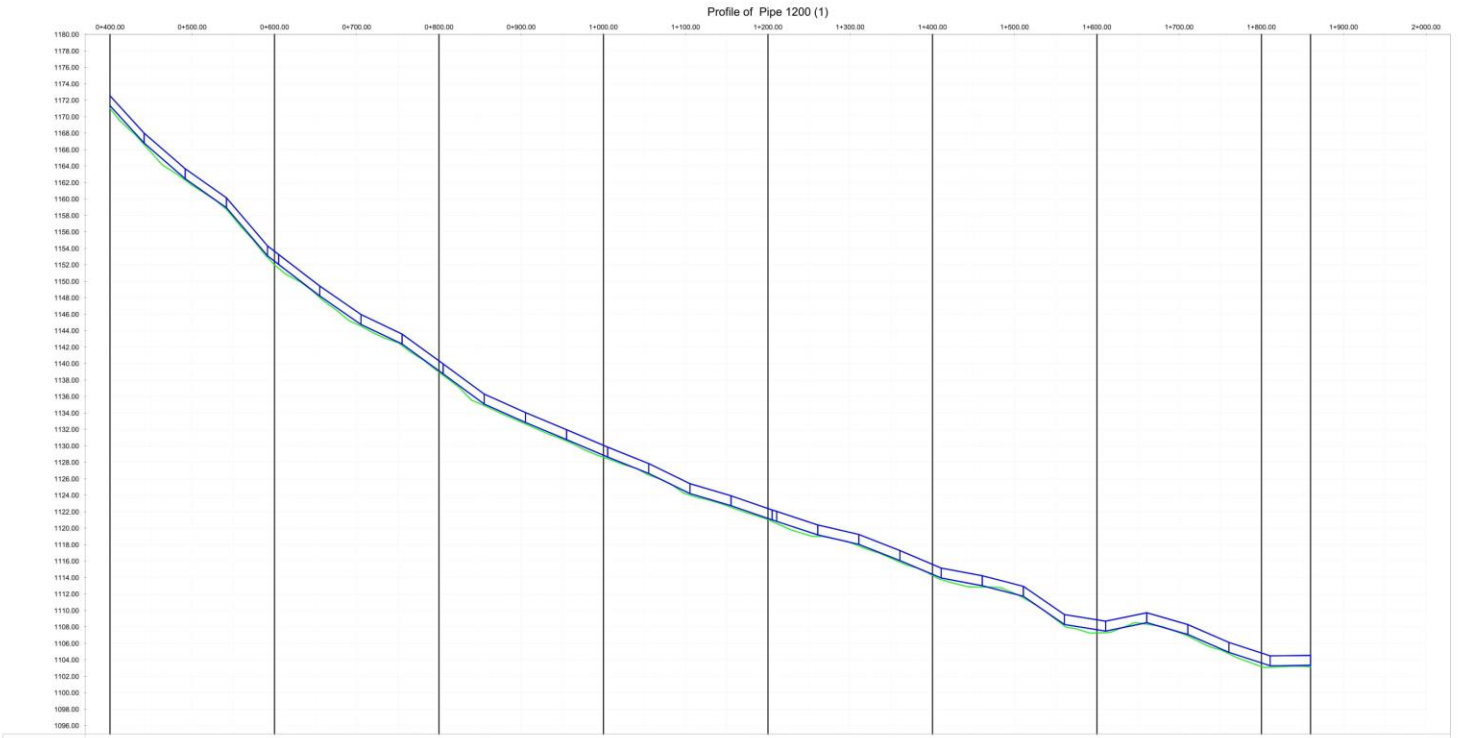
REVISIONS		
Rev	Date	Description



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.17 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.18 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description



Chainage [m]	Sec. 3		Sec. 4		Sec. 5		Sec. 6		Sec. 7		Sec. 8		Sec. 9		Sec. 10	Sec. 11
Ground level [masl]	1171.03		1151.99		1138.96		1128.63		1121.05		1114.26		1107.28		1103.20	1103.15
Pipe soffit depth [m]	-1.54		-1.67		-1.38		-1.45		-1.35		-1.34		-1.59		-1.63	-1.40
DN [mm]		1200				1200				1200						
Lenght [m]		264.89				606.25				649.64						
Bottom Slope [%]	-10.9%	-8.7%	-7.1%	-11.7%	-7.7%	-6.9%	-4.7%	-7.2%	-7.3%	-4.5%	-4.2%	-4.2%	-4.0%	-4.9%	-2.9%	-3.5%	-3.3%	-2.3%	-3.9%	-4.3%	-1.9%	-2.6%	-6.8%	-1.6%	2.1%	-2.9%	-4.3%	-3.3%	0.1%

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO

DESIGNED:	MZ
CHECKED:	AT
APPROVED:	AC

DRAWING TITLE: Water Transmission Line Pipeline profile

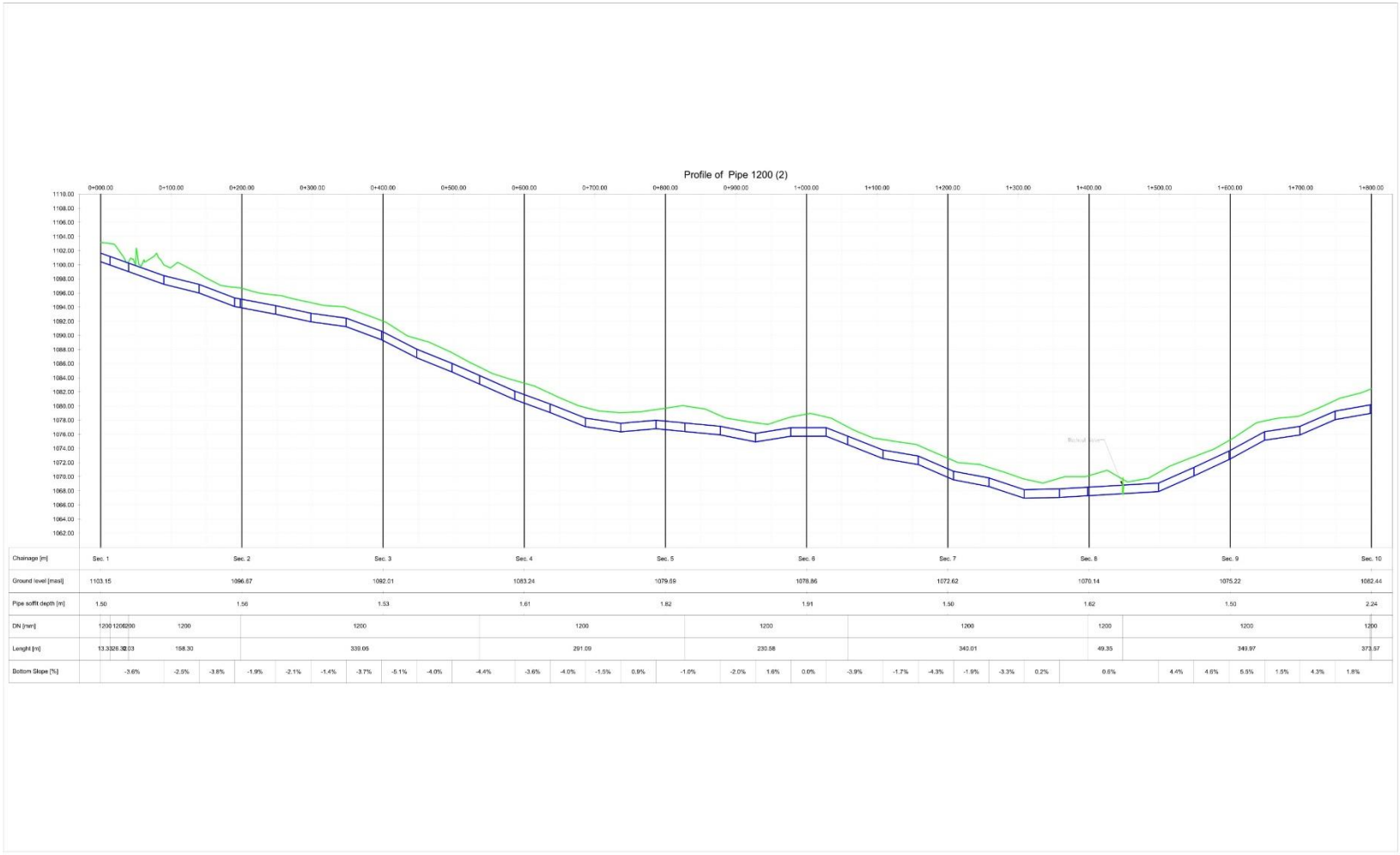
DRAWING NO. TL.02.19

DATE: March 2025

SCALE: 1:5,000 Horizontal 1:500 Vertical

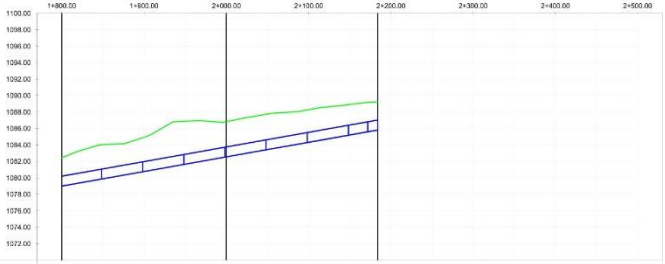
Rev	Date	Description

REVISIONS



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.20 DATE: March 2025 SCALE: 1:5,000 Horizontal 1:500 Vertical	REVISIONS Rev Date Description

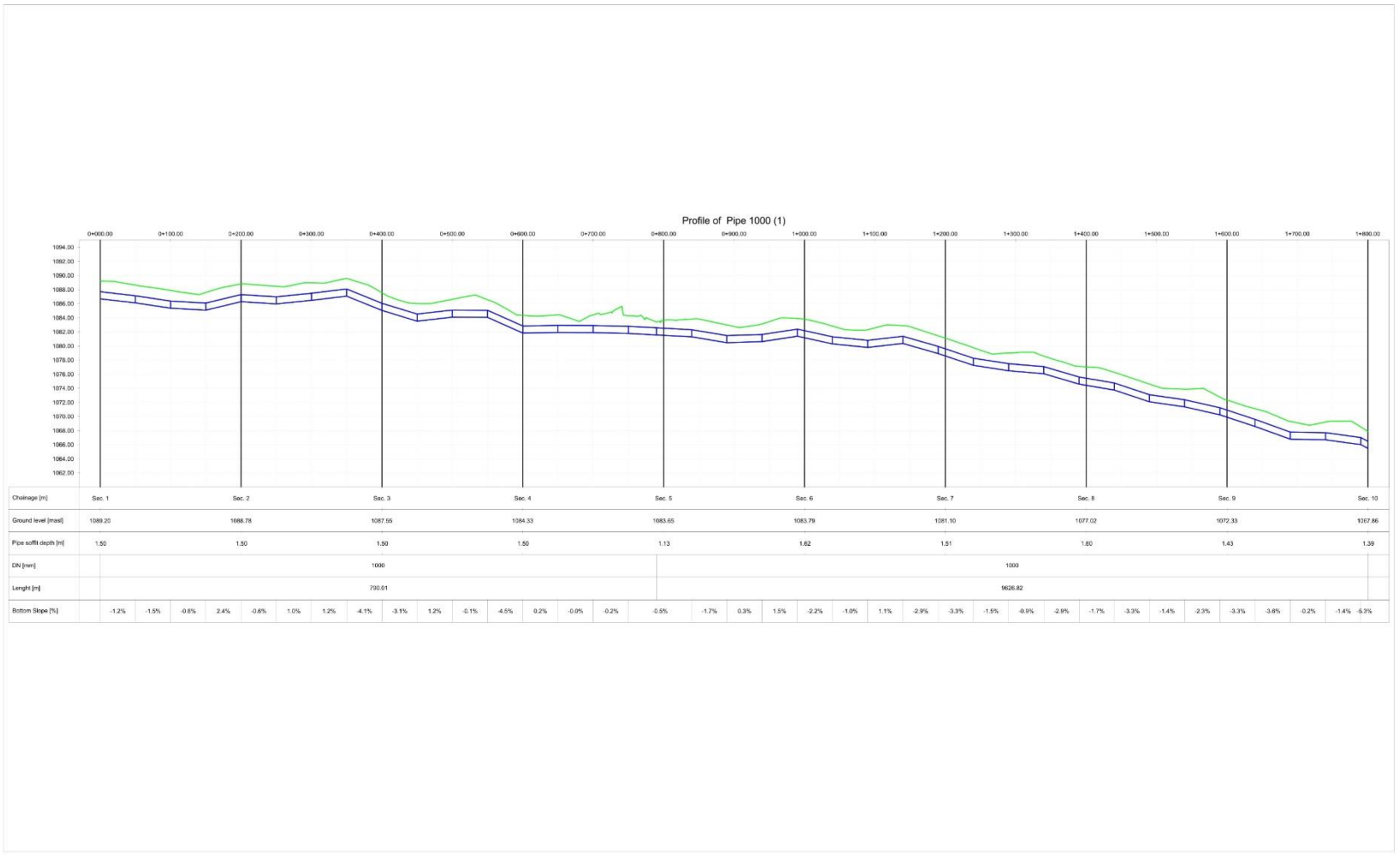
Profile of Pipe 1200 (2)



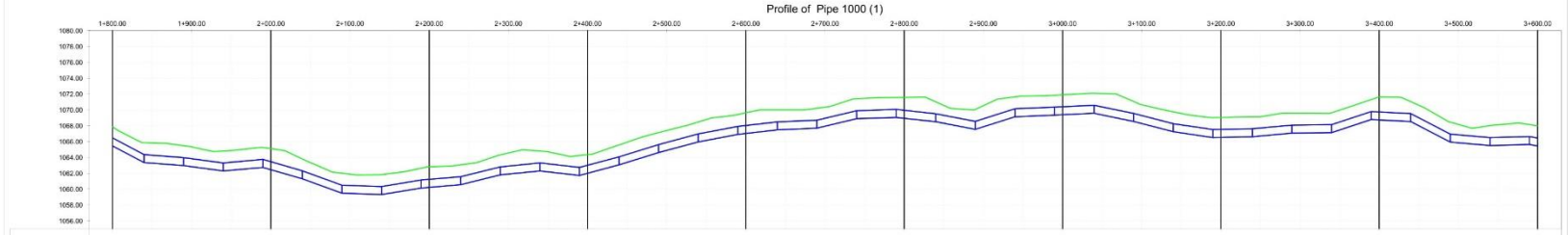
Chainage [m]	Sec. 10	Sec. 11	Sec. 12
Ground level [masl]	1082.44	1086.83	1089.20
Pipe soffit depth [m]	2.24	3.08	2.17
DN [mm]		1200	1200
Lenght [m]		373.57	12.28
Bottom Slope [%]		1.8%	

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.21 DATE: March 2025 SCALE: 1:5,000 Horizontal 1:500 Vertical

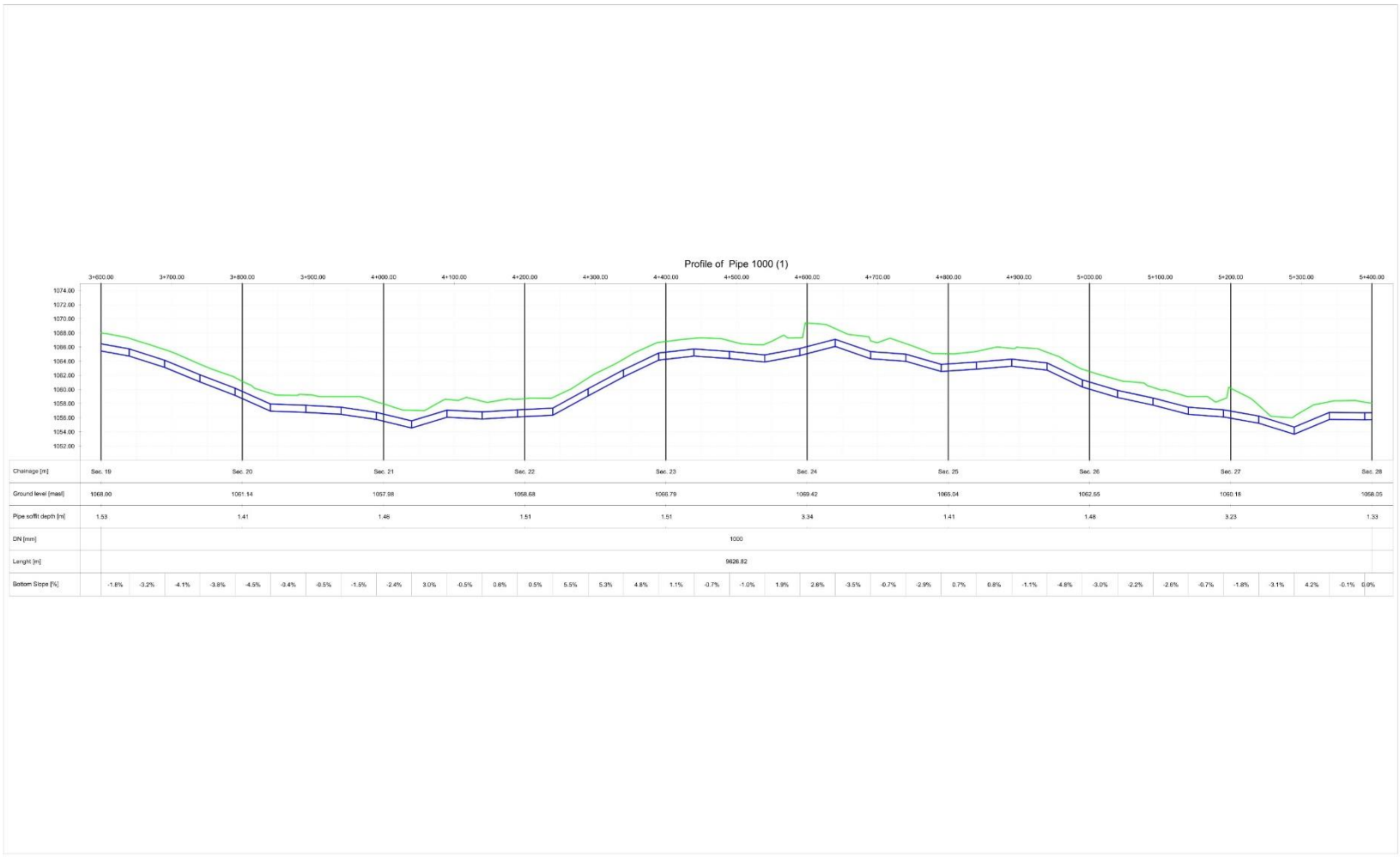
REVISIONS		
Rev	Date	Description



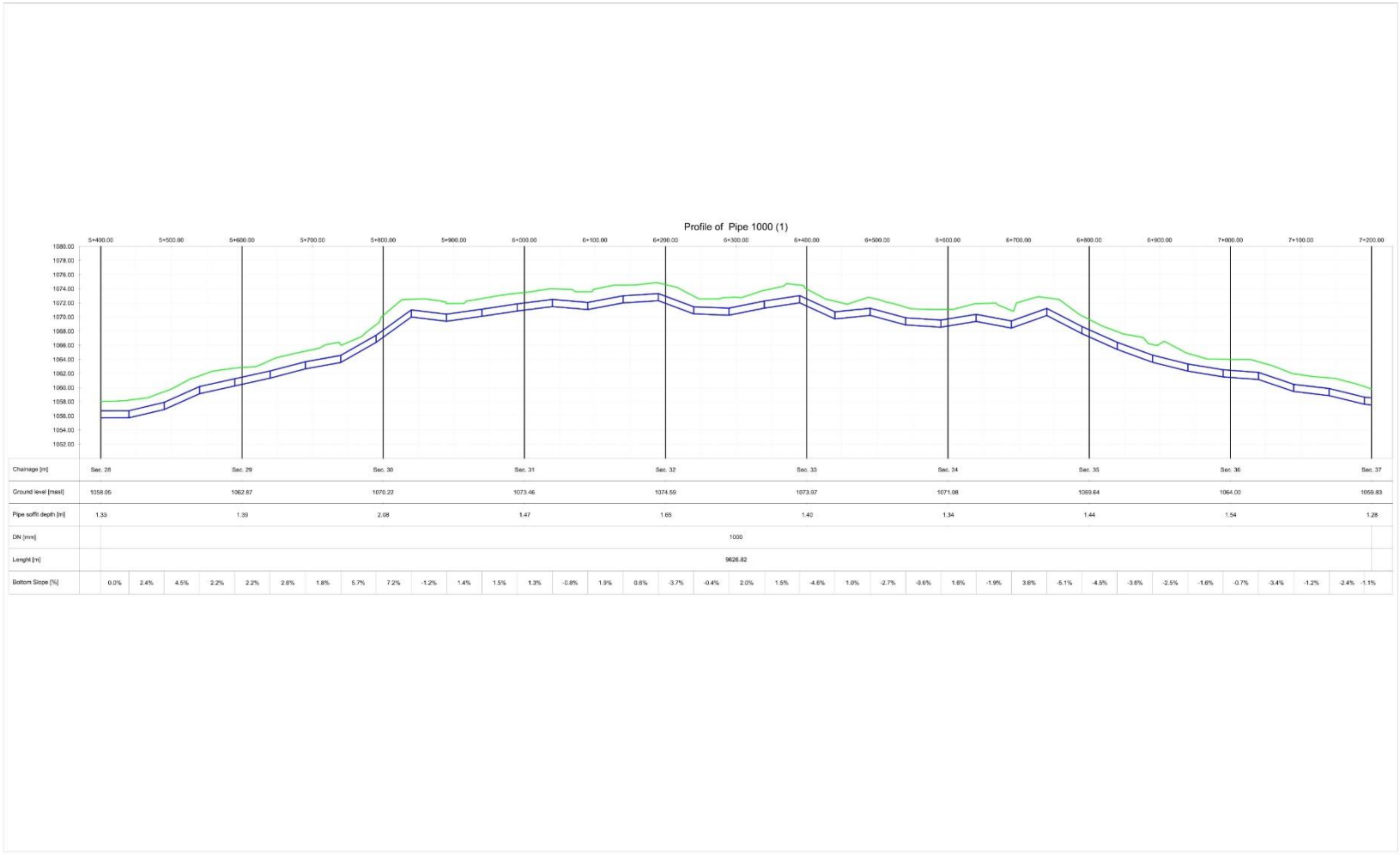
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.22 DATE: March 2025 SCALE: 1:5,000 Horizontal 1:500 Vertical	REVISIONS Rev Date Description	


Profile of Pipe 1000 (1)
1+800.00
1+900.00
2+000.00
2+100.00
2+200.00
2+300.00
2+400.00
2+500.00
2+600.00
2+700.00
2+800.00
2+900.00
3+000.00
3+100.00
3+200.00
3+300.00
3+400.00
3+500.00
3+600.00
1080.00
1078.00
1076.00
1074.00
1072.00
1070.00
1068.00
1066.00
1064.00
1062.00
1060.00
1058.00
1056.00

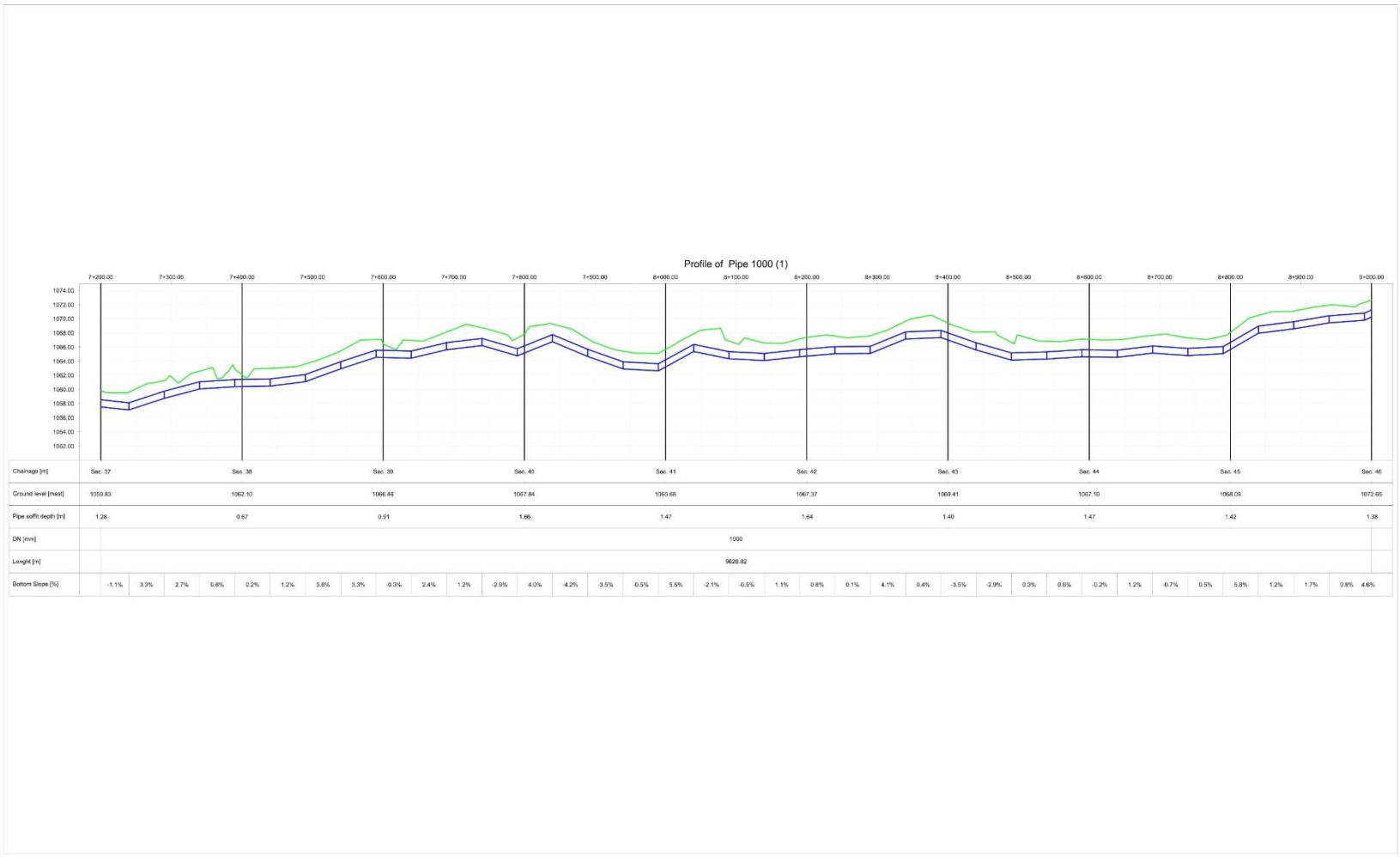
| | | |



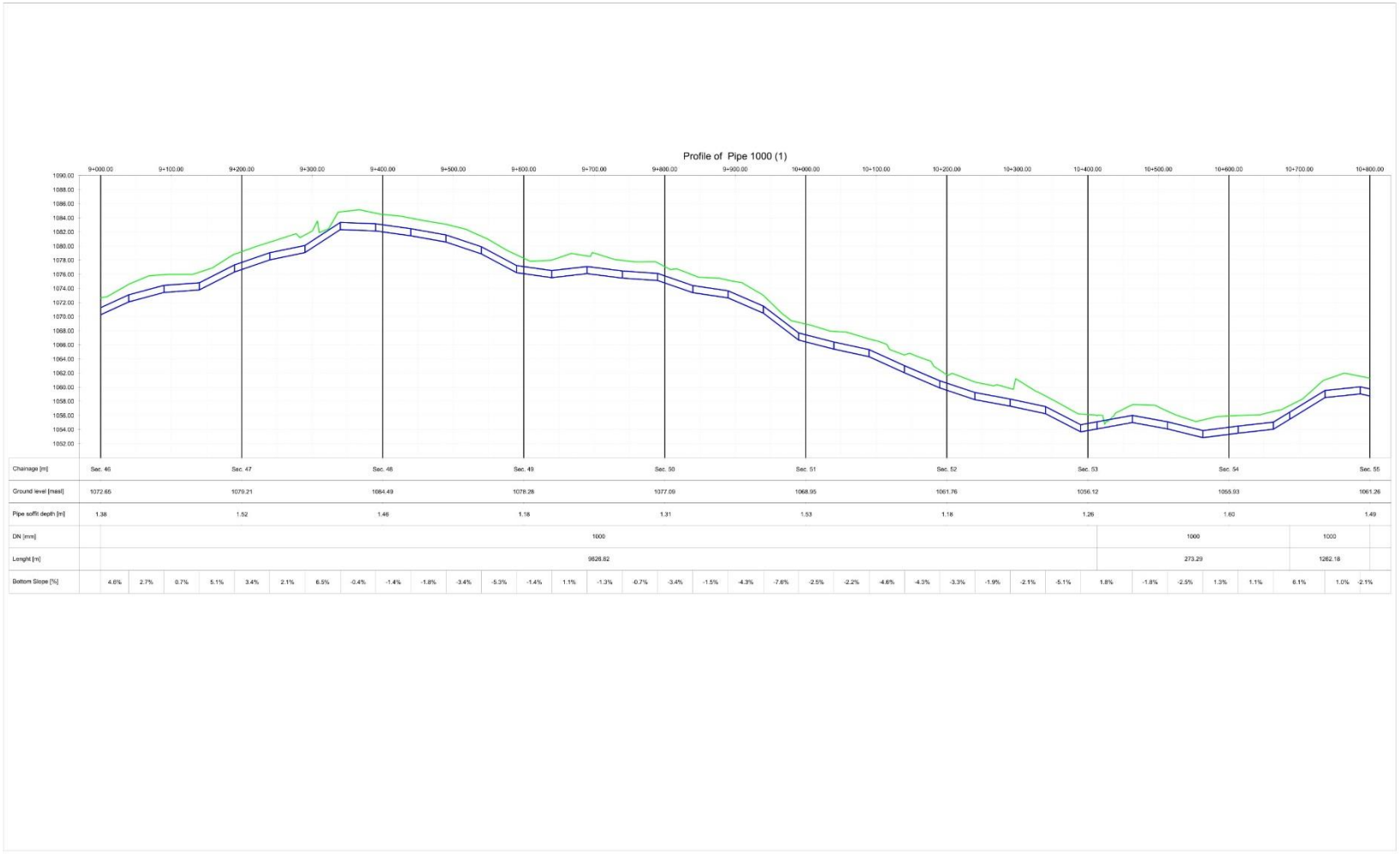
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.24 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description



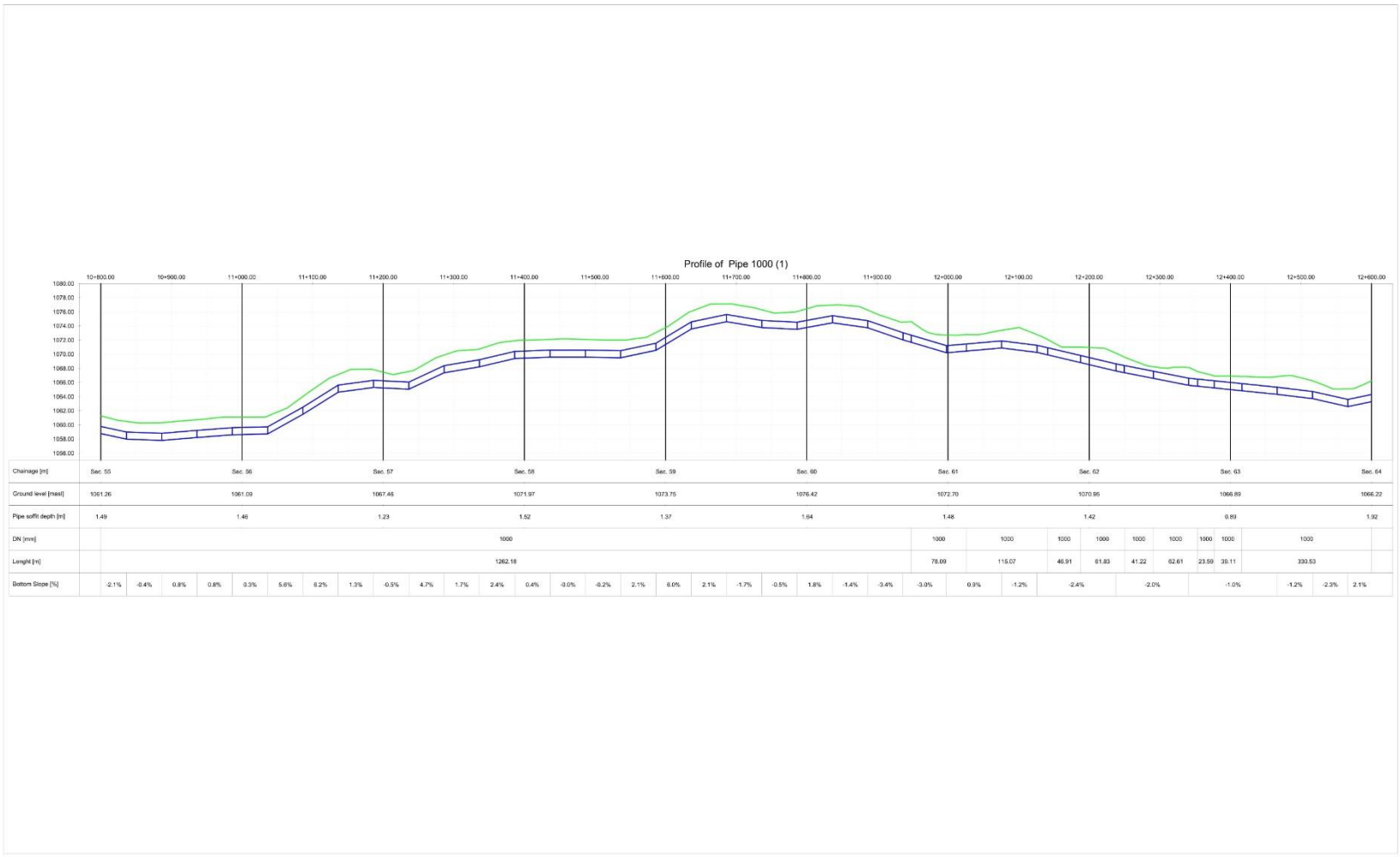
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.25 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev / Date / Description	



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.26 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description

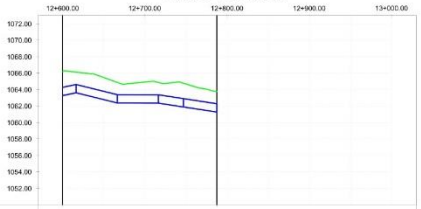

Profile of Pipe 1000 (1)
9+000.00
9+100.00
9+200.00
9+300.00
9+400.00
9+500.00
9+600.00
9+700.00
9+800.00
9+900.00
10+000.00
10+100.00
10+200.00
10+300.00
10+400.00
10+500.00
10+600.00
10+700.00
10+800.00
1090.00
1088.00
1086.00
1084.00
1082.00
1080.00
1078.00
1076.00
1074.00
1072.00
1070.00
1068.00
1066.00
1064.00
1062.00
1060.00
1058.00
1056.00
1054.00
1052.00

| | | |



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Transmission Line Pipeline profile DRAWING NO. TL.02.28 DATE: March 2025 SCALE: 1:5,000 Horizontal, 1:500 Vertical	REVISIONS Rev Date Description

Profile of Pipe 1000 (1)



Chainage [m]	Sec. 64			Sec. 65	
Ground level [masl]	1066.22			1063.79	
Pipe soffit depth [m]	1.92			1.50	
DN [mm]		1000		1000	
Lenght [m]		330.53		40.61	
Bottom Slope [%]	2.1%	-2.5%	-0.0%	-1.5%	

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO

DESIGNED:	MZ
CHECKED:	AT
APPROVED:	AC

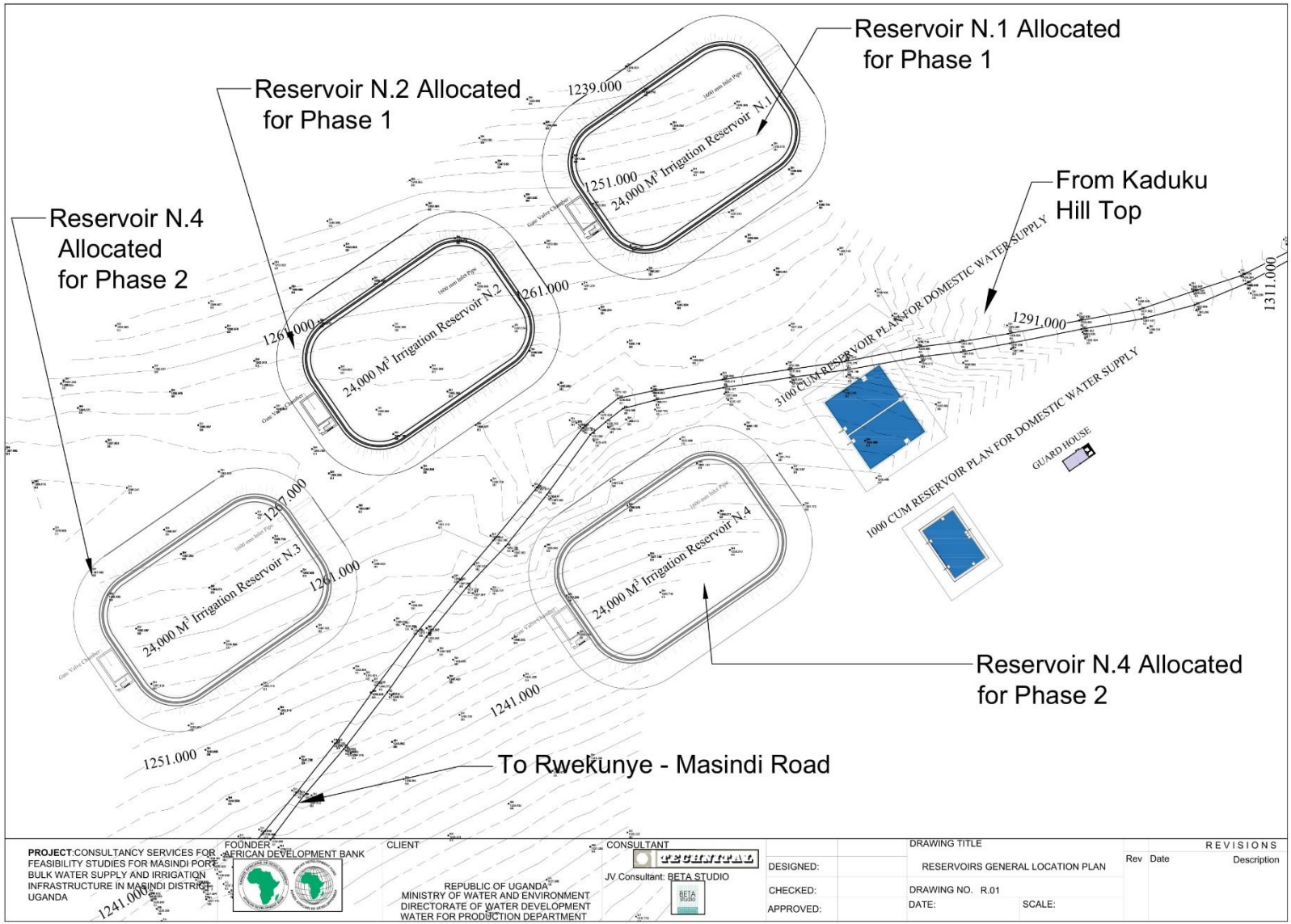
DRAWING TITLE: Water Transmission Line Pipeline profile

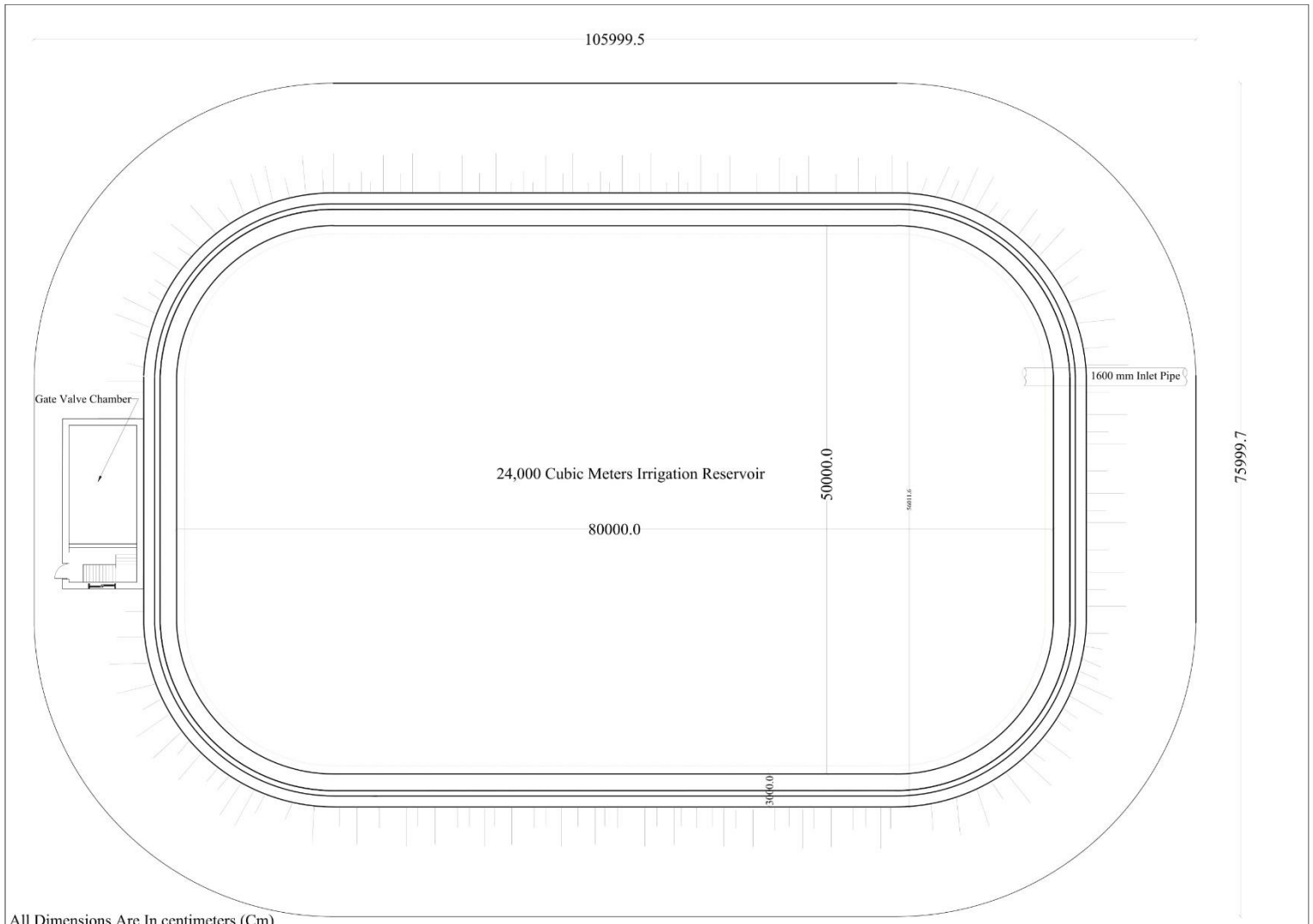
DRAWING NO. TL.02.29

DATE: March 2025

SCALE: 1:5,000 Horizontal, 1:500 Vertical

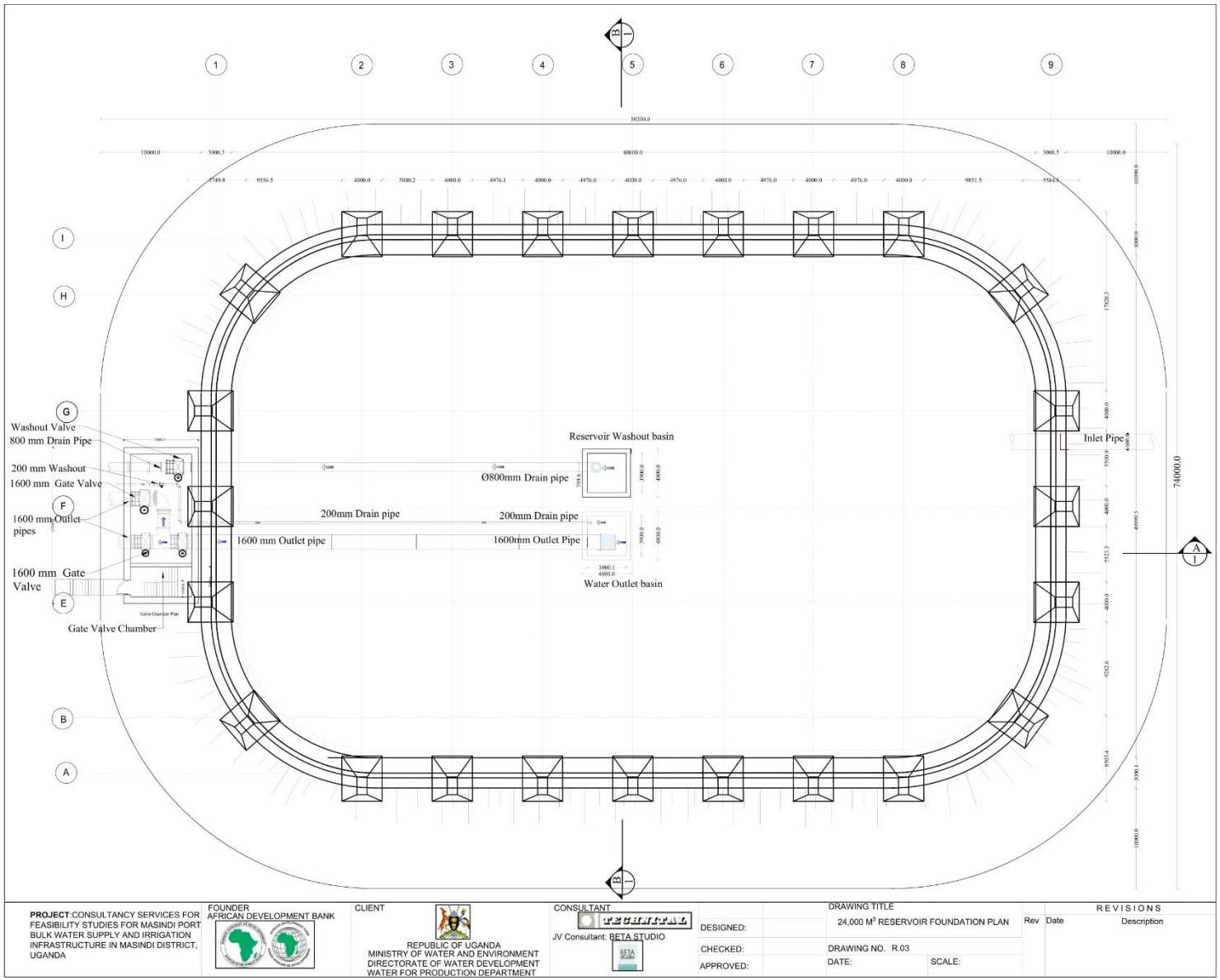
REVISIONS		
Rev	Date	Description

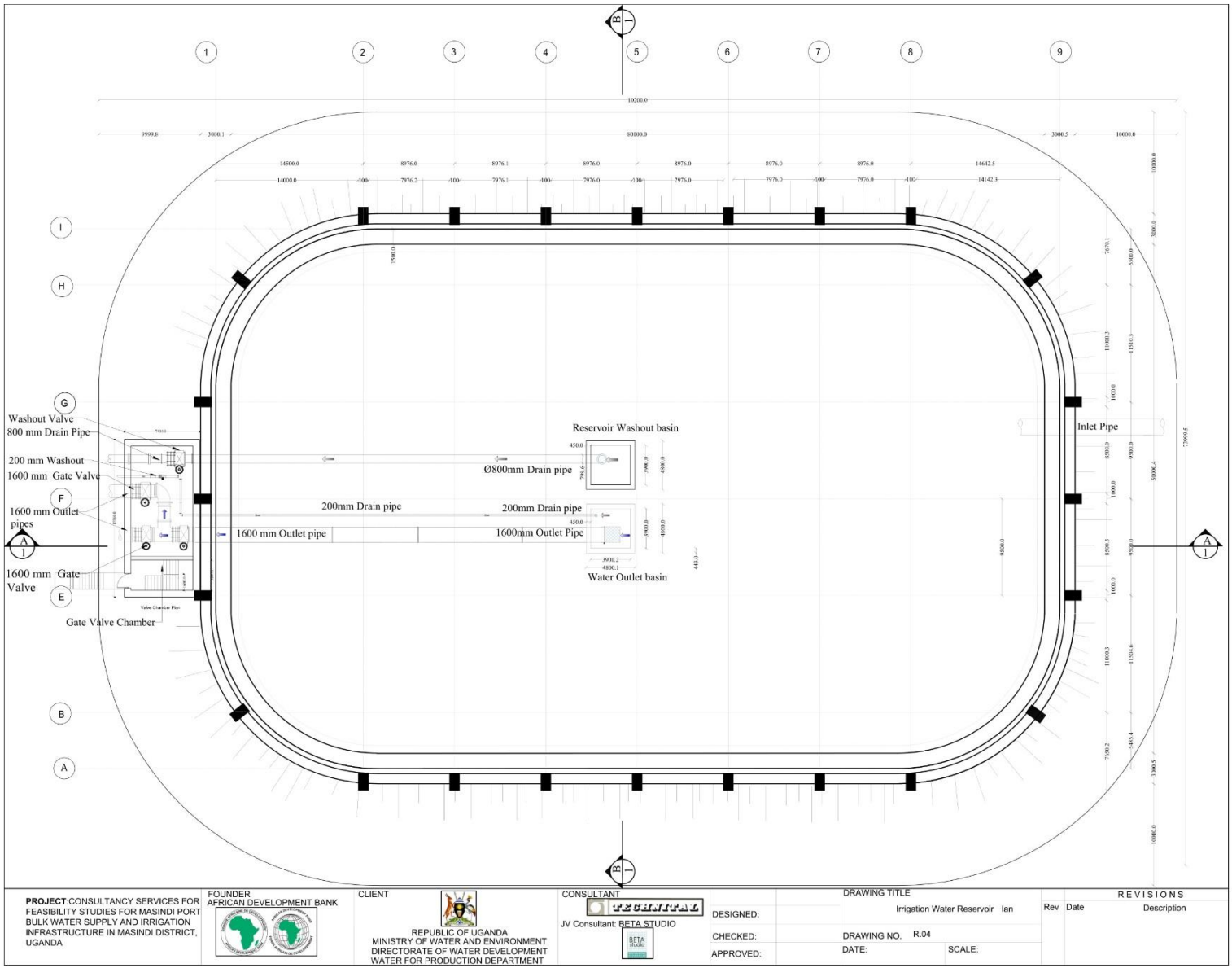

Reservoir N.1 Allocated for Phase 1
Reservoir N.2 Allocated for Phase 1
Reservoir N.4 Allocated for Phase 2
From Kaduku Hill Top
1239.000
1251.000
24,000 M³ Irrigation Reservoir N.1
1261.000
24,000 M³ Irrigation Reservoir N.2
1267.000
24,000 M³ Irrigation Reservoir N.3
1241.000
24,000 M³ Irrigation Reservoir N.4
1291.000
1311.000
3100 CUM RESERVOIR PLAN FOR DOMESTIC WATER SUPPLY
1000 CUM RESERVOIR PLAN FOR DOMESTIC WATER SUPPLY
GUARD HOUSE
Reservoir N.4 Allocated for Phase 2
To Rwekunye - Masindi Road
PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA
FOUNDER
AFRICAN DEVELOPMENT BANK
CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT
CONSULTANT
JV Consultant: BETA STUDIO
DESIGNED:
CHECKED:
APPROVED:
DRAWING TITLE
RESERVOIRS GENERAL LOCATION PLAN
DRAWING NO. R.01
DATE:
SCALE:
REVISIONS
Rev
Date
Description

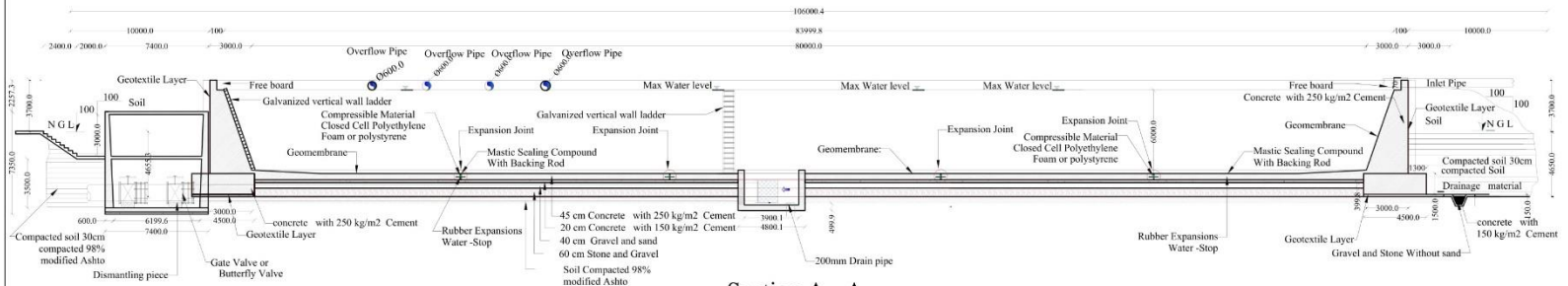


PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE 24,000 Cubic Meters Irrigation Reservoir Plan DRAWING NO. R.02 DATE: SCALE:

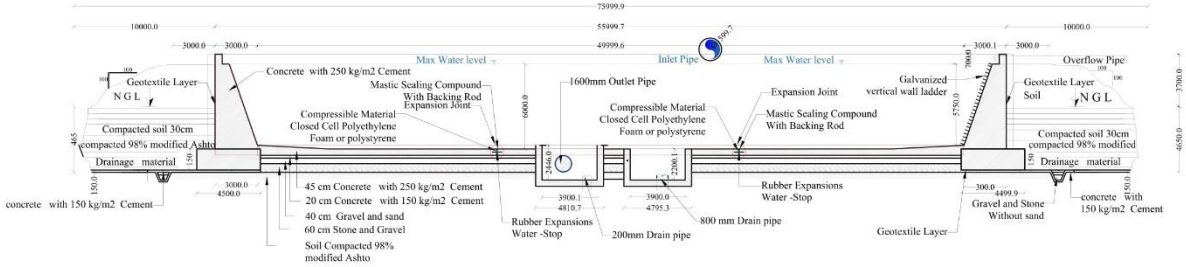
REVISIONS		
Rev	Date	Description


1
2
3
4
5
6
7
8
9
I
H
G
F
E
B
A
Washout Valve
800 mm Drain Pipe
200 mm Washout
1600 mm Gate Valve
1600 mm Outlet pipes
1600 mm Gate Valve
Gate Valve Chamber
Reservoir Washout basin
Ø800mm Drain pipe
200mm Drain pipe
200mm Drain pipe
1600 mm Outlet pipe
1600mm Outlet Pipe
Water Outlet basin
Inlet Pipe
74000.0
PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA
FOUNDER
AFRICAN DEVELOPMENT BANK
CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT
CONSULTANT
JV Consultant: BETA STUDIO
DESIGNED:
CHECKED:
APPROVED:
DRAWING TITLE
24,000 M3 RESERVOIR FOUNDATION PLAN
DRAWING NO. R.03
DATE:
SCALE:
REVISIONS
Rev
Date
Description


Washout Valve
800 mm Drain Pipe
200 mm Washout
1600 mm Gate Valve
1600 mm Outlet pipes
1600 mm Gate Valve
Gate Valve Chamber
Reservoir Washout basin
Ø800mm Drain pipe
200mm Drain pipe
200mm Drain pipe
1600 mm Outlet pipe
1600mm Outlet Pipe
Water Outlet basin
Inlet Pipe
PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA
FOUNDER
AFRICAN DEVELOPMENT BANK
CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT
CONSULTANT
JV Consultant: BETA STUDIO
DESIGNED:
CHECKED:
APPROVED:
DRAWING TITLE
Irrigation Water Reservoir Ian
DRAWING NO. R.04
DATE:
SCALE:
REVISIONS
Rev Date Description

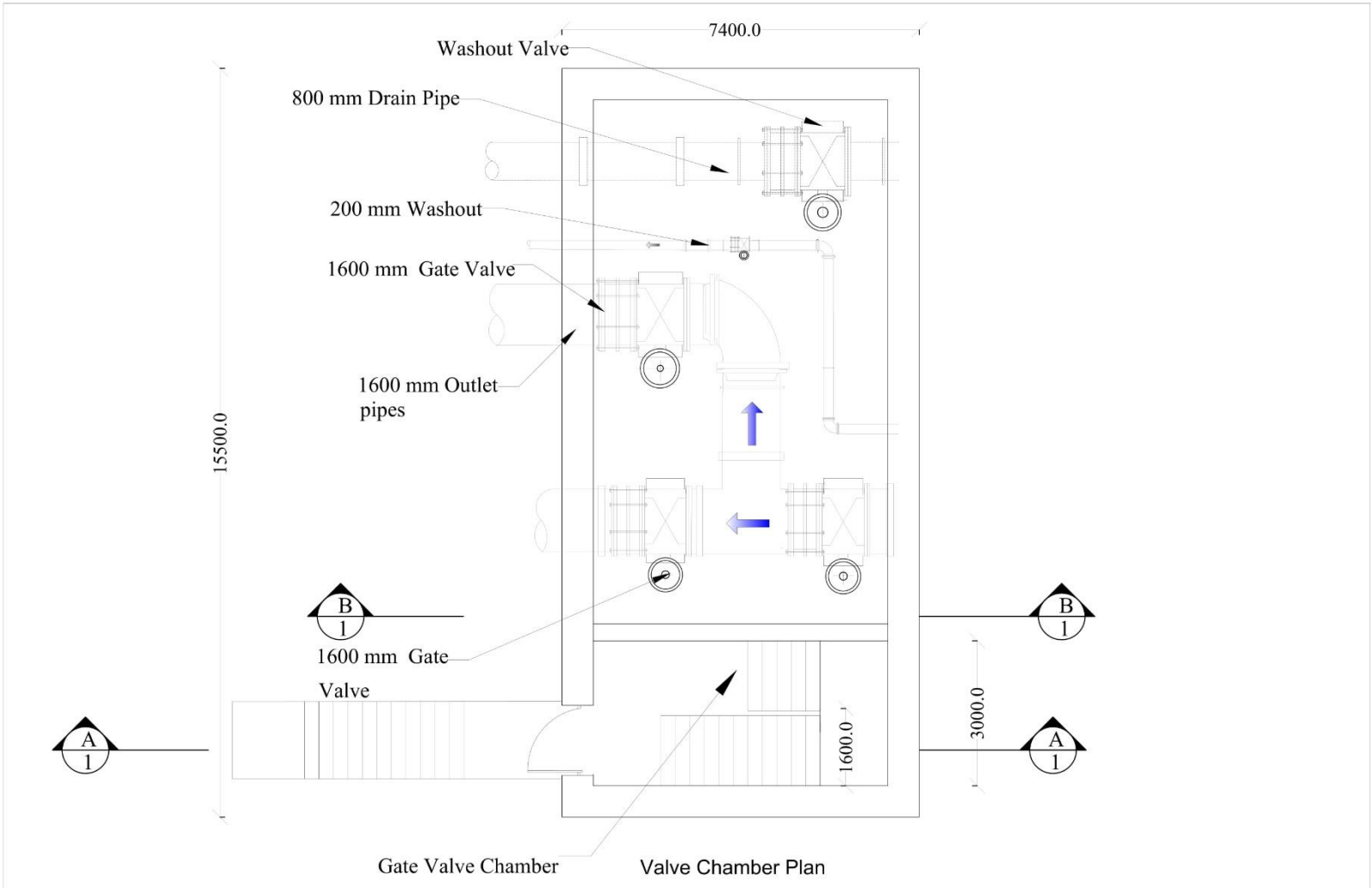


Section A - A



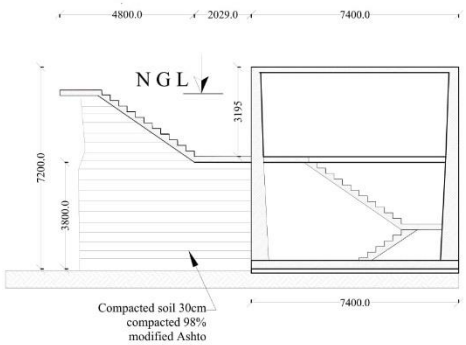
Section B - B

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE Irrigation ater Reservoir Sections DRAWING NO. R.05 DATE: SCALE:	REVISIONS Rev Date Description	

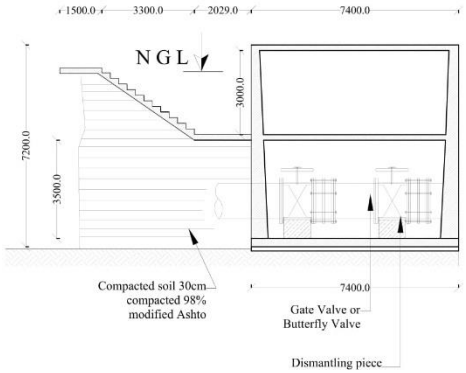


PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE Valve Chamber - Ian; DRAWING NO. R.06.1; DATE: SCALE:

REVISIONS		
Rev	Date	Description

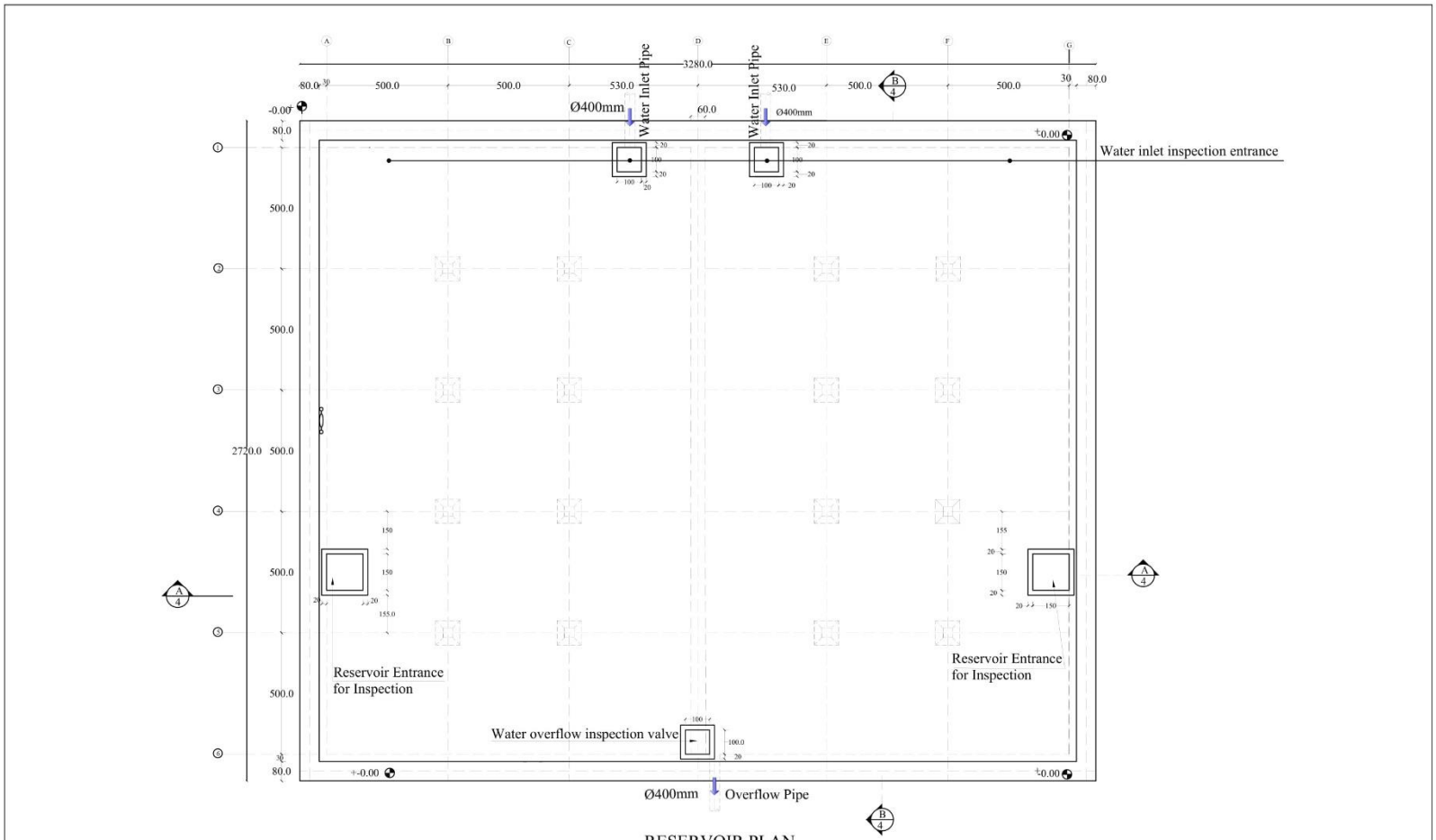


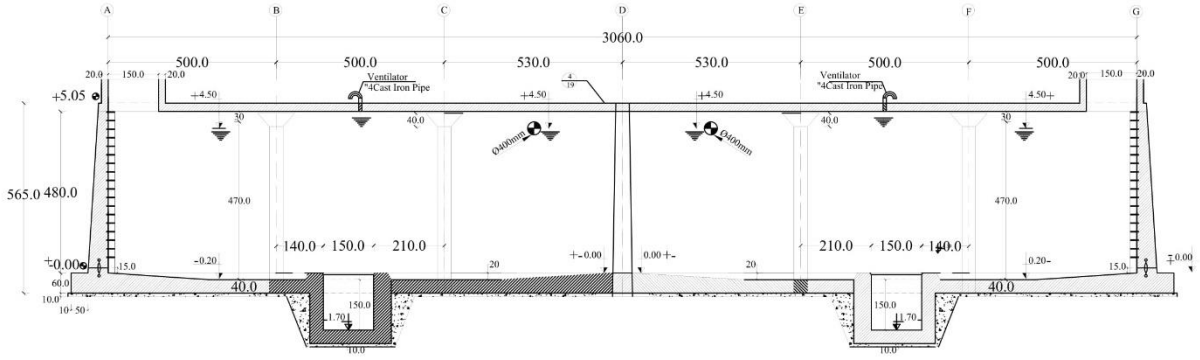
Section A - A



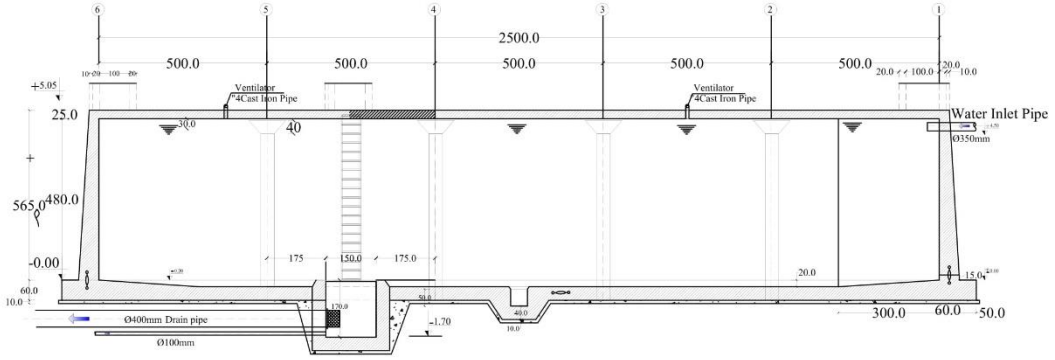
Section B - B

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED:	DRAWING TITLE Valve Chamber - Sections	REVISIONS Rev	Date Description
				CHECKED:	DRAWING NO. R.0 .2		
				APPROVED:	DATE: SCALE:		


3280.0
80.0
500.0
500.0
530.0
530.0
500.0
500.0
30
80.0
Ø400mm
Water Inlet Pipe
Water Inlet Pipe
Ø400mm
60.0
-0.00
+0.00
Water inlet inspection entrance
80.0
500.0
500.0
2720.0
500.0
500.0
500.0
Reservoir Entrance
for Inspection
Reservoir Entrance
for Inspection
Water overflow inspection valve
+-0.00
+0.00
Ø400mm
Overflow Pipe
RESERVOIR PLAN
PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA
FOUNDER
AFRICAN DEVELOPMENT BANK
CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT
CONSULTANT
JV Consultant: BETA STUDIO
DESIGNED:
CHECKED:
APPROVED:
DRAWING TITLE
DOMESTIC WATER TANK
3100 CUM RESERVOIR PLAN
DRAWING NO. R.07
DATE:
SCALE:
REVISIONS
Rev
Date
Description



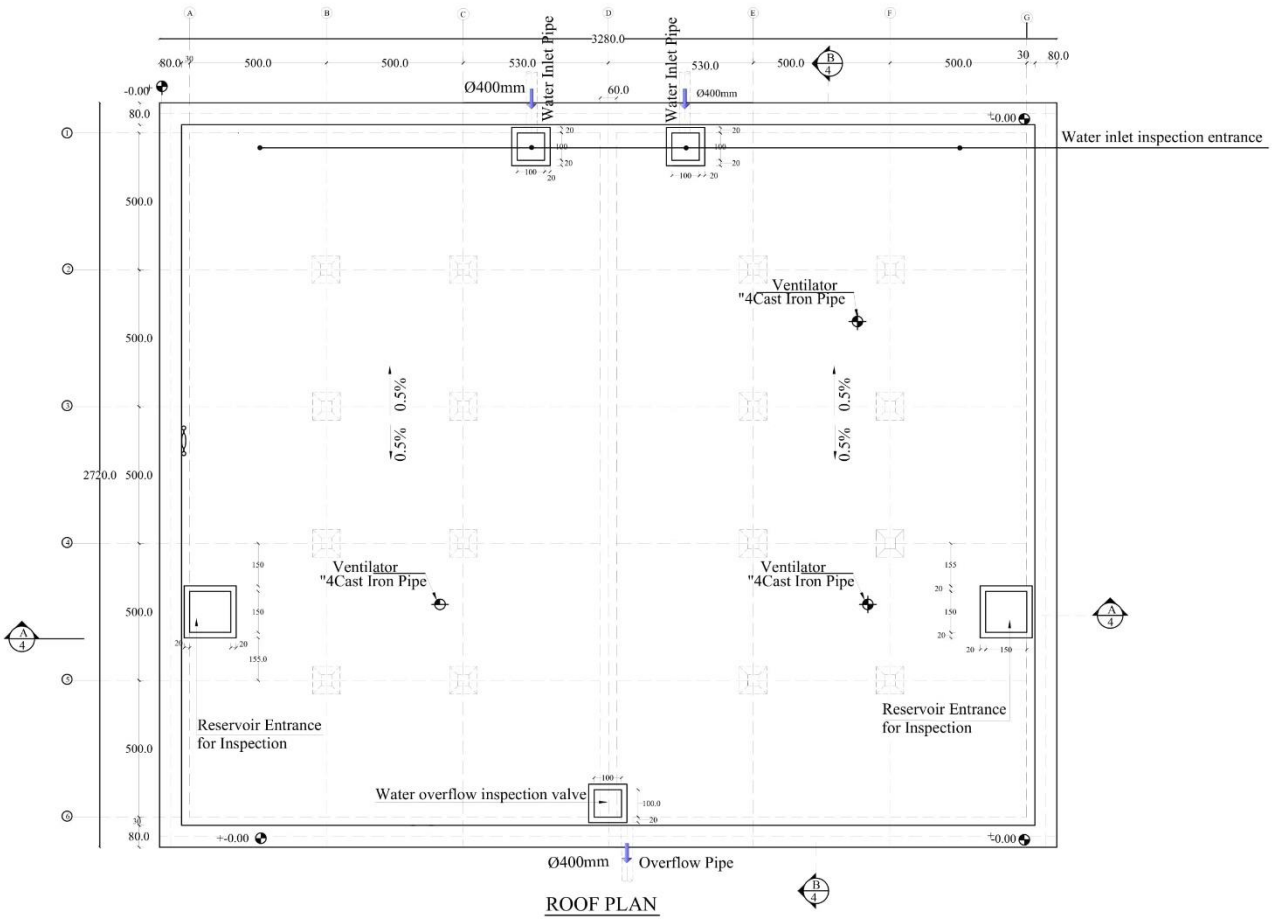
SECTION A-A



SECTION B-B

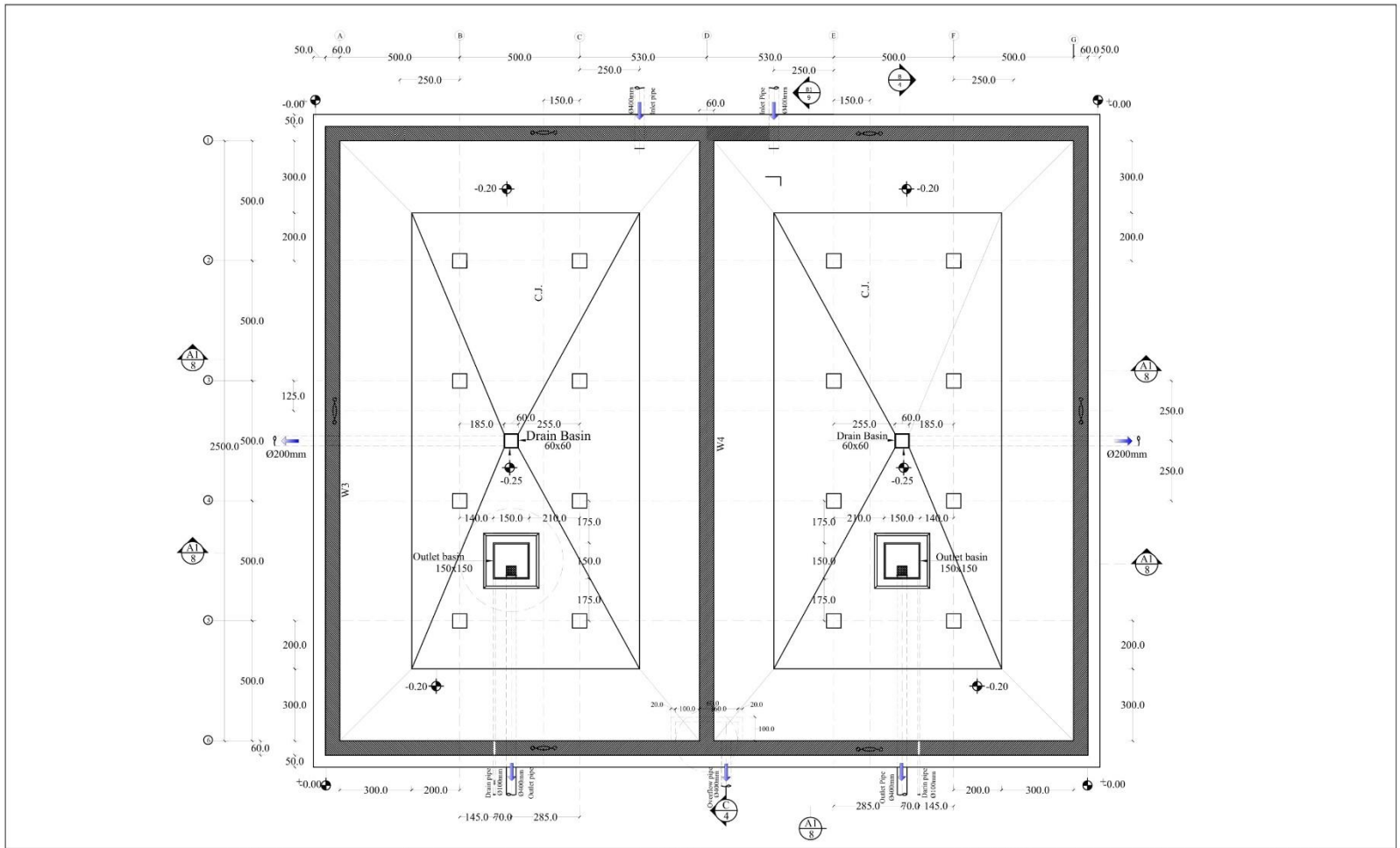
PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE DOMESTIC WATER TANK SECTION B-B & SECTION A-A DRAWING NO. R.08 DATE: SCALE:

REVISIONS		
Rev	Date	Description



ROOF PLAN

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE DOMESTIC WATER TANK FLOOR PLAN DRAWING NO. R.09 DATE: SCALE:	REVISIONS Rev Date Description	



PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
JV Consultant: BETA STUDIO

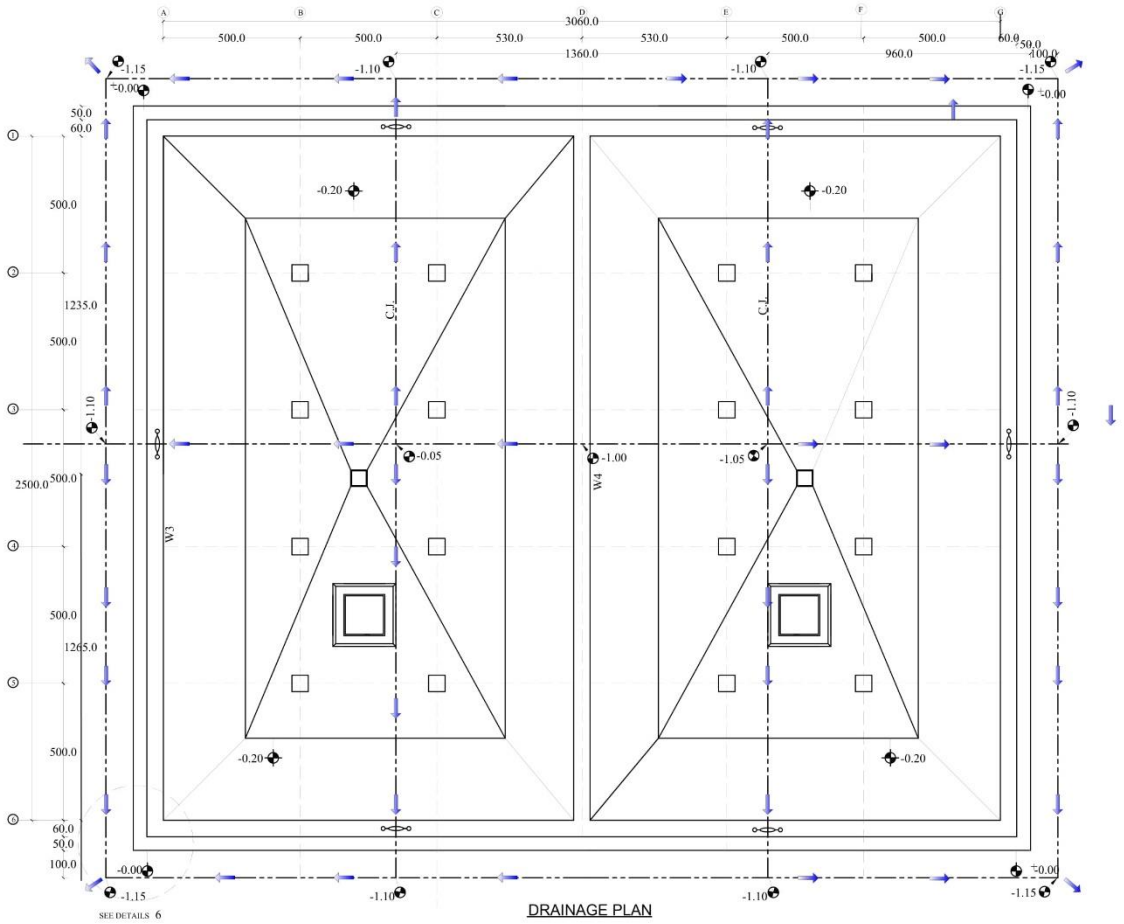
DESIGNED:
CHECKED:
APPROVED:

DRAWING TITLE: DOMESTIC WATER TANK
100 CUM FLOOR FORMWORK PLAN

DRAWING NO. R.10
DATE:
SCALE:

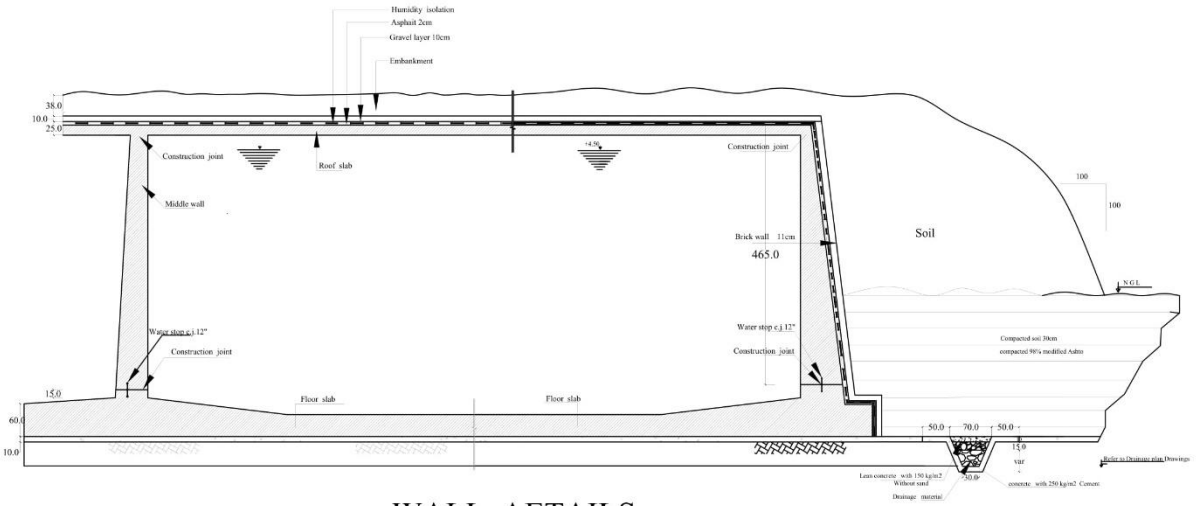
REVISIONS

Rev	Date	Description



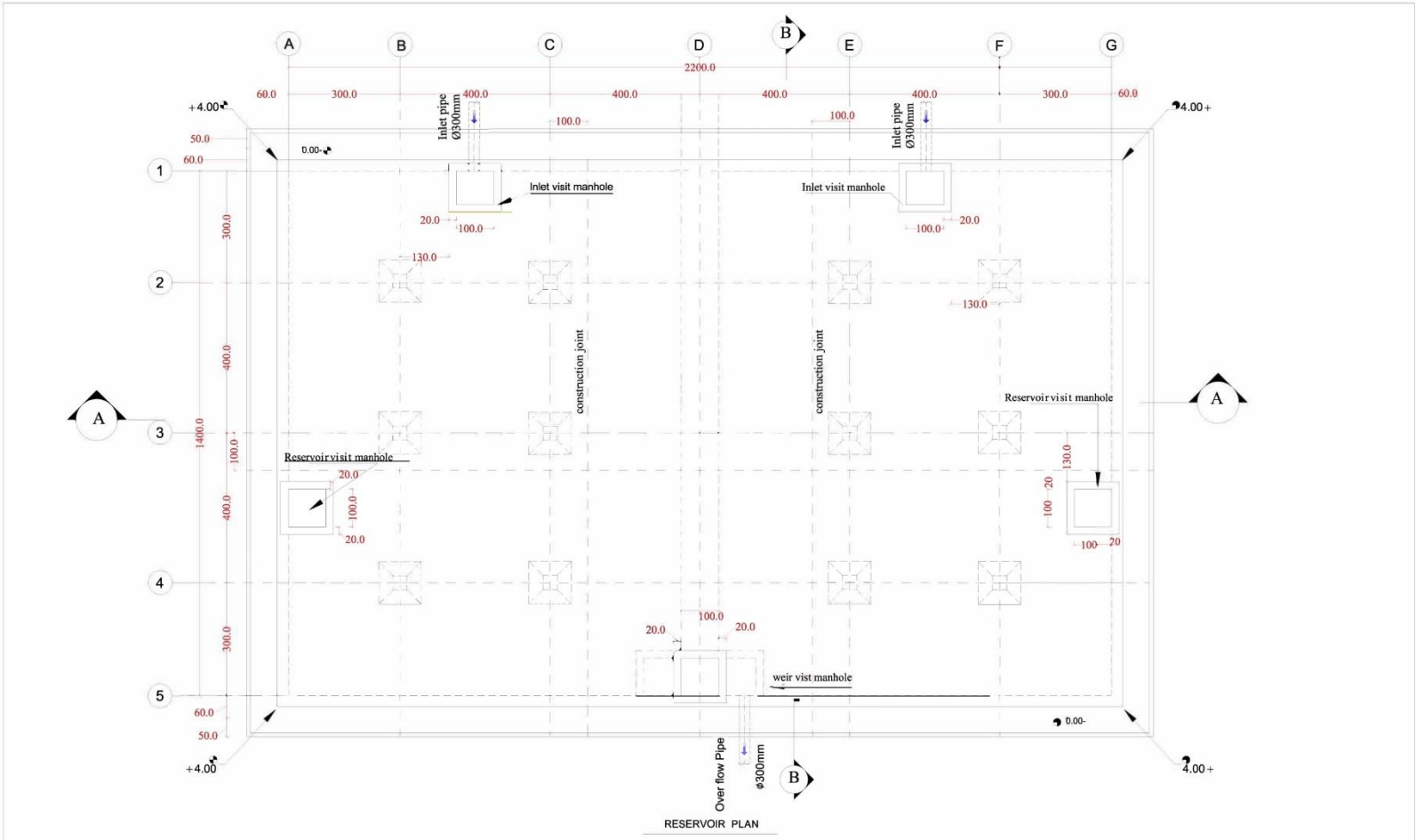
DRAINAGE PLAN

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED:	DRAWING TITLE DOMESTIC WATER TANK 100 CUM DRAINAGE PLAN	REVISIONS Rev Date Description
				CHECKED:	DRAWING NO. R.11	
				APPROVED:	DATE: SCALE:	

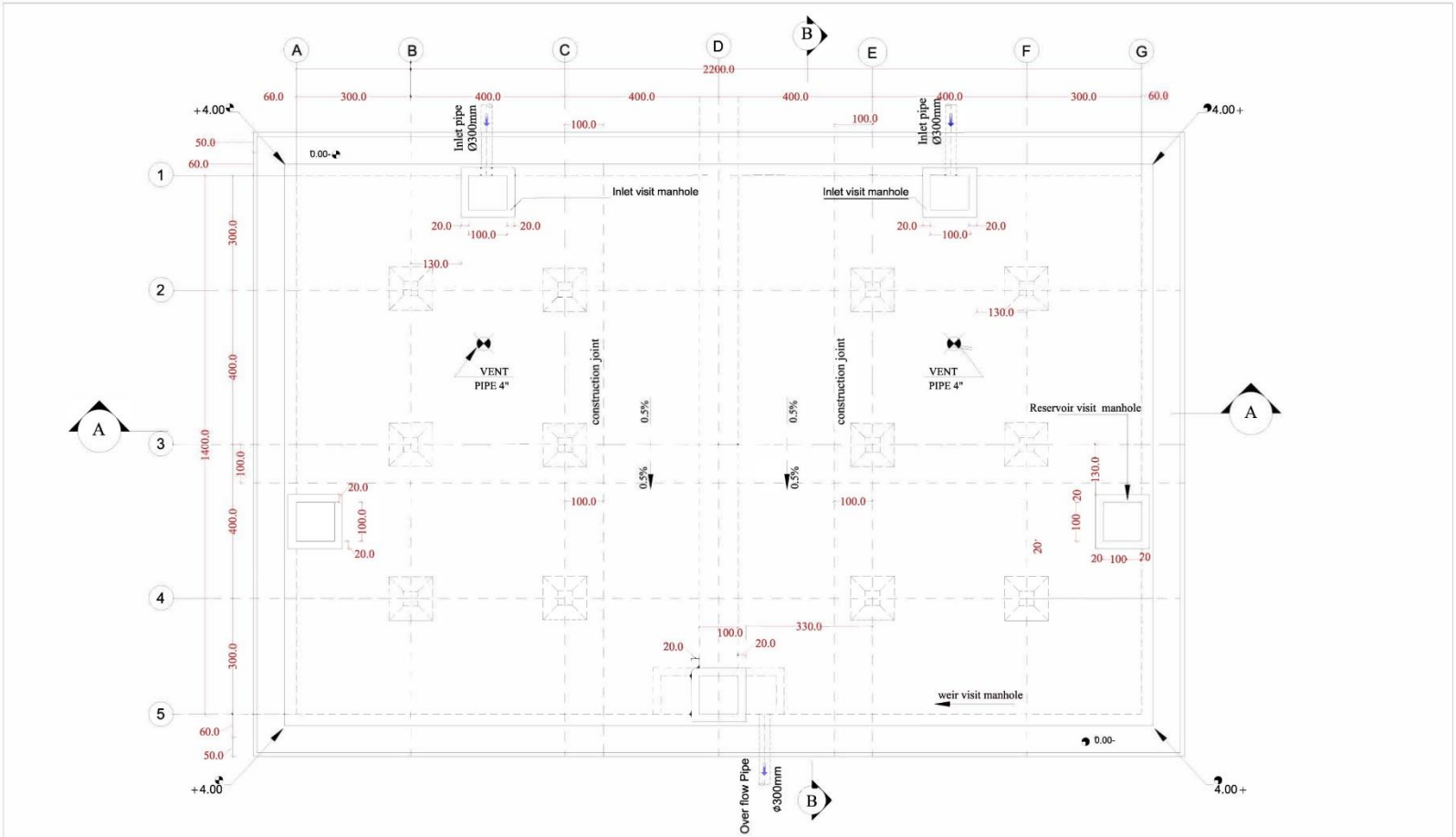


WALL AETAILS

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE DOMESTIC WATER TANK 100 CUM WALL DETAILS DRAWING NO. R.12 DATE: SCALE:	REVISIONS Rev Date Description	

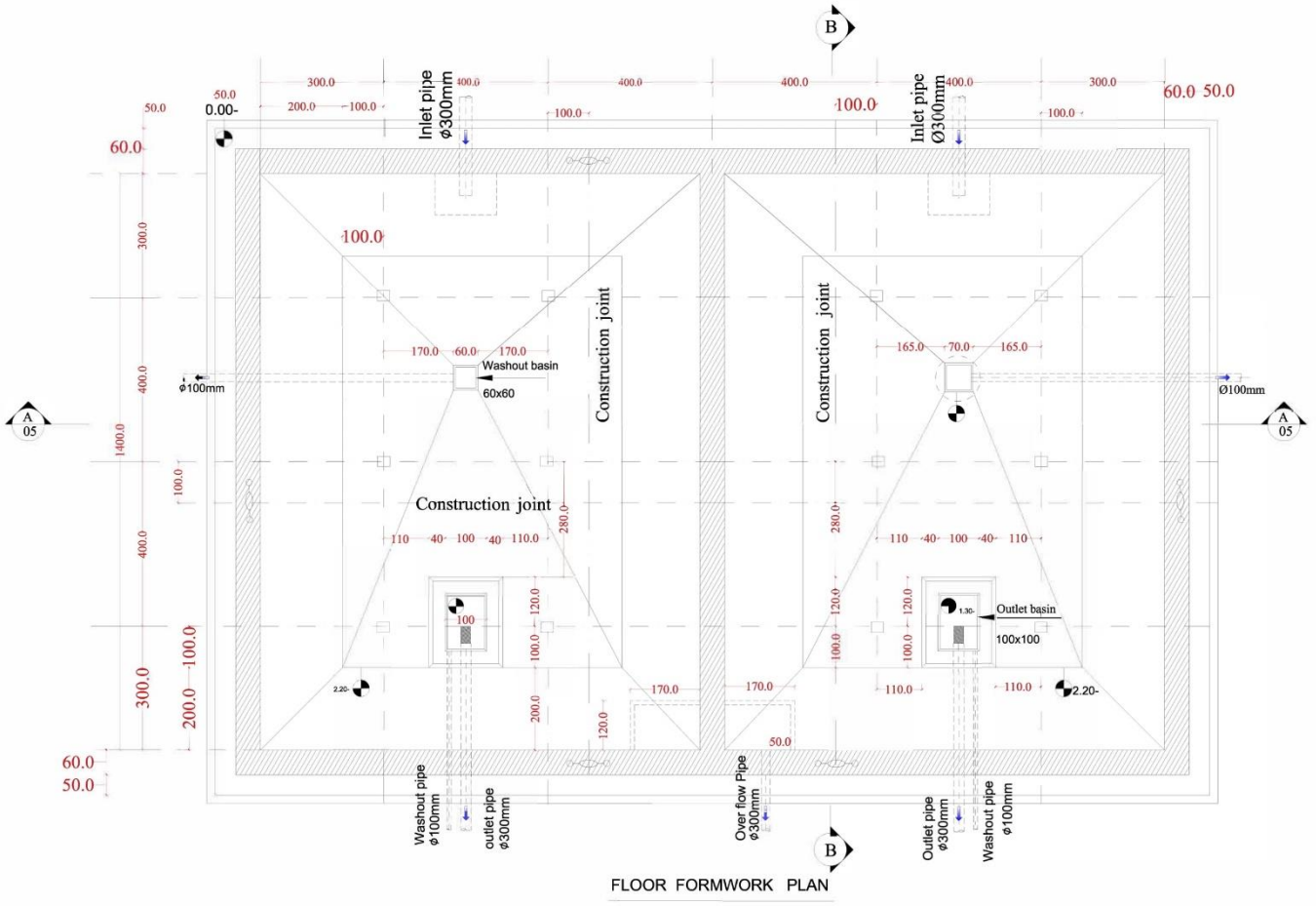


PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE DOMESTIC WATER TANK 1000 CUM RESERVOIR PLAN DRAWING NO. R.13 DATE: SCALE:	REVISIONS Rev Date Description	



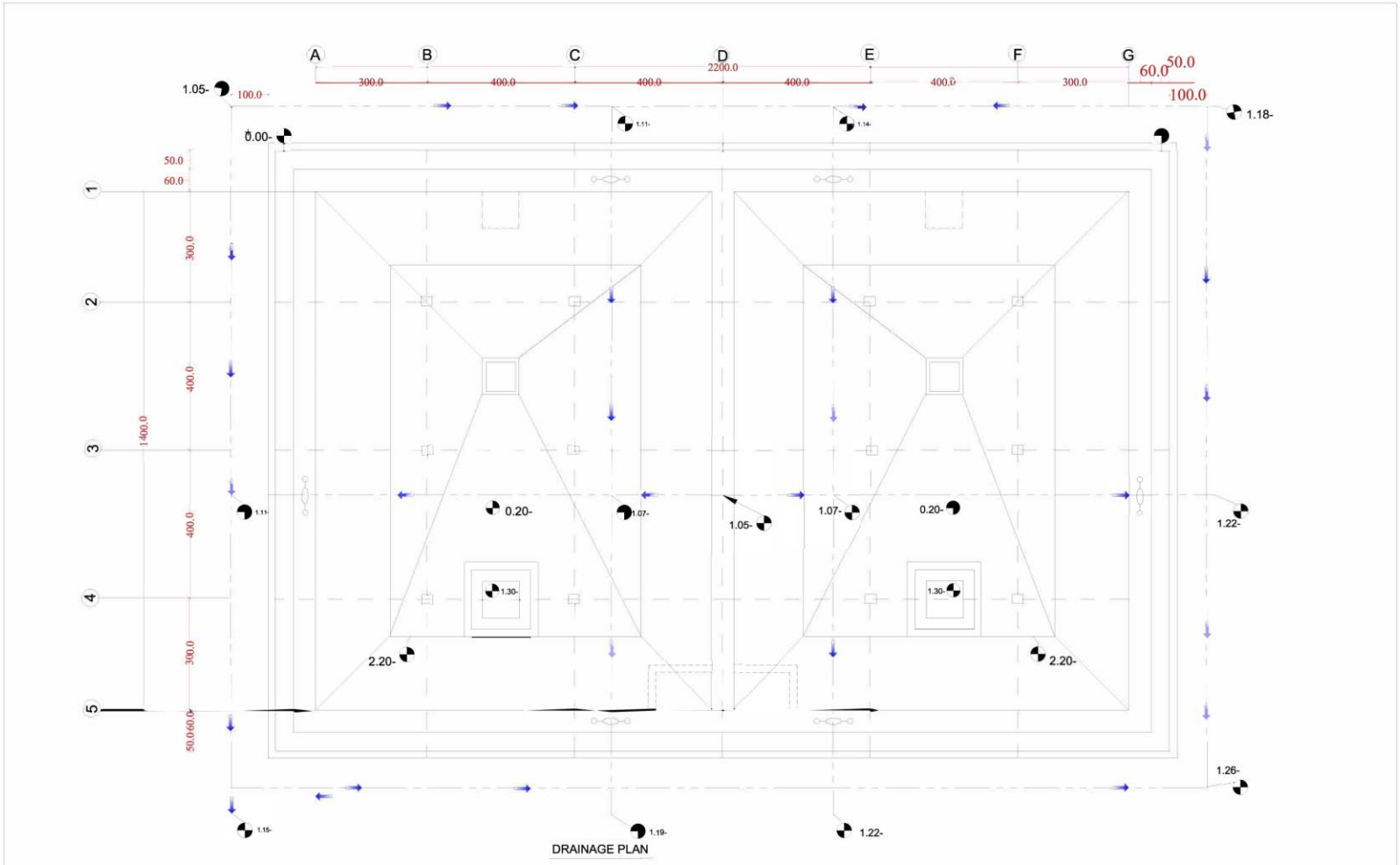
ROOF FORMWORK PLAN

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED:	DRAWING TITLE DOMESTIC WATER TANK 1000 CUM Roof Plan	REVISIONS Rev	Date Description
				CHECKED:	DRAWING NO. R.14		
				APPROVED:	DATE: SCALE:		



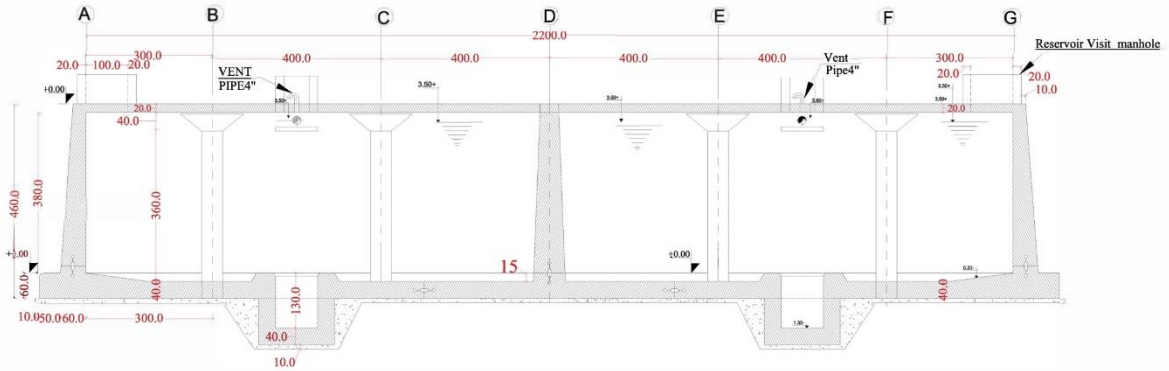
FLOOR FORMWORK PLAN

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE DOMESTIC WATER TANK 1000 Cum RESERVOIR FLOOR FRAMEWORK PLAN	DRAWING NO. R.15 DATE: SCALE:	REVISIONS Rev Date Description

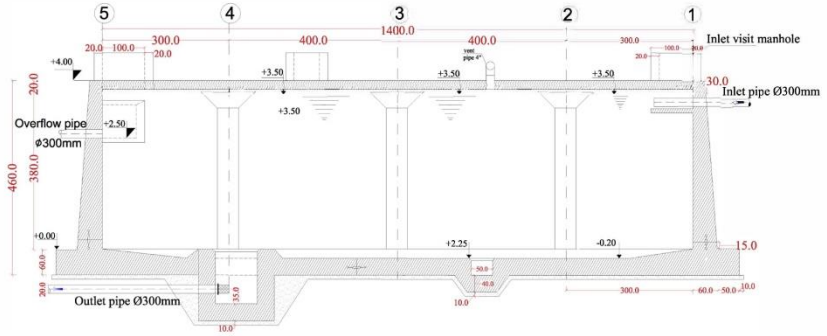


DRAINAGE PLAN

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE DOMESTIC WATER TANK 1000CUM DRAINAGE PLAN DRAWING NO. R.16 DATE: SCALE:	Rev	REVISIONS Date Description

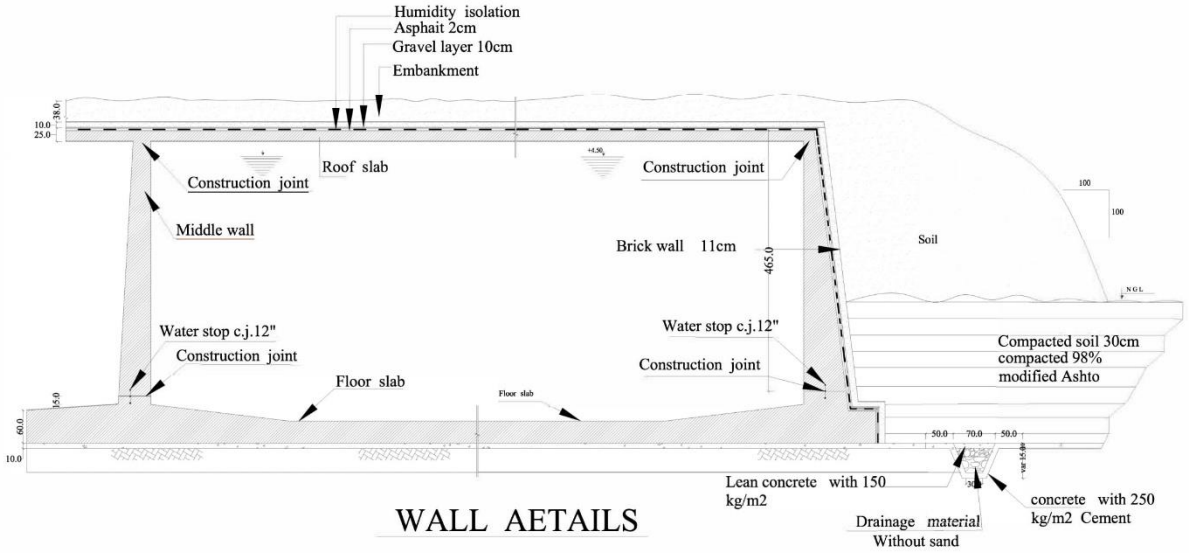


SECTION A-A



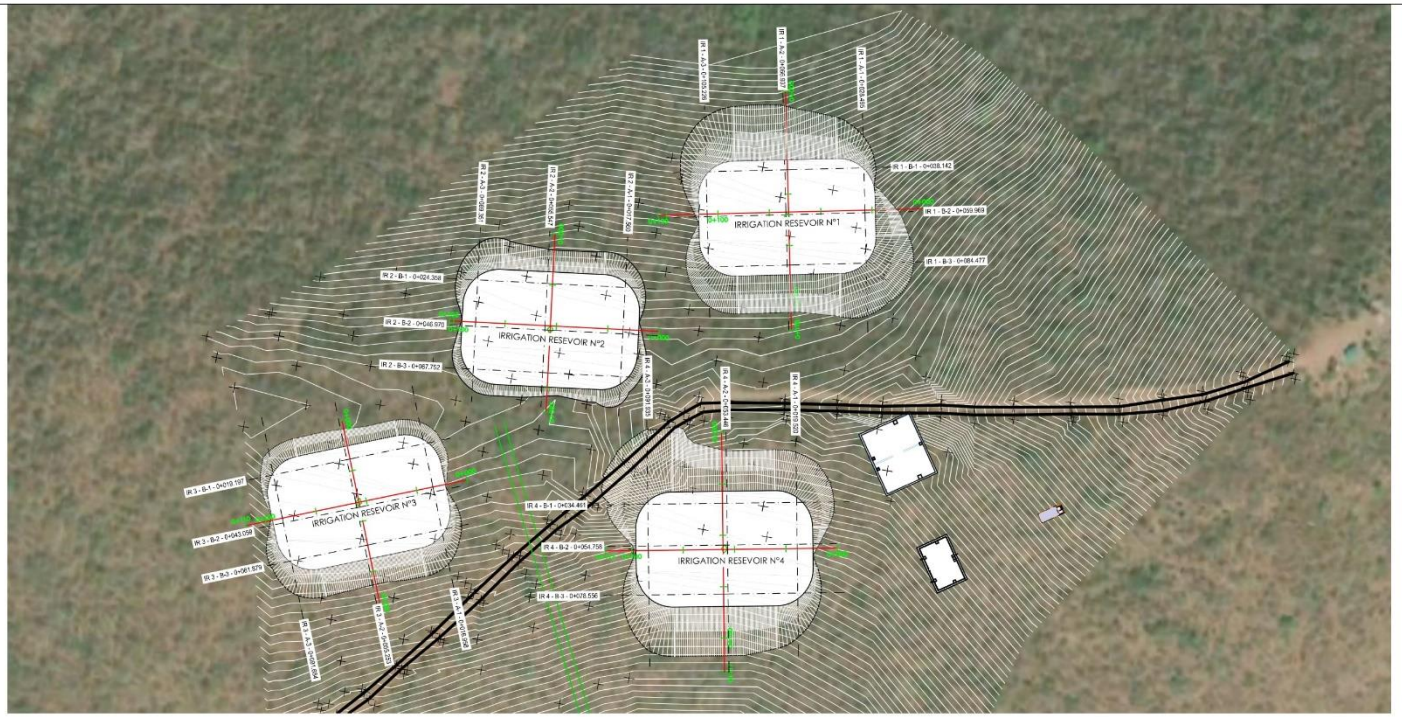
SECTION B-B

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:		DRAWING TITLE DOMESTIC WATER TANK 1000 CUM SECTION B-B DRAWING NO. R.17 DATE: SCALE:	REVISIONS Rev Date Description



WALL AETAILS

PROJECT:CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER FOR PRODUCTION DEPARTMENT	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE DOMESTIC WATER TANK 1000 CUM WALL DETAILS DRAWING NO. R.18 DATE: SCALE:	REVISIONS Rev Date Description	



Generated: 27/02/2025

Volume Summary

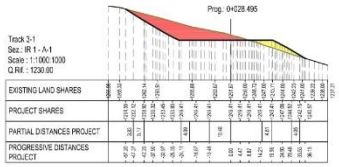
Name	Type	Cut Factor	Fill Factor	2d Area (m quad.)	Cut (M. cub.)	Fill (M. cub.)	Net (M. cub.)
Balance Irrigation Reservoir 1	full	1.000	1.000	9500.09	18493.35	18499.57	6.22<Fill>
Balance Irrigation Reservoir 4	full	1.000	1.000	9795.19	20364.80	20363.02	1.78<Cut>
Balance Irrigation Reservoir 3	full	1.000	1.000	6771.62	9104.74	9112.28	7.54<Fill>
Balance Irrigation Reservoir 2	full	1.000	1.000	6447.83	6744.52	6738.40	6.13<Cut>

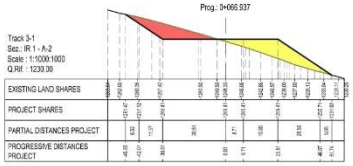
Totals

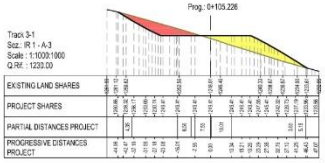
	2d Area (m quad.)	Cut (M. cub.)	Fill (M. cub.)	Net (M. cub.)
Total	32514.74	54707.41	54713.27	5.86<Fill>

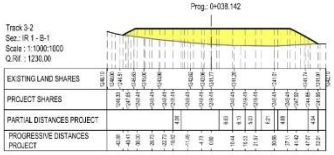
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:	DRAWING TITLE 24,000 CUM Irrigation Project Grading plan; DRAWING NO.; DATE: SCALE:	REVISIONS Rev / Date / Description

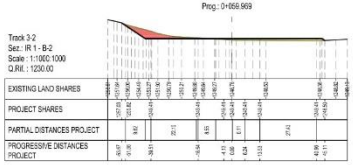
Irrigation Reservoir 1

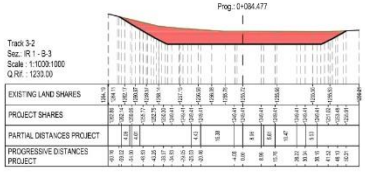




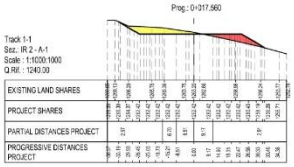


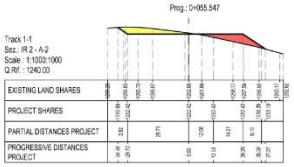


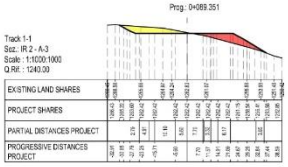


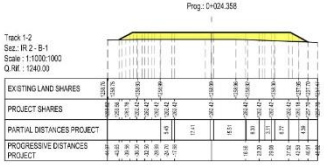


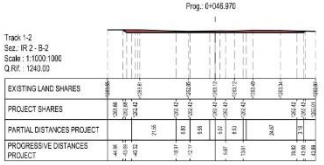
Irrigation Reservoir 2

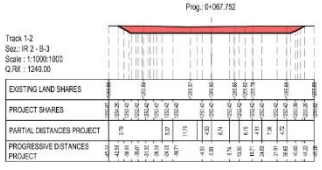








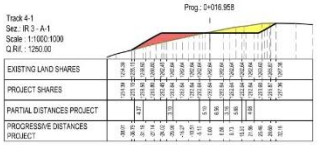




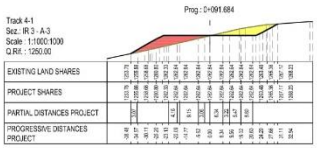


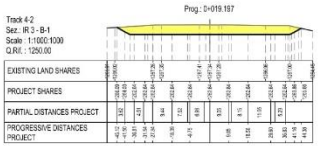
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:		DRAWING TITLE 24,000 CUM Irrigation Reservoir Grading Cross Sections 1-2 DRAWING NO. R.20 DATE: SCALE:	REVISIONS Rev / Date / Description

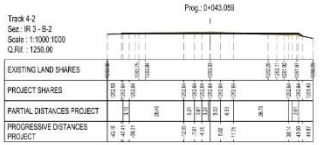
Irrigation Reservoir 3

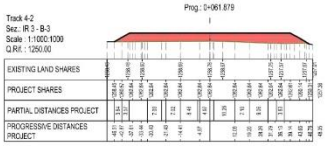




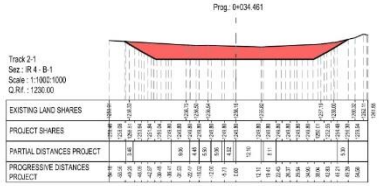


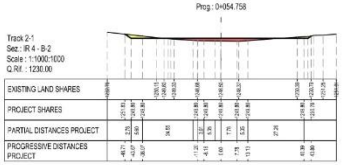


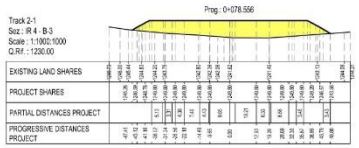


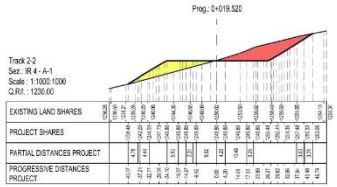


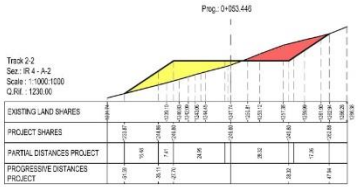
Irrigation Reservoir 4

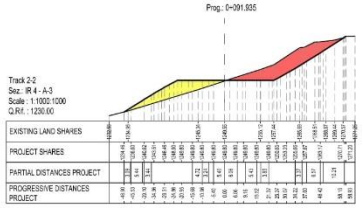






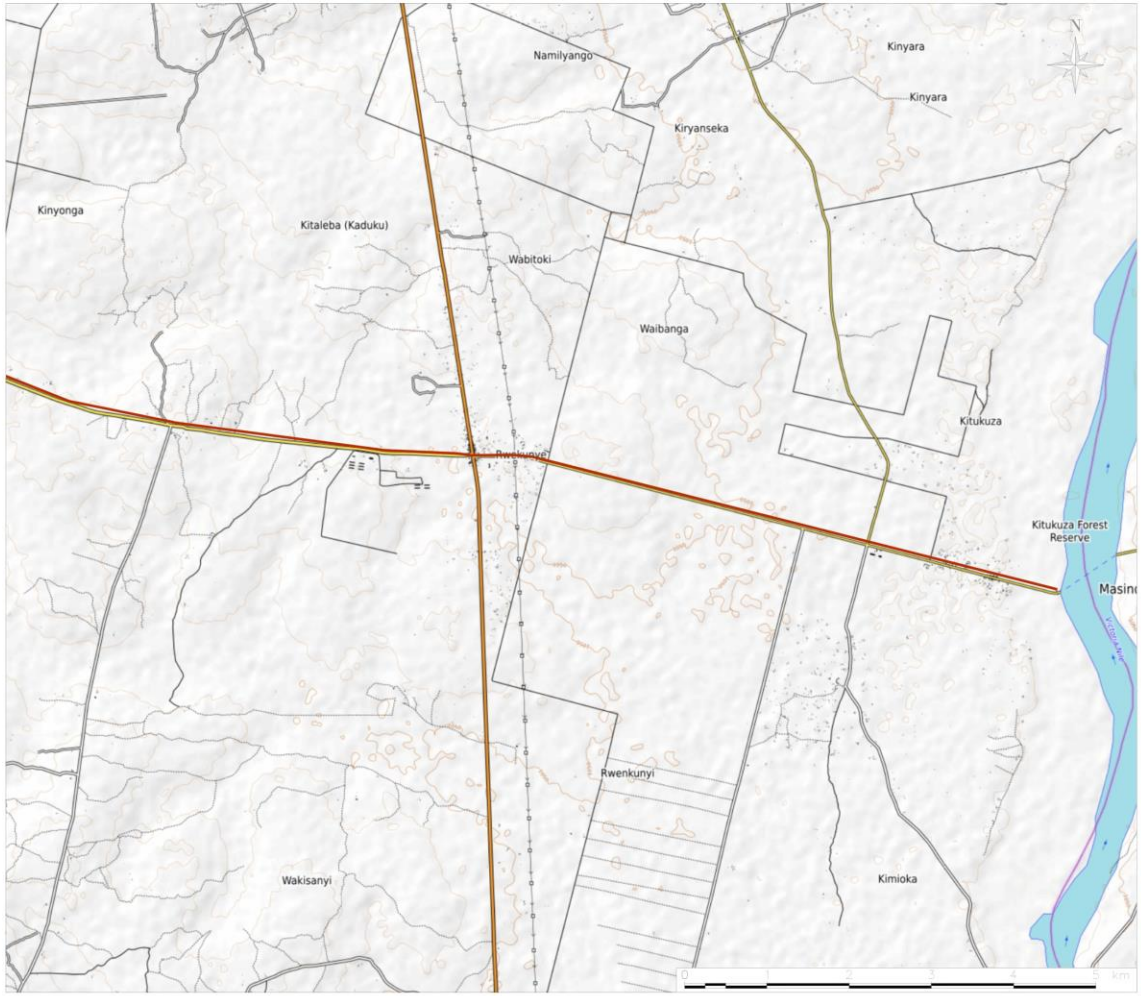








PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: CHECKED: APPROVED:		DRAWING TITLE 24,000 CUM Irrigation Reservoir Project Grading plan DRAWING NO. R.21 DATE: SCALE:	REVISIONS Rev | Date | Description



LEGEND

- PIPE ID 300 mm
- PIPE ID 272.8 mm
- PIPE ID 220.4 mm
- PIPE ID 198.2 mm
- PIPE ID 158.6 mm
- PIPE ID 141.8 mm
- PIPE ID 97.8 mm

KEY PLAN



PROJECT:
CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA

FOUNDER
AFRICAN DEVELOPMENT BANK

CLIENT
REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT
WATER FOR PRODUCTION DEPARTMENT

CONSULTANT
TECHNITAL
JV Consultant: BETA STUDIO

DESIGNED:	MZ
CHECKED:	AT
APPROVED:	AC

DRAWING TITLE
Water Distribution Network
Water supply distribution network general plan

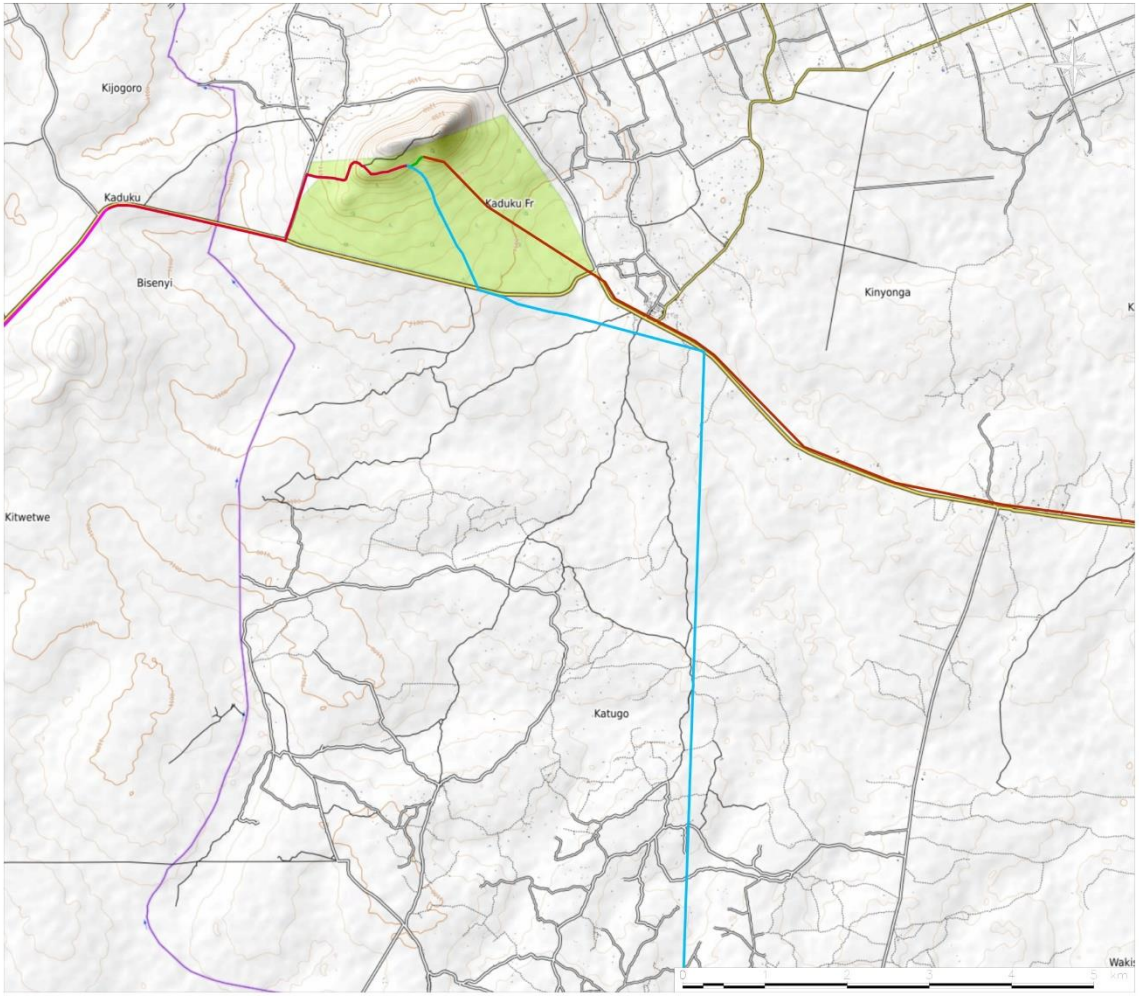
DRAWING NO. WD.01.01

DATE: March 2025

SCALE: 1:10,000

Rev	Date	Description

REVISIONS



LEGEND

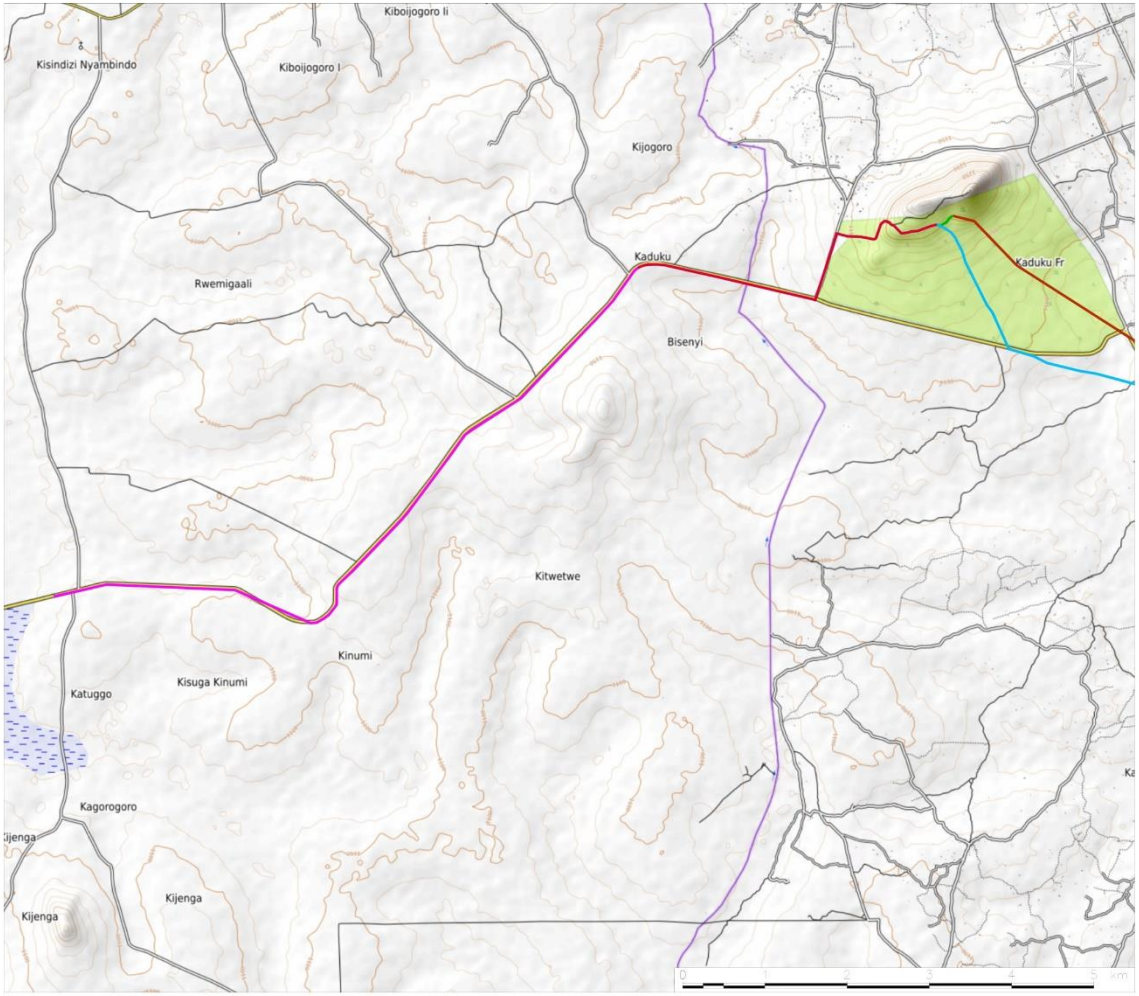
- PIPE ID 300 mm
- PIPE ID 272.8 mm
- PIPE ID 220.4 mm
- PIPE ID 198.2 mm
- PIPE ID 158.6 mm
- PIPE ID 141.8 mm
- PIPE ID 97.8 mm

KEY PLAN



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Distribution Network Water supply distribution network general plan DRAWING NO. WD.01.02 DATE: March 2025 SCALE: 1:10,000

REVISIONS		
Rev	Date	Description



LEGEND

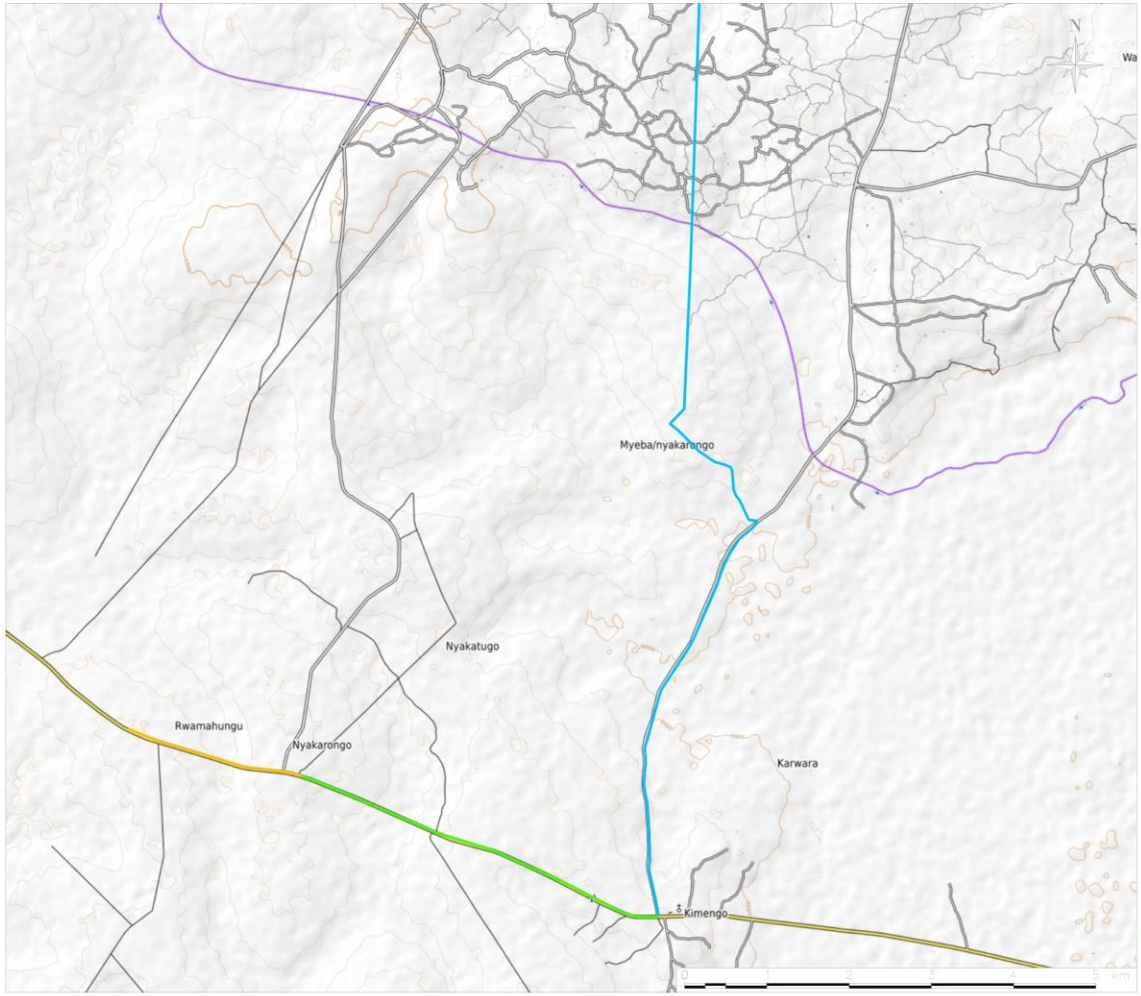
- PIPE ID 300 mm
- PIPE ID 272.8 mm
- PIPE ID 220.4 mm
- PIPE ID 198.2 mm
- PIPE ID 158.6 mm
- PIPE ID 141.8 mm
- PIPE ID 97.8 mm

KEY PLAN



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Distribution Network Water supply distribution network general plan DRAWING NO. WD.01.03 DATE: March 2025 SCALE: 1:10,000

REVISIONS		
Rev	Date	Description



LEGEND

- PIPE ID 300 mm
- PIPE ID 272.8 mm
- PIPE ID 220.4 mm
- PIPE ID 198.2 mm
- PIPE ID 158.6 mm
- PIPE ID 141.8 mm
- PIPE ID 97.8 mm

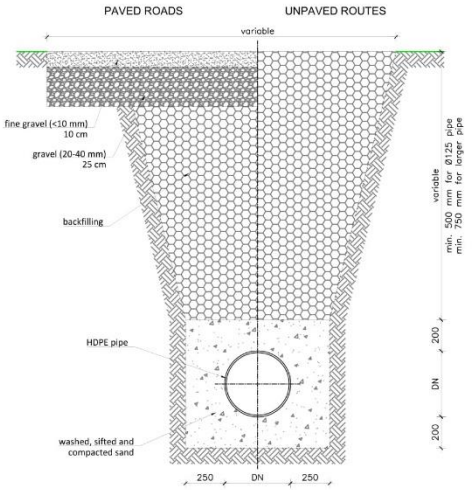
KEY PLAN



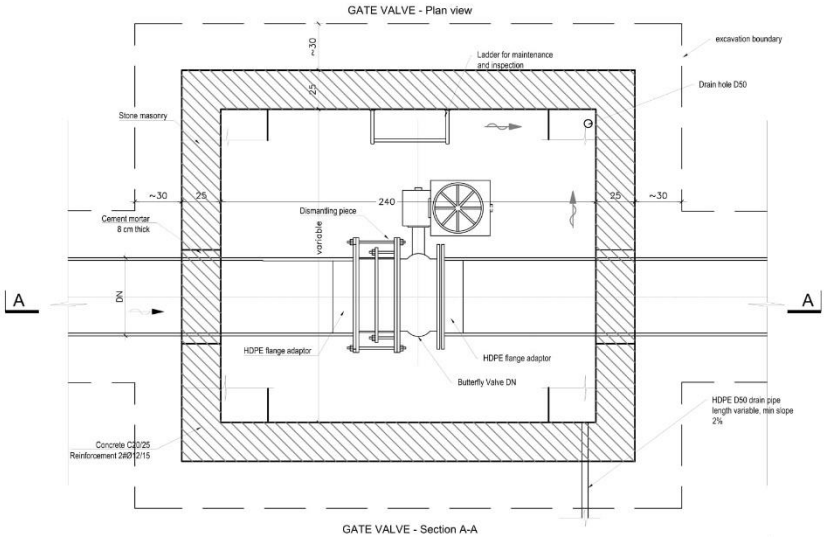
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Water Distribution Network Water supply distribution network general plan DRAWING NO. WD.01.04 DATE: March 2025 SCALE: 1:10,000

REVISIONS		
Rev	Date	Description

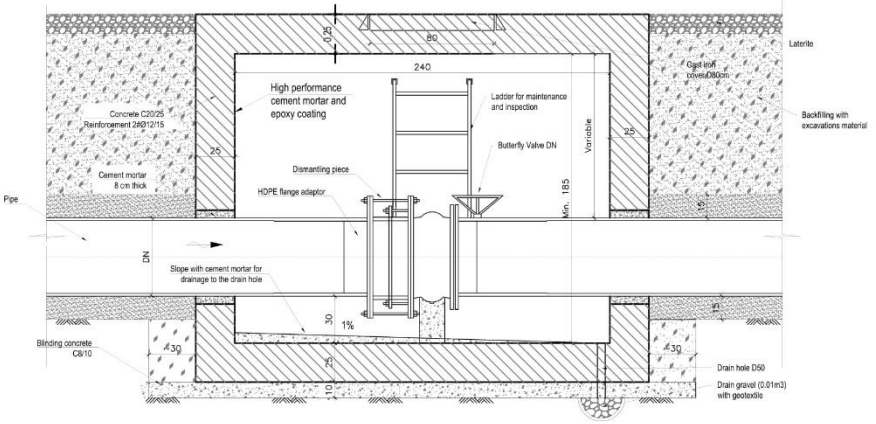
PIPE TRENCHES DETAILS FOR WATER SUPPLY NETWORK
STEEL and HDPE PIPES LAID IN SAND
Cross section



GATE VALVE - Plan view

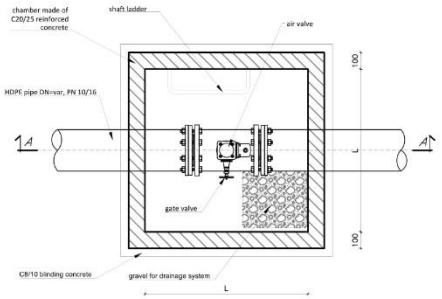


GATE VALVE - Section A-A

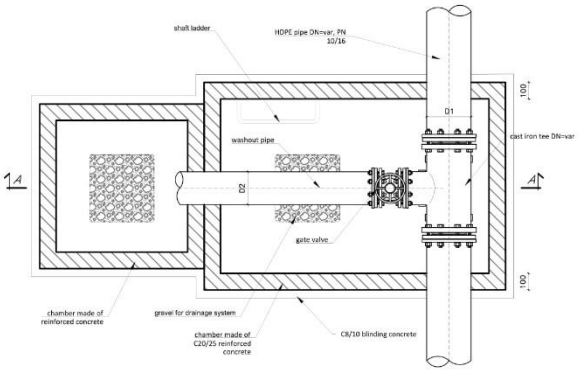


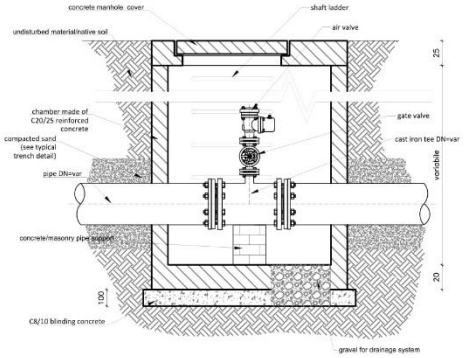
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Typical drawings Trench and gate valves DRAWING NO. TD.01 DATE: March 2025 SCALE: 1:25	REVISIONS Rev Date Description	

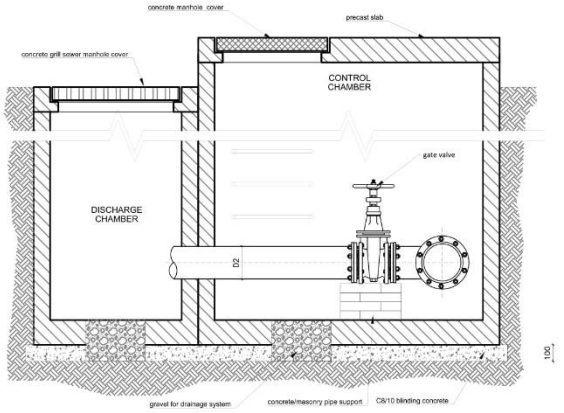
AIR VALVES
Cross section



WASHOUT VALVES
Cross section







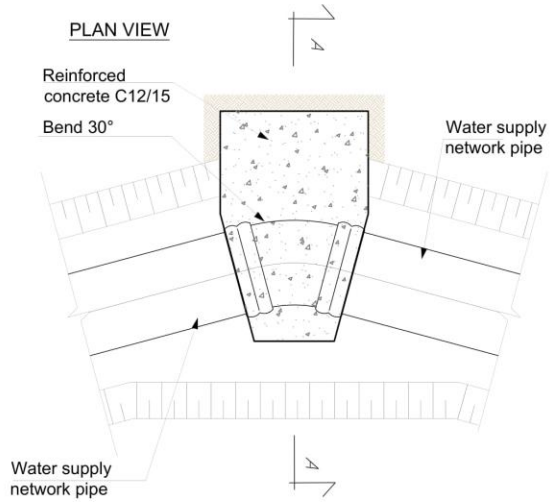
NOTE:
(1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
(2) CONCRETE STRENGTH 30MPA
(3) FLOATING CONCRETE STRENGTH 40MPA
(4) CONCRETE COVER 50MM
(5) THE DIAMETER OF THE WASHOUT PIPE IS BASED FOR PIPES WITH DIAMETER LARGER THAN DI200. ENSURE FOR PIPES WITH DIAMETER MORE THAN DN150 AND LESS THAN DI200, WHILE FOR PIPES WITH DIAMETER SMALLER THAN DI150 THE WASHOUT VALVE IS THE SAME AS THE MAIN PIPE
(6) AIR VALVES SHALL BE USED FOR PIPELINES UP TO DN200 AND HIGHER THE AIR VALVES ARE OF DN2 TYPE
(7) THE EXACT LOCATIONS OF THE PROPOSED WASHOUT AND AIR VALVE CHAMBERS ARE SHOWN IN THE PIPE PROFILES AND LAYOUTS
(8) APPROPRIATE SLOPES SHALL BE CREATED IN THE FLOOR OF EACH CHAMBER IN ORDER TO LET THE WATER DRAIN TO THE DRAINAGE SYSTEM

PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Typical drawings Air valves and washout valves DRAWING NO. TD.02 DATE: March 2025 SCALE: 1:25

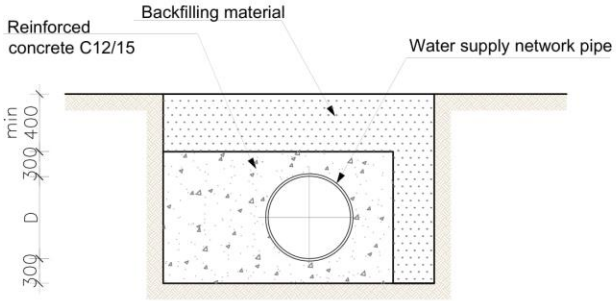
REVISIONS		
Rev	Date	Description

THRUST BLOCKS A30

PLAN VIEW

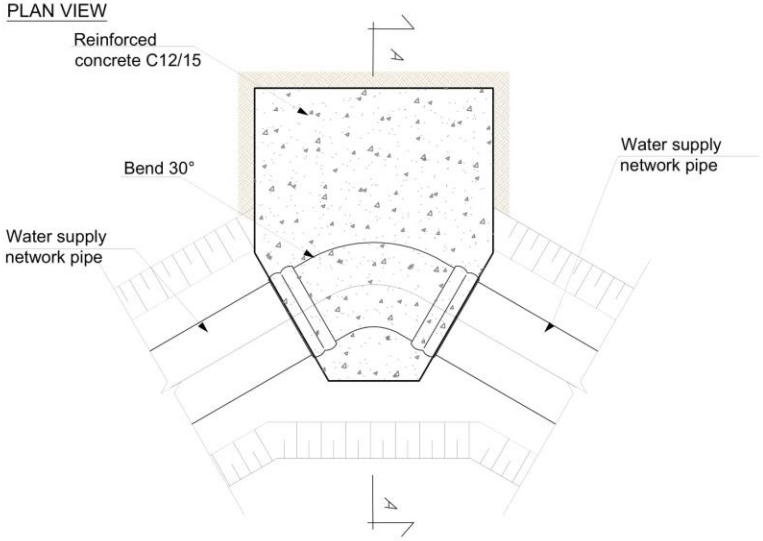


SECTION A-A

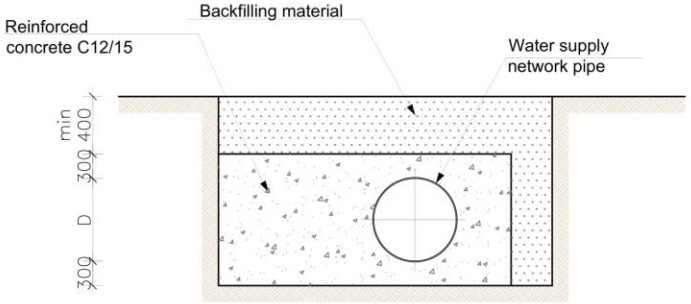


THRUST BLOCKS A60

PLAN VIEW



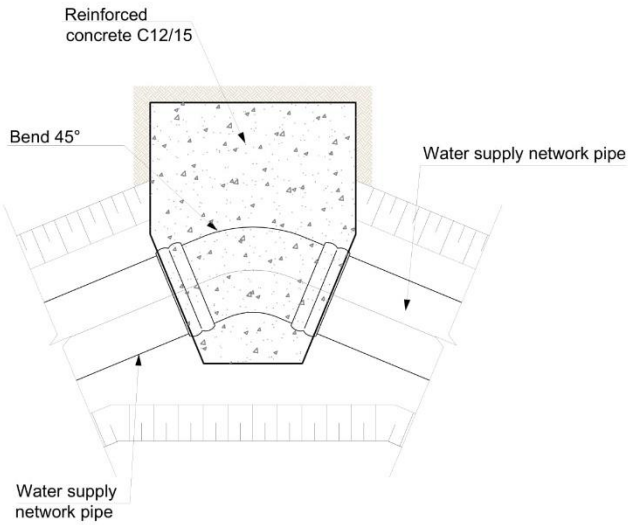
SECTION A-A



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE: Typical drawings Trust blocks (1/3) DRAWING NO. TD.03 DATE: March 2025 SCALE: 1:50	Rev	REVISIONS Date Description

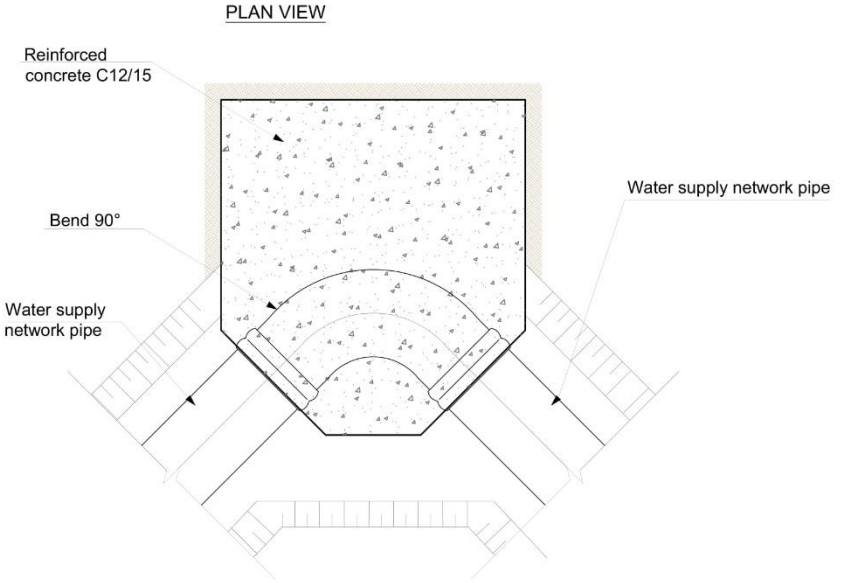
THRUST BLOCKS A45

PLAN VIEW



THRUST BLOCKS A90

PLAN VIEW



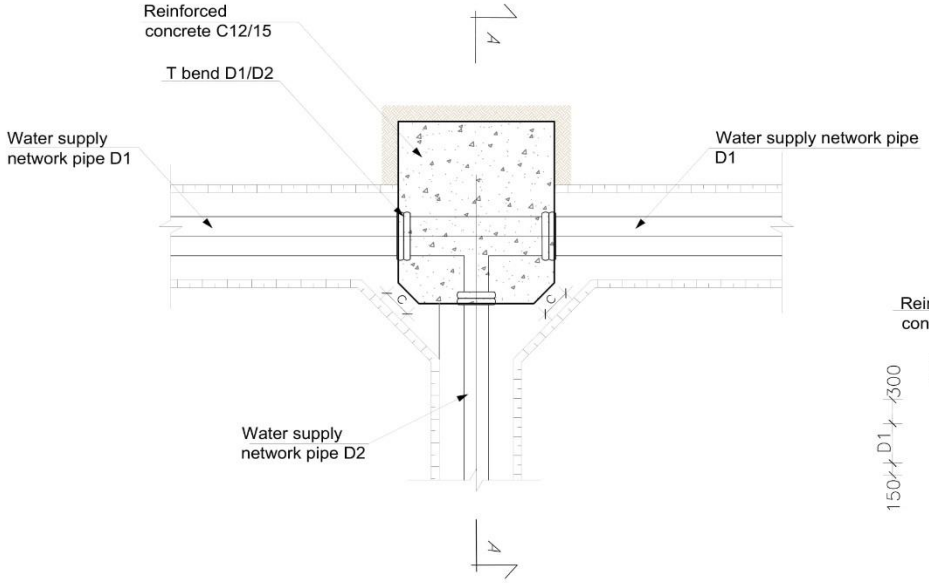
PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Typical drawings Trust blocks (2/3) DRAWING NO. TD.04 DATE: March 2025 SCALE: 1:50

REVISIONS		
Rev	Date	Description

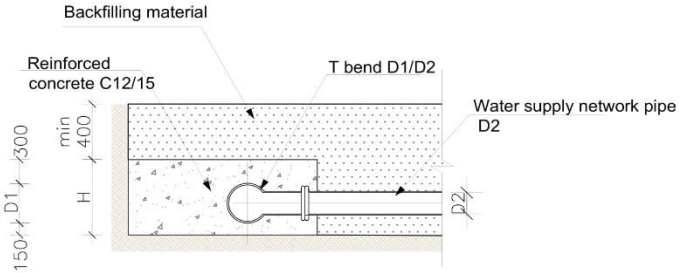
THRUST BLOCKS TYPE "T"

Scale: 1:100

PLAN VIEW



SECTION A-A



PROJECT: CONSULTANCY SERVICES FOR FEASIBILITY STUDIES FOR MASINDI PORT BULK WATER SUPPLY AND IRRIGATION INFRASTRUCTURE IN MASINDI DISTRICT, UGANDA	FOUNDER AFRICAN DEVELOPMENT BANK	CLIENT REPUBLIC OF UGANDA MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT **WATER FOR PRODUCTION DEPARTMENT**	CONSULTANT TECHNITAL JV Consultant: BETA STUDIO	DESIGNED: MZ CHECKED: AT APPROVED: AC	DRAWING TITLE Typical drawings Trust blocks (3/3) DRAWING NO. TD.05 DATE: March 2025 SCALE: 1:50

REVISIONS		
Rev	Date	Description

APPENDIX H: PEST MANAGEMENT PLAN
Executive Summary

Uganda heavily relies on rain-fed agriculture, with a significant portion of the population depending on this sector for livelihoods. The impact of climate variability has been detrimental, resulting in substantial economic losses during previous droughts. Without adequate intervention, future losses in food crop value are projected due to ongoing climate challenges. The Masindi Port Bulk Water Transfer and Irrigation Infrastructure Project aims to address these vulnerabilities by providing sustainable agricultural development opportunities. The Masindi Port Bulk Water Supply and Irrigation Infrastructure Project aims to deliver sustainable access to clean water for both domestic and agricultural use. Key objectives include improving water security, increasing agricultural productivity through irrigation, and reducing the incidence of waterborne diseases. Therefore, the project, by fostering agricultural modernization, improving rural livelihoods, and enhancing resilience to climate variability aligns with Uganda's strategic objectives of boosting export revenues and job creation, as outlined in the Uganda Vision 2040 and the National Development Plan III.

The project area is in Masindi and Kiryandongo Districts. The total population in these two districts is 707,374, with 1.7% growth rate in Masindi District and 3.3% growth rate in Kiryandongo District (from 2014 to 2024). The faster growth in Kiryandongo is majorly attributed to the influx of refugees. Masindi Port, where the project's water source is proposed, lies along the western banks of the Nile River about 30 km downstream Kyoga Lake. The topography of the study area is generally undulating, with altitudes ranging between 1,100 and 1,450 meters above sea level. The slopes become steeper near the Nile River in areas such as Masindi Port. The project is designed to cater for the water demand of a crop farming area of about 13,000 hectares, 10,340 livestock heads, and 87,000 population in Masindi Port, Kiryandongo District, Mirya, and Kimengo sub-counties in Masindi District. The infrastructure will be powered by electricity and serve various farms in the region, along with providing treated drinking water to several towns and villages. The project stems from a pre-feasibility study conducted by MWE, which identified the potential for at least 4,000 hectares of irrigable land in the region, with the River Nile as a sufficient water source.

Agriculture involving the production of crops, livestock and bee keeping is the biggest economic sector in the project area. Crops cultivation accounts for about 85% of the agricultural sector with crops including maize, cassava, bananas, sweet potatoes, beans, maize, coffee, cocoa, sugarcane, oil seeds (sunflower and soya bean), fruit trees, vegetables (tomatoes, cabbages, onions, leafy vegetables), etc., grown. The project area is part of the cattle corridor with many pastoralists rearing local breeds of cattle, sheep and goats. However, organized commercial cattle (beef, dairy and dual purpose), piggery, poultry and goat production are evident. Additionally, the area is endowed with good rainfall and rich vegetation that favours apiary/commercial insects farming specially bees for honey production.

The project will support increased crop and livestock production and productivity in the area, including those listed above. In any case, the use of agrochemicals including pesticides and fertilizers is expected

to increase to boost crop and livestock productivity. The increased use of agrochemicals may result in environmental pollution, decreased biodiversity, and potential health risks for humans and animals. It can also contribute to soil degradation, water contamination, and disruptions to ecosystems. These consequences may compromise the achievement of the project objectives.

Integrated pest management (IPM) is defined by the Panel of Experts on Integrated Pest Control at Food and Agricultural Organization (FAO) as "a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest population at levels below those causing economic injury". It is a complex, knowledge-based technology that combines biological, cultural and chemical control methods to keep pests below economically acceptable level. Practicing IPM would be an attempt to using decision rules to guide the selection of appropriate pest control methods used singly or in combination, are of economic benefits to farmers and community, benefit the environment, and the action impacts multiple pests. This Integrated Pest Management Plan (IPMP) has been prepared to guide the project's pest management interventions and to complement the Environmental and Social Management Framework (ESMF) and other safeguards instruments relevant for the project. The specific objectives of this IPMP are to:

1. Assess the current and anticipate pest problems in the project area.
2. Evaluate the capacity of Uganda's regulatory framework and institutions to promote and support safe, effective, socially and environmentally sound integrated pest management.
3. Develop an integrated pest management plan (IPMP) involving recommended best-practices for the project area.
4. evaluate the institutional capacity to support integrated pest management plan implementation and design a training programme if necessary
5. Develop monitoring and evaluation systems for the various pest management practices of the IPMP based on the government laws and the relevant African Development Bank (AfDB) environmental and social standards.

Existing and anticipated Pest and Disease / Management Practices

The project area, like anywhere in Uganda, is vulnerable to pest and disease attack especially due to the fact that the environmental conditions that favour availability of crops also favours the pests and diseases. Virtually every crop is affected by pests and therefore requires some form of pest management during cultivation. The pests envisaged in the project area may be a) w**ell-established pests that** are likely to cause losses each season unless managed or those that occasionally occur in larger outbreaks; b) **new** and emerging pests and diseases that may be newly present in the country but not yet occupying all ecologically suitable areas or those not yet in the country.

The main pest management methods can be clustered as follows:

(i) Cultural and physical control: These are control practices aimed at altering conditions or pest behaviors or pest populations. These practices include clearing fields of weeds and host plants to reduce harborage; removing infected plant parts, materials and burning / burying them;

mulching; managing manure and other soil amendments to improve crop vigour; planting timing; crop rotations; using irrigation and related field measures.

(ii) Chemical control based on using pesticides to control a range of insect and invertebrate pests, diseases and weeds. Use of pesticides is effective, fast and easy but requires proper diagnosis of the pest/disease problem is key, followed by appropriate application. Effective application of pesticides requires that farmer have appropriate knowledge of the type of pesticide in relation to the pest or disease they intend to manage. Responsible use and good handling practices limit pesticide risks to human health and environment.

(iii) Biological control: This may involve introduction of beneficial insects or predators; applying micro-organisms such as viruses, fungi and bacteria; and using pheromones to lure, trap and kill or interfere with insects' mating habits.

a. Use of natural enemies: This involves mass rearing of the pest natural enemy and its periodic release into the environment. An example of biological control in Uganda is mass release of *Typhlodromalus aripo* against cassava green mite and *Epidinocarsis lopezi* against cassava mealy bug. The deployment of the natural enemy is not an individual farmer action but by government. Once released, the enemy sustains its self for long in the habitat though a post release monitoring is required to ensure pest populations do not build up again.
b. Bio-pesticides: using bacteria, fungi, nematodes or viruses to control some pests. The most common and successful is Bacillus thuringiensis (Bt), a naturally occurring bacterium, which has been used to control several important pests (e.g. caterpillar pests in vegetables, vineyards and orchards).
c. Sex pheromones baits and traps: This involves the development and use of insect sex pheromones and other behavior-modifying chemicals to trap and kill pests. Some pheromones disrupt mating thus slowing down population build-up of insect pests.

(iv) Use of Pest or disease resistant varieties: The National Agricultural Research Organization (NARO) has developed various crop varieties with resistance to pests and diseases. Additionally, commercial seed merchants import into the country seeds of various crops with various attributes, including resistance to pests and diseases. Farmers need to be aware of these varieties and associated costs of acquiring seed/planting materials. Some of the resistance is enhanced by selecting a resistant root stock on which a desirable plant material (high performing but susceptible) is grafted Grafting has mainly been used in the management of pests and disease in fruits and vegetables. In this case, the farmer buys a grafted seedling ready to plant.

(v) Regulatory pest management: The objective of regulatory pest management is to prevent the introduction and/or spread of pests through the application of various pest management techniques such as pest exclusion, detection, eradication, mitigation, and public education. Achieving this objective requires limiting movement of commodities and materials, and treating commodities, materials, and the environment. This requires regulatory authorities to

efficiently and effectively identify pest harm, assess pest risk; and manage pest risk. Two approaches are commonly used:

a. Quarantine: The primary strategy to exclude pest entry is through the use of quarantines. Quarantine inspection programs at ports of entry are designed to prevent the introduction and establishment of pests into the country. Quarantine can be effective at reducing the incidence of pest introduction and reduce any incidents of pest introduction to a manageable population that can be eradicated.
b. Eradication: If prevention is not successful and an introduction occurs, there is need for the control program to institute eradication measures. Eradication generally means using all available viable options, which often includes the application of pesticides or destruction of plant materials. Eradication programs require participation of farmers and communities who must first be sensitized especially if losses to farmers are anticipated. Farmers require adequate knowledge of such pests and implications for noncompliance.

(vi) Integrated pest management (IPM): This means considering all available pest control techniques and other measures that discourage the development of pest populations, while minimizing risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. IPM requires a combination of cultural, biological and chemical measures to manage diseases, insects, weeds and other pests. It considers all relevant control tactics and methods that are locally available, evaluating their potential cost-effectiveness. Implementation of IPM lies with farmers who adopt practices they view as practical and valuable to their activities. Ultimately, IPM is a site-specific strategy for managing pests in the most cost-effective, environmentally sound and socially acceptable way. Using IPM is rather complex and require intensive extension measures to ensure that farmers learn and adopt IPM

Whereas integrated pest management is highlighted as the adopted strategy for pest management, the use of IPM is not widespread. The use of pesticides is increasing despite the high cost of the products relative to the purchasing power of majority of farmers. A successful IPM plan for the project must be low cost, scalable and knowledge driven combining traditional practices with modern techniques. Emphasis should be on prevention using cultural methods (for example, crop rotation, intercropping, sanitation, planting resistant varieties), biological control, and judicious use of pesticides. This should be supported by farmer education to build competencies in implementation of Integrated Pest Management and establishing pest monitoring and early warning system.

Introduction

This Integrated Pest Management Plan is part of the Feasibility study for the Masindi Port Bulk Water Supply and Irrigation Infrastructure Project in Masindi and Kiryandongo districts. The rationale for the project is rooted in the need to support agricultural development in rural areas of Uganda.

The agricultural sector of Masindi and Kiryandongo districts is predominantly characterised by micro-scale and smallholder farmers, most of whom rely on subsistence farming as their primary source of livelihood. According to the Uganda Bureau of Statistics (UBOS) 2014 Masindi District Report, approximately 69% of households in the region depend on agriculture, highlighting the sector's critical role in sustaining local communities. However, this heavy dependence on rain-fed agriculture makes the population highly vulnerable to climatic variability and seasonal disruptions. In Masindi district, food crops produced include, cassava, bananas, sweet potatoes, beans, maize among others. The major cash crops grown are sugarcane, coffee, and cocoa. Sugarcane production has taken most of arable land in the district and has affected on food production. In Kiryandongo district, most of the population are engaged in farming. Major crops grown include cassava, sweet potatoes, maize, beans and groundnuts. Others are simsim, rice and vegetables. Cash crops including cotton, sunflower soybean and tobacco are widely grown. Other major activities carried out include livestock rearing, fishing.

To achieve the project objectives above, there is need for effective management of pests in a manner that does not pose health and safety risks to the farmer, users of products, the public and the environment – water, soils and biodiversity. This Integrated Pest Management Plan (IPMP) was prepared through literature review and is made up of an Introduction, a review of common pests which may be relevant to the project, a review of applicable pest management options and finally a management plan presenting recommendations on pest management under the project.

Key Pests and Diseases that may affect Crops grown in the project area – An Overview

The term pest in crop production refers to external biological agents that compete and interfere with the proper growth and development of a target crop. Examples include weeds, insects and disease-causing pathogens such as fungi, viruses and bacteria. Damage to the crop may arise from competition for available nutrients, water, light or space as in the case of weeds, or may manifest by way of harm where a particular pest subsists and feeds on the plant or transmits disease pathogens. Pests can thus either directly harm the plant or may pave way for secondary infestation by disease or other pests. Arising from this damage the crop may not be able to realize its full productive potential or may even die.

Crop losses due to pests and diseases are estimated at 10-20% (pre-harvest); 20-30% (post-harvest); and up to 100% for perishable crops and export crops. Annual losses in monetary terms amount to US$ 35-200 million (bananas), US$60-80 million (cassava), US$10 million (cotton) and US$8 million(coffee). Pests affect food crops, causing significant losses to farmers and threatening food security. Therefore, pest management is thus vital for sustained agricultural productivity because without proper pest management a farmer's effort can be of no benefit.

Each of the crops grown in the project area has unique pests associated with them. Here below s a review of the major pests occurring on each crop mentioned above:

Banana

Banana is affected by several pests and diseases which result in significant decline in yield. The banana weevil also referred to as the banana root borer (Cosmopolites sordidus) is the most damaging pest in Uganda especially in neglected plots. It lives, feeds and breeds in pseudostems for periods of up to two years. It lays eggs against the sides of the stems. After hatching, the larva bores into the stem, weakening them and making them liable to wind damage. Other pests are nematodes, including *Radopholus similis*, *Pratylenchus goodeyi*, *Helicotylenchus multicinctus* and *Meloidogyne* spp. They infect root tissues and impair absorption and transportation of water and nutrients in addition to weakening plant anchorage in soil. Damage to banana is associated with a reduction in bunch weight, loss of bunches due to plant toppling, increase in crop cycle duration and decrease in plantation longevity with yield losses ranging from 30% to 50%.Black sigatoka, which is also referred to as black leaf streak is caused by the fungus *Mycosphaerella fijiensis*, a pathogen that has a wide host, range and considered the most important folia disease of banana. Infestation results in significant reductions in leaf area through premature drying of leaves and yield loss. Early leaf drying results in incomplete filling of banana fingers as well as premature ripening both of which are detrimental in exported fruit. Yield loses have been estimated to more than 50% under heavy infestation. Studies done at Kawanda, revealed a bunch weight reduction of 37% due to black sigatoka. The disease is more damaging and difficult to control than yellow sigatoka (*Mycosphaerella musicola*). Fusarium wilt is caused by the soil borne fungus *Fusarium oxysporum* f.sp. *cubense*. The disease has remained one of the most important diseases of bananas in the country having wiped out entire plots of susceptible cultivars. It has been recorded all around the country especially where susceptible cultivars such as Bogoya, Kayinja, Sukali Ndizi and Kisubi are grown. Banana Bacterial wilt is caused by the bacterium *Xanthomonas campestris* pv. *Musacearum*, causes wilting of banana plants of all age causing the affected plants to die prematurely.

Beans

The common bean (*Phaseolus vulgaris*) is often infested by a complex of insect pests, including bean aphid (Aphis fabae), bean fly (*Ophiomyia* spp.), thrips (*Frankliniella occidentalis* and *Megalurothrips sjostedti*), legume pod borers (*Maruca* sp and *Helicoverpa armigera*), pod suckers (*Clavigralla* sp, *Riptortus* sp and *Nezara viridula*), semi-looper (*Trichoplusia* sp), cutworm (*Agrotis* sp), flower and pollen beetles (*Mylabris* sp and *Coryna* sp), common whitefly (*Bemisia tabaci*), and bean leaf beetles (*Ootheca* spp). In Uganda, the bean fly, causing up to 100% yield loss, aphids causing up to 90% yield loss, bean leaf beetles causing up to 49% yield loss, and thrips causing up to 27% yield loss, are the most devastating. Diseases of beans include those caused by fungi such as: angular leaf spot caused by *Phaeoisariopsis griseola*; anthracnose caused by *Colletotrichum lindemuthianum*, and bean rust caused by *Uromyces appendiculatus*. Diseases caused by bacteria include common bacterial blight caused by *Xanthomonas axonopodis* pv. *phaseoli* and halo blight caused by *Pseudomonas syringae* pv. *phaseolicola*. Viruses, especially the bean common mosaic virus, continue to limit production levels.

Cassava

The pests of cassava are insects, mites, and vertebrates. The pests attack and feed on different parts of cassava plants. Some feed on the leaves and stems while others feed on the stems and roots. The common leaf and stem pests of cassava are cassava mealybug, cassava green mite, variegated grasshopper, and whiteflies. The cassava mealybug, *Phenacoccus manihoti* is commonly found at cassava shoot tips, on the under surfaces of leaves, and on stems. The insects are covered with large amounts of white waxy materials. They are wingless, pink in color, oval, and have very short body filaments. The cassava mealybug sucks sap from cassava leaves and shoot tips. The pest reduces the lengths of the internodes and causes the leaves to clump together into "bunchy tops". The pest also distorts the stems, dries up the leaves and eventually, if the attack is particularly severe, it defoliates the plants. The damage is more severe in the dry than in the wet season.

Cassava green mite, *Mononychellus tanajoa*, lives on the under surface of young cassava leaves. Mites are wingless, very tiny, and appear as specks to the naked eye. In the farm, you can see them more clearly if you look at them under a hand lens. The nymphs (immature mites) are green in color and turn yellowish as they get older. Red mites also occur on cassava, mostly on the older leaves, but they are not common and do not cause serious damage. Crop damage symptoms: Cassava green mite sucks sap from cassava leaves and shoot tips. The pest causes tiny yellow chlorotic spots the size of pin pricks, on the upper leaf surfaces. Young leaves attacked by cassava green mite become small and narrow. The pest kills the terminal leaves and as these drop the shoot tip looks like a "candlestick". Cassava crop damage by the pest is more severe in the dry than in the wet season.

The variegated grasshopper is another pest of cassava which chews cassava leaves, petioles, and green stems, defoliating the plants and causing debark of stems. The pest damage is more common on older than on younger cassava plants and is more severe in the dry than in the wet season.

Spiraling whitefly (*Aleurodicus disperses*) adults and nymphs occuring in large numbers on the undersurfaces of cassava leaves suck sap from cassava leaves. As they feed, they secrete large amounts of honeydew which supports the growth of black mold on the plant. The blackened leaves dry up and drop. A similar pest but smaller than the spiraling whitefly is the Bemisia whitefly (*Bemisia tabaci*) whose adults and nymphs occur on the under-surfaces of young leaves of cassava. Bemisia whiteflies suck sap from the leaves, but this does not cause physical damage to the plant. As they feed, the insects inject the plant with viruses which cause cassava mosaic disease (CMD) and Cassava brown streak disease (CBSD), and this is the main reason why the insect is an important cassava pest.

Subsequently, Cassava mosaic disease (CMD) and Cassava brown streak disease (CBSD) are the most important diseases of cassava in the project area, and all major cassava growing regions in Uganda. Cassava mosaic disease (CMD) infection in cassava plants manifests as mosaic, mottled, deformed and twisted leaflets. There is observed overall reduction in size of leaves and plants and such plants normally produce few or no tuber although this is dependent on the severity of the disease and the age of the plant at which it was infected. On the other hand, Cassava brown streak disease (CBSD) causes serious economic losses in the yield and quality of the roots especially in susceptible varieties, where infestation

renders the cassava roots unusable particularly when left in the ground for longer periods. CBSD symptoms are observable on the leaves, stems and roots; however, on the leaves, the symptoms are more prominent on older leaves than young ones. Unlike CMD, infected leaves do not become distorted. The characteristic symptom on the leaves appears as patches of yellow areas mixed with normal green colour which may enlarge and join to form comparatively large yellow or necrotic patches. These yellow patches are more pronounced in mature than young leaves. On the stems, the disease appears as dark brown streaks and spots and is more prominent on the upper green portions of the stem. On the roots, the disease causes cracks, discoloration, root constriction and malformation. The harvested roots are corky with yellow-brown necrotic spots.

Cocoa

Cocoa is affected by a range of pests and diseases, with some estimates putting losses as high as 30% to 40% of yields. Among the pests, the major ones are mirids, cocoa pod borer and mealybugs. The most common mirids species affecting cocoa in African countries are *Distantiella theobroma* and *Sahlbergella singularis*. Cocoa mirids pierce the surface of cocoa stems, branches and pods, killing the penetrated host cells and producing unsightly necrotic lesions. Mirids feeding on shoots often result in the death of terminal branches and leaves, causing dieback. Mated female mirids lay up to 60 eggs that are embedded in the bark of stems or inside the pod husk. Pests usually occur on trees exposed to sunlight since such trees tend to bear more fresh shoots and pods. Although the insect is attracted to trees exposed to sunlight; after locating their source of food they inhabit shady areas on trees. Some indigenous plants grown with cocoa have been identified as alternative hosts for some species of mirids. The cocoa pod borer (CPB) also known as cocoa moth (*Conopomorpha cramerella*) attacks both young and mature cocoa pods. A common symptom of infested pods is unevenness and premature ripening. Infestation of young pods results in heavy losses because the quantity and quality of the bean becomes seriously affected. A CPB moth is 7mm long and brown in colour with a white strip on the forewings. The female lives for about 5-7 days and lays 100-200 eggs on the surface of the cocoa pod. The larval period is about 14-18 days, then 5-8 days before hatching as a moth. Mealybugs, like *Planococcus* spp and *Stictococcus* spp., are vectors of the cocoa swollen shoot virus (CSSV), which can cause severe damage and even death in cocoa tree

Among the cocoa diseases, witches' broom, frosty pod rot, black pod and vascular-streak dieback are the most important in Africa. Witches' broom caused by a fungus *Moniliophthora perniciosa*, attacks only actively growing tissue (shoots, flowers and pods) causing cocoa trees to produce branches with no fruit and ineffective leaves. The pods show distortion and present green patches that give the appearance of uneven ripening. Frosty pod rot is caused by the basidiomycete fungus *Moniliophthora roreri* which infects only actively growing pod tissues, especially young pods. The time from infection to the appearance of symptoms is about 1-3 months. The most outstanding symptom is the white fungal mat on the pod surface. Phytophthora pod rot, also known as Black pod, is caused by the fungus *Phytophthora* spp. Three fungal species of the same genus are responsible – *P. palmivora*, *P. megakarya* and *P. capsici*. The *P. palmivora* causes global yield loss of 20-30% and tree deaths of 10% annually. *P. megakarya* is the most important pathogen in Africa, known as the most aggressive of the Pod rot pathogens. Vascular-streak dieback (VSD) is caused by the fungus *Oncobasidium theobroma*. The initial

characteristic symptoms are the chlorosis of one leaf on the second or third flush behind the tip. The fungus may spread internally to other branches or the trunk, usually causing death of the tree. When an infected leaf falls during the rainy season, hyphea may emerge from the leaf scar and develop into a basidiocarp, evident as a white, flat, velvety coating over the leaf scar and adjacent bark.

Coffee

There have been declines in coffee volumes in the last decade in Uganda which has largely been attributed to pest and diseases although there are other factors that have also been suggested. It has also been suggested that changes in climatic conditions that have resulted in rampant droughts, unpredictable and varied rain patterns, temperature changes could have resulted in the appearance of new pests and severity of new and existing pest problems. In addition, the results of climate could have resulted in migration of pests to ecological zones where they never existed. Diseases causing losses of economic importance include coffee wilt disease, coffee leaf rust, coffee berry disease. Coffee wilt diseases caused by *Gibberella xylariodes* (Telomorph: *Fusarium xylariodes*) is an important disease since first reported on Robusta coffee in the early 1990s but combined use of resistant clones and field phytosanitary campaigns have led to the disease not being a major threat to the coffee industry as previously. Coffee leaf rust is caused by the rust fungus *Hemileia vastatrix* and Coffee berry disease is caused by the fungal pathogen *Colletotrichum kahawae* were initially known to cause major loses on only Arabica coffee, but the diseases have also been reported to affect Robusta coffee. Among insect pests, the black twigborer (*Xylosandrus compactus*) is recently reported as the major pestcausing extensive damage on coffee Robusta coffee. The insect thrives on more than 40 plant and forest tree species have been recorded and reported in Uganda. The affected twigs do not bearberries.

Cotton

Insect pests are the major production constraint on cotton in Uganda. The African bollworm (*Helicoverpa armigera*) is the most important cotton pest in Uganda. It is a difficult pest to manage because it has a wide range of hosts especially vegetables like tomatoes, okra, pepper and peas. Most of these are grown within the proximity of cotton fields. Another serious pest reported is the lygus bug (*Lygus simonyi*) that causes serious damage through sucking the young leaves and apical buds causing retarded growth and young cotton boll buds, causing fruit failure. Jassids feed on cotton leaves causing them to curl at the edges, turn yellow or reddish and in severe cases, they may even dry. The Cotton diseases include cotton bacterial blight caused by *Xanthomonas citri* pv. *malvacearum*, the wilts caused by the soil-borne fungi *Fusarium oxysporum* f.sp *vasinfectum*) and *Verticillium dahlia*, and the leaf spots caused by *Alternaria macrospora* and *Cercospora gossypina*.

Groundnuts

Many fungal, viral, nematode and bacterial diseases have been reported on groundnuts, many of which are widespread, but only a few of them may be economically important in the project area. Major diseases in this region include groundnut rosette, early leaf spot (*Cercospora arachidicola*), late leaf spot

(*Phaeoisariopis personata*), Rusts (Puccinia arachidis) and aflatoxin (caused by *Aspergillus niger*, *Aspergillus flavus*). Groundnut rosette disease is a very serious viral disease of groundnuts in Uganda. It is transmitted by aphids feeding on the crop. The plants infected by this disease look stunted and presents a bushy appearance. There is a marked reduction in the size of the leaflets and mottling becomes visible. Plants infected when young produce progressively smaller distorted, curled and yellow leaflets. Early infected plants (when infection occurs before flowering) produce no yield and there is no control once a plant is infected. Control of aphids will prevent further spread of the disease. Early leaf spot (*Cercospora*. *arachidicola*) and late leaf spot (*Phaeoisariopsis personatum*) are generally found coinfecting in a single field, and always confused with harvest indicators making mitigation measures difficult. The diseases maybe expressed on both the leaves and stems, and this results in poor crop stand and yield.

Aflatoxins are a group of toxic metabolites produced by *Aspergillus flavus* and *Aspergillus parasiticus*. Because groundnut pods grow in the soil and at early development stages the pod and the seed coat are tender and easily damaged, this allows fungi to invade groundnuts easily. Additionally, at maturity, ground nut seeds have a high oil content which also favours fungal growth. Therefore, groundnuts are prone to aflatoxin contamination in the field, during postharvest drying and storage, and shipment.

Maize

The common maize pests include stalk borers, armyworms, cutworms, and various storage pests. Stem borers, such as the African maize stalk borer *Busseola fusca*, and the spotted stem borer *Chilo partellus*, can cause significant damage to maize stalks. Armyworms like Spodoptera frugiperda and Spodoptera exempta are also major pests, feeding on leaves. Additionally, storage pests like the larger grain borer *Prostephanus trunctus*, maize weevil *Sitophilus zeamais*, and lesser grain borer *Rhyzopertha dominica* can damage stored maize. The Fall armyworm (FAW) *Spodoptera frugiperda* (Lepidoptera: Noctuidae) is now established across Uganda and is a highly polyphagous and destructive pest of maize. It causes heavy damage especially on shoots and growing points. The larvae are the damaging stage of FAW which feeds on different parts of host plants. The larvae usually feed on leaves, creating a “windowing’ effect and moist sawdust-like frass within the whorl and the upper leaves. This kills the growing point early in the season preventing any cobs from forming. The diseases include those caused by viruses: maize streak virus and maize lethal necrosis (MLN); Fungi: turcicum leaf blight caused by *Exserohilim turcicum*, gray leaf sport caused by *Cercospora zeaemaydis* and *Cercospora sorghai* var. *maydis*; and ear rots caused by *Sternocarpella maydis*, *Fusarium graminearum* and *F. verticillioides*. Ear rots are associated with production of aflatoxins. The notorious parasitic weed, Striga is not yet reported in the project area, but it can be a major problem likely to cause heavy cereal crop loses if established. There are two species *Striga hermonthica* and *Striga asiatica* reported in Uganda.

Rice

Rice yields in Uganda are decimated diseases such as rice yellow mottle virus, a Sobemovirus vectored by the Chrysomelids, bacterial blight caused by Xanthomonas oryzae pv. oryzae and rice blast caused by

Magnaporthe oryzae (Anamorph: Pyricularia oryzae). These diseases have been recorded wherever rice countrywide. The following pest arthropods are found associted with rice: large-sized stalk-eyed fly (*Diopsis longicornis*), small-sized stalk-eyed fly (*D. apicalis*), plant bugs (Pentatomidae and Alydidae), planthoppers and leafhoppers (Delphacidae and Cicadellidae), leaf beetles (*Chaetocnema* spp., *Chrysispa viridicyanea* and *Altica* spp.), short-horned grasshoppers (*Coryphosima* spp. etc.) and long-horned grasshoppers (Tettigoniidae). However, the stem borers and the African rice gall midge (AfRGM) are perceived to be the 1st and 2nd most detrimental insect pests. Additionally, in storage, pests like the maize weevil *Sitophilus zeamais* and rice weevil *Sitophilus oryzea*, and lesser grain borer *Rhyzopertha dominica* can damage stored rice.

Simsim

The most significant pests of sesame (sesamum indicum) in Uganda are the sesame webworm (*Antigastra catalaunalis*) and the sesame gall midge (*Asphondylia sesami*). These pests can cause significant damage to sesame crops, leading to reduced yields. Alternaria blight, Cercospora leaf spot, Fusarium wilt, Phytophthora leaf spot, and Macrophomina root/stem rot. Cercospora leaf spot disease is one of the major diseases affecting sesame production in Uganda. Other major foliar diseases are on the leaves (which may spread to other parts of the plant) and include powdery mildew and the leaf spots: Alternaria, Cercospora, Pseudomonas, and Xanthomonas. Other diseases are soilborne and occur primarily on the roots and stems, for example, Macrophomina, Phytophthora, and Fusarium.

Soybean

The major soybean pests include stink bugs, particularly the green stink bug (*Nezara viridula*), Riptortus bugs, and groundnut leaf miners (*Aproaerema modicella*). The groundnut leaf miner (*Aproaerema modicella*) is a new important pest of soybeans in Uganda. Other important pests include pod borers, soybean stem flies, and root-knot nematodes. Bean leaf beetles and other related pests, such as cutworms and aphids, can also be a problem. Lately bruchids attacking soybean seed during storage have been observed. The most significant soybean disease is Soybean Rust (*Phakopsora pachyrhizi*). Other important diseases include Frogeye Leaf Spot, Red Leaf Blotch (*Coniothyrium glycines*), sudden death syndrome (SDS), and bacterial blight. Root diseases like Pythium, Phytophthora, Fusarium, and Rhizoctonia can also cause significant issues.

Sugarcane

Farmers commonly reports pests like sugarcane aphids, stalk borer, termites and white grubs as major threats, especially in newly planted sugarcane. The African sugarcane borer (*Eldana saccharina*) attack cane of all ages, although frequently, the most serious damage occurs in carry over cane of 15-months or more. The borer feeds voraciously on the soft tissue inside the sugar-cane stalk causing serious loss in yields and cane quality. Up to 14 borers per internode have been recorded, and the stem can become completely hollowed out. It has been estimated that, for every1 *Eldana* borer/100 stalks average throughout the season, 0,5 ton cane/hectare is lost. Another estimate indicates that for every 1% stalk length red, 1% of your ERC% cane is lost. In a severe infestation the entire crop can be destroyed. Under

drought conditions *Eldana* damage may become increasingly severe, as stressed cane is particularly susceptible. The other stalk borers include *Chilo infescatellus* and *Chilo saccharifugus*. Other pests on sugarcane include the cane grubs, which are larvae of the June beetles (*Lepidiota stigma*) which eat the young cane's roots and shoots; a range of plant parasitic nematodes; the sugarcane woolly aphid spread with the movement of infested plant material; scale insect (*Melanaspis glomerata*) which affects both productivity of cane and quality of juice; and termites (*Macrotermes natalensis*). Sugarcane farmers in Uganda also face several economically significant diseases that reduce yield, sugar content, and profitability. The most important diseases include sugarcane smut (*Sporisorium scitamineum*); leaf scald (Xanthomonas albilineans); Red Rot (Colletotrichum falcatum); ratoon stunting disease (Leifsonia xyli subsp. xyli); and Yellow Leaf Virus (SCYLV).

Sunflower

The most common and damaging sunflower pests include aphids, cutworms, leafhoppers, sunflower moth, sunflower beetles, thrips, and various caterpillars. Birds, especially grackles and blackbirds, can also cause significant damage by feeding on sunflower seeds. The most common and damaging sunflower diseases in Uganda include downy mildew, rust, Phomopsis stem canker, Sclerotinia wilt, Verticillium wilt, charcoal rot, and Septoria leaf spot.

Sweet Potato

The major pest of sweet potato in Uganda is the African sweet potato weevil (*Cylas puncticollis* and *Cylas brunneus*), causing yield losses ranging from 60% to 100%, especially during dry spells. The larvae feed within the storage roots and stems, leading to poor root quality and potentially rendering them unfit for consumption. The other pests include the sweet potato butterfly (*Acraea acerata*), white grubs, millipedes, whiteflies, and aphids. The most significant sweet potato diseases are viruses and Alternaria blight, with sweet potato virus disease (SPVD) being the most devastating. SPVD, caused by a combination of Sweet potato feathery mottle virus (SPFMV) and Sweet potato chlorotic stunt virus (SPCSV), can lead to 50-98% yield loss in susceptible varieties. Alternaria blight, causing leaf spot and stem blight, is also a major concern, particularly in the Lake Victoria region.

Tobacco

Although the production of tobacco is on the decline, the major diseases affecting the tobacco include blue mold (Peronospora tabacina), black shank (Phytophthora nicotianae), root rots (Pythium spp. and Fusarium spp), damping-off particularly problematic in nursery beds (Pythium spp. and Fusarium spp) and tobacco mosaic virus (TMV). Tobacco Mosaic Virus (TMV) is highly contagious virus causes a mosaic pattern on the leaves, with areas of light green and dark green. It can be spread through contact with diseased plants or infected equipment.

Fruits and Vegetables

The fruits are ravaged by the fruit fly (*Bactrocera dorsalis*, *Ceratitis cosyra*, Ceratitis rosa and Ceratitis capitata) and false codling moth (*Thaumatotibia leucotreta*). The prevalence of these pests has resulted in export restrictions of fruits and vegetables. Other pests include whiteflies, aphids, thrips, bugs and beetles, etc. There are many fungal, bacterial, viral diseases on vegetables, depending on the kind of vegetable.

Pests and diseases Livestock sector

In the project area there are cattle, goats, sheep, pigs, poultry, dogs and cats as domestic animals and the area is adjacent to conservation areas with increased in animal disease outbreaks including those transmissible between animals and humans (zoonoses). Depending on the livestock, they are affected by protozoan, bacterial, helminthiasis, nutritional disorders, viral diseases.

Current pest management options – an overview

The overview above highlights the potential pests and disease that may affect the production and productivity of the current important crops in the project area. The problem of crop pests and diseases is exacerbated by the inability to monitor and identify infestations in a timely manner, and to plan and implement effective pest management. Nationally, the blame is to institutional insufficiency in terms of phytosanitary capacity in pest and disease risk analysis, diagnostics, surveillance and control and policy interventions; research capacity to evaluate and respond to problems; extension services to promote good agricultural control practices, and access to quality inputs. At farm level, the farmers have limited capacity to identify, differentiate and diagnose disease problems and effectively respond to them. In situations where they can identify the problems, they fall short on management practices both pre- and post-harvest. On the other hand, where pest management advice is given by research and extension services, the farmers may not follow the advice because there is no economic incentives to invest in pest management; the recommended inputs are not accessible and usually of questionable quality; and the farmers may be tired of conflicting advice by uncoordinated service providers.

The pest management options available to farmers is often influenced by accessibility, cost, and awareness. The main pest management methods can be clustered as follows: a) Cultural & physical; b) chemical c) biological d) use of resistance e) regulatory f) Integrated Pest Management (IPM).

a) **Cultural and physical control**: These are applied control practices aimed at altering conditions or pest behaviors or pest populations. These practices include clearing fields of weeds and host plants to reduce harborage; removing infected plant parts, materials and burning / burying them; mulching; managing manure and other soil amendments to improve crop vigour; planting timing; crop rotations; using irrigation and related field measures. Passing on messages related to cultural

practices may require relatively more intense dissemination approaches such as extension agent visits or moderate approaches like field days. For management of some pests, collective action is required because if only a few farmers implement field sanitation measures, their crops may still be infected because of poor sanitation in their neighbours' fields. For example, in the control of Banana Xanthomonas wilt, collective community action was used due to the ease of spread of the disease from infected fields to non-infected fields.

b) Chemical control: Using chemical pesticides is the most common pest management option due to quick results but probably the most problematic. Chemical pesticides are biologically active chemicals that control a range of insect and vertebrate pests, diseases and weeds. Pesticides may be systemic or contact, selective or non-selective, and residual or non-residual. Effective application of pesticides requires that farmer have appropriate knowledge of the type of pesticide in relation to the pest or disease they intend to manage. Use of pesticides is effective, fast and easy but requires proper diagnosis of the pest/disease problem is key, followed by appropriate application. Responsible use and good handling practices limit potential pesticide residues in crops and the environment as well as help avoid pest resurgence and resistance. To ensure this, there is need for demonstrations and more intensive extension approaches that incorporate follow up and routine check with farmers on usage of chemicals.

c) Biological control: This involves nature's own methods of pest control. This includes introduction of beneficial insects or predators; applying micro-organisms such as viruses, fungi and bacteria; and using pheromones to lure, trap and kill or interfere with insects' mating habits. The challenge to the use of biological control is the limited availability of biocontrol agents, especially where government is not involved, and the farmers lacking awareness and trust in non-chemical methods.

i) ***Use of natural enemies***: This involves mass rearing of the pest natural enemy and its periodic release into the environment. An example is mass rearing and release of *T. aripo* against cassava green mite and cassava mealy bug in Uganda. The natural enemy was obtained from IITA (West Africa) and currently managed by the Bio-Control Unit at the NARL in Kawanda. Deployment of the natural enemy is considered easy, even farmers can do it once given the biocontrol agent by research. Once released, the enemy sustains its self for long in the habitat though a post release monitoring is required to ensure pest populations do not build up.

ii) ***Bio-pesticides***: Involves the mass rearing and use of bacteria, fungi, nematodes or viruses to control some pests. The most common and successful is *Bacillus thuringiensis* (Bt), a naturally occurring bacterium, which has been used to control several important pests (e.g. caterpillar pests in vegetables, vineyards and orchards). Use of bio-pesticides is moderately complex and farmers need practical guidance on how to apply them.

iii) ***Sex pheromones baits and traps***: This involves the development and use of insect sex pheromones and other behavior-modifying chemicals to trap and kill pests. Some pheromones disrupt mating thus slowing down population build-up of insect pests. Often use of traps requires collective action – and messages are relatively complicated. Sometimes farmers operating traps for monitoring are perceived to be rearing and releasing the pest.

d) Use of resistance: This involves use of planting materials that have levels of resistance or tolerance to pests and diseases. Whereas the trait is always switched on, and the farmers does not have to spend more money beyond buying the planting material, some of the varieties with resistance traits are costly and have trade-offs (e.g., taste, longer maturity). Two approaches are commonly used:

i) ***Pest or disease resistant varieties***. NARO and other research institutions have developed various crop varieties with resistance to pests and diseases. Farmers need to be aware of these varieties and associated costs of acquiring seed/planting materials. Raising awareness of new varieties is likely to involve relatively simple messages – explaining what the advantages are and indicating where to buy a variety. To enhance further learning and observations, intermediate approaches such as farmer field days and demonstrations may be undertaken so that farmers observe first had the difference between their own varieties and resistant ones, and possibly associated agronomic practices.

ii) ***Grafting or budding*** is also used to enhance resistance of plants by selecting a resistant root stock on which a desirable plant material (high performing but susceptible) is grafted. Grafting has mainly been used in the management of pests and disease in fruits and vegetables. The technique is quite complex and therefore requires more intensive extension approaches, combined with demonstrations for farmers to be able to understand and effectively adopt it.

e) Regulatory pest management: The objective of regulatory pest management is to prevent the introduction and/or spread of pests through the application of various pest management techniques such as pest exclusion, detection, eradication, mitigation, and public education. Achieving this objective requires limiting movement of commodities and materials, and treating commodities, materials, and the environment. This requires regulatory authorities to efficiently and effectively identify pest harm, assess pest risk; and manage pest risk. Two approaches are commonly used:

i) ***Quarantine***: The primary strategy to exclude pest entry is through the use of quarantines. Quarantine inspection programs at ports of entry are designed to prevent the introduction and establishment of pests into the country. Quarantine can be effective at reducing the incidence of pest introduction and reduce any incidents of pest introduction to a manageable population that can be eradicated.

ii) ***Eradication***: If prevention is not successful and an introduction occurs, there is need for the control program to institute eradication measures. Eradication generally means using all available viable options, which often includes the application of pesticides or destruction of plant materials. Eradication programs require participation of farmers and communities who must first be sensitized especially if losses to farmers are anticipated. Farmers require adequate knowledge of such pests and implications for noncompliance. Moderately intensive measures such as field days can be used for farmer education, or lighter methods such as mass campaigns through radio and TV.

f) Integrated pest management (IPM): IPM means considering all available pest control techniques and other measures that discourage the development of pest populations, while minimizing risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. IPM requires a combination of cultural, biological and chemical measures to manage diseases, insects, weeds and other pests. It takes into account all relevant control tactics and methods that are locally available, evaluating their potential cost-effectiveness Implementation of IPM lies with farmers, who adopt practices they view as practical and valuable to their activities. Ultimately, IPM is a site-specific strategy for managing pests in the most cost-effective, environmentally sound and socially acceptable way. Using IPM is rather complex and require intensive extension measures to ensure that farmers learn and adopt IPM practices.

Legal and institutional framework for pest management

National Development Plan

The second national development plan IV covers the period 2025 - 2030. Agriculture is one of three prioritised areas (along with tourism and minerals, oil and gas). Although growth during the first national development plan was only around 1% per annum, attributed to a range of factors including crop pests and diseases, in line with the Comprehensive Africa Agriculture Development Program (CAADP), the sector is seen as critical to economic development. Infrastructure development and human capital development are also prioritised as fundamental to growth and the goal of achieving middle income status by 2030. In agriculture 12 value chains are prioritised for investment (Cotton, Coffee, Tea, Maize, Rice, Cassava, Beans, Fish, Beef, Milk, Citrus and Bananas), 7 of which are crops, including the four which are reported by MAAIF as suffering the highest monetary loss due to pests (banana, cassava, cotton and coffee). For these 12 value chains, emphasis will be on the following:

i. Strengthening agricultural research and implementing the single spine extension system
ii. Technology adaptation at the farm level
iii. Increasing access to and effective use of critical farm inputs
iv. Promoting sustainable land use and soil management
v. Increasing access to agricultural finance with specific options for women farmers
vi. Strengthening agricultural institutions for effective coordination and service delivery

vii. Promoting agro-industrialization to increase value addition in agriculture, creating linkages between farm inputs and outputs, and boosting the manufacturing sector.

Among the key interventions planned for agriculture, only one intervention refers directly to pests – control pests, diseases and vectors. However, a number of the others will affect how pests are controlled, for example:

i. Ecologically sound technologies and practices, could include Integrated Pest Management (IPM).
ii. Quality standards, market requirements, regulation and safety standards, all of which are related to pest management, particularly the level of use of pesticides
iii. Provision of information should include information on how pests are managed
iv. Promotion of investment in storage infrastructure to reduce post-harvest losses will affect management of stored product pests.

Elsewhere in the NDP it is said that a national regulatory mechanism consistent with the World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) Agreement will be established, which would include phytosanitary issues for which DCP is responsible.

National Agricultural Policy (NAP) 2013

The vision of the NAP is "A Competitive, Profitable and Sustainable Agricultural Sector", and the mission is "To transform subsistence farming to sustainable commercial agriculture." There are 5 objectives:

i. Ensure household and national food and nutrition security for all Ugandans
ii. Increase incomes of farming households from crops, livestock, fisheries and all other agriculture related activities
iii. Promote specialization in strategic, profitable and viable enterprises and value addition through agro-zoning
iv. Promote domestic, regional and international trade in agricultural products
v. Ensure sustainable use and management of agricultural resources

These have much in common with the agriculture component of NDPII, which built on the NAP. As in the NDPII, pests are mentioned as a cause of limited production, and something that will be addressed. The policy also describes the roles of key stakeholders (see section 3.2), and notes that as a result of the creation of a number of agencies, several divisions and departments have been re-organised, including those with responsibility for disease and pest control.

Agriculture Sector Strategic Plan (ASSP)

The Agriculture Sector Strategic Plan 2015/16-2019/20 (ASSP) is still in draft; this analysis is based on the April 2016 version. The ASSP follows on from the Agriculture Sector Development Strategy and Investment Plan (DSIP) for the period 2010/11 to 2014/15, and is based on a review of the DSIP. So the ASSP, NAP and NDPll have much in common.

In general the performance of the agriculture sector over the period of the DSIP was disappointing. Productivity of some crops increased only slightly, while for others productivity actually declined. The review highlighted some success. In the area of pest management progress was made in developing policies (mainly the Plant Protection and Health Act), resulting, it is claimed, in improved control of

pests, vectors and diseases, although no evidence is presented. The review also found that continuous countrywide forecasting of crop pest and diseases was undertaken, and that the capacity of the MAAIF laboratory technicians was strengthened for diagnosis of pests and diseases. Furthermore it is stated that a robust post-entry quarantine regime to handle dangerous pests, diseases and weeds was established at various border posts. Despite these successes, a high prevalence of pests and diseases is cited as a serious constraint, examples mentioned in the plan coffee wilt disease, banana xanthomonas wilt, cassava brown streak virus, fruit flies and citrus canker, all pests of the priority crops. One of the lessons from DSIP was that new and emerging pests and diseases are serious impediments to production, and by implication the ability to respond effectively to such pests will be necessary to achieve the ASSP targets.

The ASSP vision is 'A competitive, profitable and sustainable sector'. Its mission is 'Transforming the sector from subsistence farming to commercial agriculture'. In contrast to the sluggish performance over the last 5 years, the goal is an average growth rate of 6% per year over the period of the plan. The ASSP has four strategic objectives:

i. Increasing agricultural production and productivity;
ii. Increasing access to critical farm inputs;
iii. Improving agricultural markets and value addition; and
iv. Improving service delivery through strengthening the institutional capacity of MAAIF and its agencies.

Crop protection largely falls under Objective 1, which aims to strengthen:

i. Generation and adoption of research technologies;
ii. Provision of extension services: enhancing access to extension services through operationalisation of the single spine agricultural extension system;
iii. Control of pests, diseases and vectors among crops and animals by strengthening the institutional and regulatory framework; strengthening the capacity of laboratories and disease control infrastructure; and conducting market surveillance to rid the market of counterfeit agro-chemicals.

The Plant Protection and Health Act, 2016

The preamble identifies the purpose of the new act:

i. Consolidate and reform the law relating to protection of plants against destructive diseases, pests and weeds
ii. Prevent the introduction and spread of harmful organisms that may adversely affect Uganda's agriculture, the natural environment and livelihood of the people
iii. Ensure sustainable plant and environmental protection
iv. Regulate the export and import of plants and plant products and introduction of new plants in accordance with international commitments on plant protection
v. Protect and enhance the international reputation of Ugandan agricultural imports and exports
vi. To entrust all plant protection regulatory functions to the government

These objectives are in line with the International Plant Protection Convention (IPPC), to which Uganda is a contracting party. In particular, the convention requires contracting parties to nominate a National Plant Protection Organization (NPPO), and specifies the NPPO's responsibilities.

The Agricultural Chemicals (Control Act) 2006

This act is to control and regulate agricultural chemicals including all sorts of pesticides, fertiliser, growth regulators, wood preservatives, bio-rationals (potent plants, parts of plants or chemical extracts of plant origin), biopesticides, bio-fertilisers or any other chemicals used for promoting and protecting the health of plants. The Act is administered through an Agricultural Chemicals Board, appointed by the Minister, comprising 10 members and 10 more *ex-officio* members including the Commissioner for Crop Protection, and a Registrar from MAAIF who acts as the secretary. The functions of the board are to ensure that regulations on the manufacture, storage, distribution and trade in, use, importation and exportation of agricultural chemicals are made and followed. The board advises the minister on applications for registration and licenses, on policies for safe use, storage and disposal of agricultural chemicals including public awareness campaigns, and on enforcement of regulations. The Board receives technical advice from a 15-person Agricultural Chemicals Technical Committee. The Act also confers powers on inspectors regarding monitoring and enforcing conformity with the Act and its regulations. Thus as would be expected from such an act, there is appropriate control over the use of pesticides and other agrochemicals. However, the supporting regulations can have a significant effect on the way in which pesticides are used. The regulations regarding registration have not been seen, but we understand that the Board has discretionary powers, for example in granting specific producers a permit to import an unregistered pesticide for use on the farm only. Such discretionary powers should be used to promote and encourage investment in and marketing of lower risk products such as biopesticides. We have been told of cases where permits for biological control agents have resulted in quite rapid registration, though we do not know whether this is a frequent occurrence or not.

The Seeds and Plant Act 2006

This act provides for the promotion, regulation and control of plant breeding and variety release, and the multiplication, conditioning, marketing, importing and quality assurance of seeds and other planting materials. The Act is administered through the National Seed Board, comprising 9 members and 3 ex-officio members including the Commissioner for Crop Protection. The Act also establishes a Technical Committee which functions as the variety release committee, the secretary of which is the head of the certification service. The Act establishes the National Seed Certification Service in the Crop Protection Department, which is responsible for the design, establishment and enforcement of certification standards, methods and procedures. This includes licensing of seed merchants and dealers, seed conditioners, and seed exporters and importers.

The Act provides for different categories of seed to be defined in the regulations (which have not been seen). The Act appears to provide the necessary legal powers for effectively regulating the seed sector, though as with control of agricultural chemicals, the difficulty is in implementation. The Department of Crop Protection has many important tasks including providing the seed certification service, but it has insufficient resources and capacity.

Biosafety and biotechnology bill 2012

There has been much debate about the pros and cons of biotechnology, especially genetic modification. This is relevant to crop protection because some of the most widely used modifications confer pest

resistance, and in Uganda a number of such traits have been engineered and tested. Enactment of the Bill would provide the necessary regulatory framework for the commercialization and release of these materials, which would have substantial implication for the way in which pest problems are managed.

National Environment Act 2019

An Act to provide for sustainable management of the environment; to establish an authority as a coordinating, monitoring and supervisory body for that purpose; and for other matters incidental to or connected with the foregoing. It stipulates the principles of environment management to the following:

(a) To assure all people living in the country the fundamental right to an environment adequate for their health and well-being;
(b) To encourage the maximum participation by the people of Uganda in the development of policies, plans and processes for the management of the environment;
(c) To use and conserve the environment and natural resources of Uganda equitably and for the benefit of both present and future generations, taking into account the rate of population growth and the productivity of the available resources;
(d) To conserve the cultural heritage and use the environment and natural resources of uganda for the benefit of both present and future generations;
(e) To maintain stable functioning relations between the living and non-living parts of the environment through preserving biological diversity and respecting the principle of optimum sustainable yield in the use of natural resources;
(f) To reclaim lost ecosystems where possible and reverse the degradation of natural resources;
(g) To establish adequate environmental protection standards and to monitor changes in environmental quality;
(h) To publish relevant data on environmental quality and resource use;
(i) To require prior environmental assessments of proposed projects which may significantly affect the environment or use of natural resources;
(j) To ensure that environmental awareness is treated as an integral part of education at all levels;

To ensure that the true and total costs of environmental pollution are borne by the polluter;(l)to promote international cooperation between Uganda and other states in the field of the environment.

Integrated Pest management plan

Introduction

The main objective of the project is to improving water security, increasing agricultural productivity through irrigation, and reducing the incidence of waterborne diseases. Whereas it is not explicitly an agricultural project, provision of water for agriculture production will indeed enhance crop production and productivity. The environmental conditions that favour availability of crops in most parts of Uganda also favour the growth and spread of pests and diseases. Therefore, developing a pest management plan that provides a cost-effective, scalable, and sustainable approach to pest management, reducing reliance on harmful pesticides while increasing yields and farmer resilience, is necessary. When implementing an IPM, not only economic benefits should be considered, but also ecological balance and social security. Based on this theory, principles of pest control should be based on:

i) agronomic (cultural control) measures that create conditions that are not conducive to the development of pests and diseases
ii) different biological characteristics and habits of pests, making full use of the natural factors controlling the pests and diseases,
iii) strengthening the monitoring/forecasting of pests and diseases occurrence and damage
iv) using biological, physical, chemical and other complementary, coordinated, complementary measures to avoid killing natural enemies and polluting the environment, to control pests and diseases at acceptable levels. When pests and diseases incidence and damage are significant, and other control methods cannot effectively control the pests and diseases, then high-efficiency, low-toxic and low-residue chemical pesticides may be used, and safe application methods adopted to reduce chemical pesticides in soil or water environment.

Integrated Pest Control Practices of Main Crops

The natural conditions of the two districts in the project area are quite similar and the crops planted are also similar. However, the crops are many, and there is no information yet of the crops selected for support under the water for production activities. Therefore, here, we present general practices that can be adapted for each individual crop. In summary, there are mainly cultural control measures, physical and mechanical measures, biological, ecological control and chemical control.

Cultural control practices

i. Selecting pest-tolerant and resistant varieties and increasing the pest tolerance of the crops
ii. Using formulated fertilizers
iii. Increasing use of organic fertilizer
iv. Practicing healthy cultivation techniques.
v. Conducting crop rotation
vi. Field and orchard sanitation
vii. Dry sowing of seeds and rational irrigation to prevent the propagation of soil-borne diseases,
viii. Deep ploughing fields to kill pupa, control the habitat of pests and reduce the population of the pests that may stayover in soils and crop debris.
ix. Trimming fruit trees in appropriate ways to eliminate excessive buds and sprouts and improving the ventilation among trees and light penetration through the crown by cutting off lower leaves.
x. Timely weeding, creating environmental conditions that are not conducive to pest breeding.
xi. Promote the cultivation of crops that protect the natural enemies of pests (such as soybean, sesame, vetiver).

Physical and Mechanical Methods

The physical prevention and treatment method are to use light, color, odor and the special response to physical factors such as heat, radiation, sound to prevent and control pest. It mainly includes the following measures:

i. Using light to trap insects that are active during night (e.g moths)

ii. Using the solar radiation to kill pathogens and insects in soil; hot water to kill the pathogenic bacteria, weevils and nematodes in planting material
iii. Cutting off and burning the diseased branches and leaves to reduce the pest population
iv. Keeping farmland flooded to a specific period to reduce the pest population in the soil

Biological Control Method

The biological control method is the use beneficial insects and pathogens (parasites, predators and pathogenic microorganisms) to control pests. It mainly involves:

i. Protecting natural enemies, and creating the environment suitable for the natural enemy, increase the number of natural enemies such as predatory ladybug
ii. Using biological agents and products such as bacteria: bacillus thuringiensis, bacillus subtilis; fungi: beauveria, trichoderma, otomycosis; and viruses: nuclear polyhedrosis virus; antibiotics: agricultural streptomycin, jinggangmycin, etc
iii. sex pheromone to attract one sex of the insect pest (core agent) and botanical pesticide, to kill the pest once attracted into the trap can

Chemical Control methods

The use of chemical pesticides to control diseases, pests and weeds and other harmful organisms. The chemical pesticide has the advantage of being easy to use, effective to wide range of pests, high efficiency, being able to rapidly control the spread of pests, especially for the outburst pests, so it can be used as an emergency measure. However, simply using large amount of chemical pesticide will not only kill the natural enemy of pests, but also damage the field ecosystem, which will lead to the outburst of secondary pests, bring environment pollution and generate a series of side effects of poisoning human and livestock. In addition, using one type of pesticide in long-term will increase the pesticide resistance of the target pest. Therefore, how to control the use of chemical pesticides so as to reduce its impact on environment pollution and human health should be key in this project. The following principles shall be followed in the project area:

1. Educate farmers that rationally using agricultural, physical and biological methods with necessary chemical methods can also effectively control pests.
2. When the pest economic injury level is reached, timely using efficient, low toxic pesticide to play its best effect and keep the pests and diseases below the economic injury level.
3. When there is a major pest outbreak, a crop protection team for ministry of Agriculture Animal Industry and Fisheries is formed and dispatched to undertake the spraying.
4. Use non-pollution techniques of pesticide application:
    - Use efficient, low toxic and low residual pesticide
    - Promoting use of pesticide spray aids to reduce pesticide dosage effectively. For example, using polyol nonionic surfactant with pesticides (insecticides, fungicides, herbicides, plant growth regulators, except for living biopesticides) reduces pesticide quantities by 20-40% compared to the conventional dosage. At the same time, additives such as monosilicic

acid, gibberellin, indole acetic acid, brassinolide, and other additives can improve the resistance of crops and alleviate the toxicity of heavy metals to crops.

- Identify the pest occurrence hotspot with large pest population, and low dosage pesticide with high efficiency when the pest is still young to optimize the effects of pesticide. Avoid pesticide that will kill the natural enemy of pests.
- Observe the interval of pesticide application.
- Continuous use of one single pesticide for long-term is prohibited. The pesticides shall be used in turns with different modes of action
- Use personal protection equipment will applying pesticides
- Use calibrated pesticide application equipment to improve the effectiveness of pesticide.
- Strengthen and disseminate education and training on safe and proper use of pesticide, including properly wearing protective clothes, mastering the general knowledge on emergency treatment of pesticide poisoning, etc.
- Safe storage of agricultural chemicals (e.g. away from children access and food, etc.) should be ensured.
- Proper handling of empty pesticide containers and packing; do not clean pesticide applying instruments in natural waters.

IPM plan implementation strategy

Phase 1: Baseline Assessment (Months 1-3):

i. Pest Mapping:
    a. Conduct field surveys in target districts to identify key pests on the major crops
    b. Use GIS mapping to track hotspots
ii. Farmer Needs Assessment: Survey 500+ farmers on current practices via mobile tools

Phase 2: Core IPM Strategies (Months 4-24)

i. Prevention and Monitoring: Train 200 community pest scouts (50% women) to use, for example pheromone traps for pest surveillance and using mobile based platforms for reporting

ii. Climate-Smart Practices:
iii. promote drought-resistant intercrops (e.g., drought-tolerant beans with maize)
iv. adjust planting calendars using weather advisories to facilitate crops escaping pest attacks.

v. Institute direct control measures:
vi. Establish local biocontrol production hubs, partnering with private sector or government agencies
vii. Distribute light traps and pheromone traps to farmer groups.
viii. Train in handpicking insect eggs and larvae

ix. Judicious Chemical Use

x. Draft and disseminate a pesticide reduction protocol:

   a. Use efficient, low toxic and low residual pesticide
   b. Promoting use of pesticide spray aids to reduce pesticide dosage effectively. For example, using polyol nonionic surfactant with pesticides (insecticides, fungicides, herbicides, plant growth regulators, except for living biopesticides) reduces pesticide quantities by 20-40% compared to the conventional dosage. At the same time, additives such as monosilicic acid, gibberellin, indole acetic acid, brassinolide, and other additives can improve the resistance of crops and alleviate the toxicity of heavy metals to crops.
   c. Identify the pest occurrence hotspot with large pest population, and low dosage pesticide with high efficiency when the pest is still young to optimize the effects of pesticide. Avoid pesticide that will kill the natural enemy of pests.
   d. Observe the interval of pesticide application.
   e. Continuous use of one single pesticide for long-term is prohibited. The pesticides shall be used in turns with different modes of action
   f. Use personal protection equipment will applying pesticides
   g. Use calibrated pesticide application equipment to improve the effectiveness of pesticide.
   h. Strengthen and disseminate education and training on safe and proper use of pesticide, including properly wearing protective clothes, mastering the general knowledge on emergency treatment of pesticide poisoning, etc.
   i. Safe storage of agricultural chemicals (e.g. away from children access and food, etc.) should be ensured.
   j. Proper handling of empty pesticide containers and packing; do not clean pesticide applying instruments in natural waters.
   k. Substitute synthetics with neem-based pesticides (initiate local production).

xi. Post-Harvest IPM:

xii. Introduce and popularize Purdue improved crop storage bags for storage of dry grains for maize/bean

xiii. Train in neem leaf grain treatment

Phase 3: Capacity Building (Ongoing): IPM Farmer Field Schools and Radio Lessons (in local languages)

Phase 4: Monitoring & Scaling (Months 25-36)

i. Impact assessment: Key Indicators are % yield increase (baseline vs. harvest records) and Reduction in pesticide use (agro-dealer sales data).

ii. Scale-Up:

   a. Policy advocacy: work with MAAIF to integrate IPM into National Extension Guidelines
   b. Private Partnerships: Incentivize agro-dealers to sell biocontrol agents.

APPENDIX I : WATER SOURCE PROTECTION PLAN

WATER SOURCE PROTECTION PLAN (WSPP) FOR THE PROPOSED MULTI-PURPOSE WATER FOR CLIMATE RESILIENCE AND IRRIGATION DEVELOPMENT FOR LIVELIHOOD TRANSFORMATION (MWACRID) PROJECT IN THE SUB-COUNTIES OF MASINDI-PORT AND KIGUMBA IN KIRYANDONGO DISTRICT; MIRYA AND KIMENGO IN MASINDI DISTRICT, UGANDA

1. Introduction

The MWACRID Project is a strategic initiative aimed at enhancing climate resilience, agricultural productivity, and access to clean water in the districts of Masindi and Kiryandongo. The project proposes to abstract water from the River Nile at Masindi Port to supply bulk water for irrigation, domestic use, and potentially small-scale industrial needs.

This Water Source Protection Plan (WSPP) outlines the measures that will be implemented to safeguard the integrity, sustainability, and quality of the surface water source at Masindi

Port. The plan aligns with Uganda's Water Act (1997), National Water Policy, and Water Source Protection Guidelines (2013) by the Ministry of Water and Environment (MWE).

2. Description of the Water Source

- Source Type: Surface Water (River Nile)
- Location: Masindi Port Landing Site, Kimengo Sub-county, Masindi District
- Catchment Area: The Nile catchment feeding into Masindi Port spans parts of upstream districts, including settlements, farms, and transportation corridors.
- Proposed Abstraction Point: Approximately 100–150 meters from the main shoreline.
- Current Uses:
    - Fishing
    - Domestic water collection
    - Small-scale irrigation
    - Boat transport activities
- Water Quality Risks:
    - Pollution from agrochemicals, livestock, and human waste
    - Soil erosion and sedimentation

3. Objectives of the Water Source Protection Plan

- To prevent pollution and degradation of the water source and its catchment
- To ensure long-term water quality for human consumption, agricultural use, and ecological health
- To strengthen stakeholder engagement in the stewardship of water resources
- To harmonize water source protection with land use planning and development goals
- To comply with national environmental and water governance regulations

4. Water Source Protection Zones

Protection of the intake will be implemented through delineated protection zones with specific control measures.

Zone I: Immediate Protection Zone (0–100m from intake)

- Activities Prohibited: Settlement, cultivation, washing, waste disposal, livestock access
- Protection Measures:
    - Demarcation using visible markers and signage

- Installation of fencing or vegetation buffer
- Routine surveillance by the Water User Committee
- Enforcement of a "no-access" buffer directly at the intake point

Zone II: Intermediate Protection Zone (100–500m)

- Activities Controlled: Restricted farming with no agrochemicals, regulated boat docking, public education
- Protection Measures:
  - Alternative water collection points for communities
  - Regulation of agricultural activities through bylaws
  - Tree planting and erosion control structures (e.g., vetiver grass, contour bunds)

Zone III: Extended Catchment Management Area

- Activities Covered: Broader land use practices including agriculture, road construction, waste management
- Protection Measures:
  - Climate-smart agriculture training for farmers
  - Catchment-wide soil and water conservation efforts
  - Promotion of agroforestry and wetland restoration
  - Stormwater runoff control through retention basins and drainage planning

5. Risk Identification and Mitigation

Threat	Source	Impact	Proposed Mitigation
Agrochemical runoff	Surrounding farms	Eutrophication, water toxicity	Promote organic farming; buffer vegetation strips
Livestock intrusion	Pastoralists	Fecal contamination	Establish dedicated watering points upstream
Solid waste and sewage	Riverbank communities	Disease vectors, pollution	Improve waste collection; construct sanitation facilities
Boat fuel/oil leaks	River transport	Water pollution	Enforce regulations for docking; emergency spill response kits
Soil erosion/siltation	Uncontrolled farming	Reduced water clarity, pump damage	Reforestation, contour plowing, erosion barriers

6. Institutional Arrangements and Stakeholder Roles

Entity	Responsibilities
Ministry of Water and Environment (MWE)	Technical oversight, enforcement of protection guidelines, coordination with national stakeholders
Masindi and Kiryandongo District Local Governments	Implementation of bylaws, sensitization, and monitoring
National Water and Sewerage Corporation (NWSC)	Management of intake infrastructure, water quality monitoring
NEMA and DWRM	Environmental monitoring, regulatory compliance
Local Councils and Community Water User Committees	Routine monitoring, conflict resolution, community sensitization
Project Implementation Unit (PIU)	Budget allocation, coordination of activities within project scope
Private Sector (e.g., farmers, boat operators)	Compliance with best practices and regulatory guidance

7. Monitoring, Reporting, and Evaluation

Key Monitoring Parameters:

- Water Quality: Turbidity, fecal coliforms, nitrates, phosphates, pH, temperature
- Catchment Condition: Vegetation cover, signs of erosion, human activity encroachment
- Compliance Monitoring: Adherence to land use restrictions in protection zones

Frequency and Reporting:

- Water Quality Testing: Monthly by NWSC or DWO
- Catchment Surveillance: Quarterly by Water User Committee and District Technical Team
- Annual Review: Joint review with MWE, Districts, and Community Leadership

Tools:

- Monitoring checklist
- Incident reporting form
- GIS-based source protection map
- Aerial/drone imagery

8. Community Engagement Strategy

- Awareness Campaigns: Sensitization through local radio, village meetings, and posters
- Bylaw Development: Support LC1 and LC3 levels in drafting and enforcing water source protection bylaws
- Training: Farmers, fishermen, and water users trained in best practices
- Incentives: Possible support for communities implementing conservation practices (e.g., seedlings, fencing materials)