



**MUVUMBA MULTIPURPOSE WATER RESOURCES
DEVELOPMENT PROGRAM-ADDITIONAL
FINANCING (AF)**

MUVUMBA IRRIGATION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

Final Report

November 2025

Project Particulars	Description
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Consultant/Authoring Firm	IBC Group
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DECLARATION

This is to declare that this Environmental and Social Impact Assessment (ESIA) Report has been prepared by IBC Group- team of experts. The report has been developed in full compliance with the laws and regulations governing Environmental Impact Assessment (EIA) in the Republic of Rwanda, including Ministerial Orders and REMA guidelines, as well as the applicable requirements of the African Development Bank (AfDB) Integrated Safeguards System (ISS, 2023).

ABOUT THE AUTHOR

The IBC Group is a consultancy firm joint licenced by the Rwanda Association of Environmental Professional Practitioners. It is also certified for International Standards like Enironmental Mangemeny System (ISO 14001), Quality Management System (ISO 9001:2015), Occupational Health and Safety Management System (ISO 4500). IBC has its headquarters in IBC group House, KN-5 rd, KK 83 Ave, Kigali PO. BOX:5825 Kigali. Over a period of 20 years, the company has been specializing in conducting Environmental Studies, Social Studies including Resettlement Action Plans (RAPs), Feasibility and Engineering Designs Studies, Involuntary Resettlement, Climate Change Risk Assessment, Socio-economic Assessment, Baseline Surveys, Waste Management, Water and Sanitation, and Advisory Services in sectors ranging from agriculture, energy development, infrastructure and housing development, transport, and water supply.

EXECUTIVE SUMMARY

BACKGROUND

This report is an Environmental and Social Impact Assessment (ESIA) of the irrigation project for a net command area estimated at 3,073 ha. The project is a part of Muvumba multipurpose water resource development program (MWRDP). The project proponent is the Rwanda Water Resources Board (RWB) of the Government of Rwanda.

This ESIA aims to identify, assess, and proposed mitigation measures for potential environmental and social impacts to ensure that irrigation project complies with AfDB safeguards, Rwandan Laws, and International Best Practice, while promoting sustainable development.

PROJECT OVERVIEW

The Government of Rwanda (GoR) has been implementing the Muvumba Multipurpose Water Resources Development Program (MMWRDP), with financing from the African Development Bank (AfDB). The objective of the program is to improve water, energy, food and nutrition security by harnessing water resources for irrigation, domestic, livestock use and hydropower generation, while ensuring sustainability of the resources and building resilience against climate change and variability. The first major component under the program is the ongoing dam construction and hydro power plant installation, currently at 31.96 percent as at July 2025.

As part of the ongoing Muvumba Multipurpose Water Resources Development Program, the GoR seeks additional financing for an Irrigation Project to enhance agricultural productivity in the drought-prone Nyagatare District, Eastern Province of Rwanda. The project objective is to improve food and nutrition security by developing an irrigation system covering a command area of approximately 3,073 hectares, spanning the sectors of Nyagatare, Karama, Tabagwe, Rwempasha, and Rukomo. Project outcomes will include sustainable and climate resilient crop production and increased productivity on 3,073 ha of irrigated agricultural land in Nyagatare District, leading to improved food security and nutrition; improved and sustainable farmer incomes; and improved skills of WUAs (Water Users Association) members, cooperatives and youth-led organizations in the operation, management and maintenance of irrigation scheme

The project includes the construction of concrete-lined primary canals, booster pumping stations, paddy field irrigation, center pivot and sprinkler systems, access roads, and associated hydraulic structures.

The irrigation project is in Nyagatare District, Eastern part of Rwanda specifically in the sectors of Rwempasha, Rukomo, Tabagwe and Karama. It is intended to transform rain fed subsistence agriculture to irrigated agriculture. It is proposed that up to 3,073 ha of the Muvumba marshland on both side of the Muvumba River, should be irrigated by water stored behind the Muvumba Dam, whose construction is ongoing. The main project objective is to increase productivity and commercialization of agriculture as well as supplying water to livestock to increase livestock products.

The irrigation scheme will consist of different infrastructures such as main irrigation structures (cross drainage structures, siphons, road crossings, etc.), the irrigation network from the intake to the level of plot, the valley/gully drains crossing irrigation canals structures, inverted siphons,

bridges crossing the main canals aligned to access roads. The command area of irrigation project covers the valley of Muvumba river starting from the Muvumba Multipurpose Dam. The main conveyance system to supply water to the scheme is proposed to be through a lined canal. Since a pressurized system was also proposed in this detailed design, pumping stations have also been recommended to be used.

The upper boundary of the command area is defined and limited by the alignment of the Primary canal which is designed with a bed slope of 1 in 4000. The command area is divided into ten zones based on the canal alignment in the left and right side of Muvumba river. The irrigation canal is routed from aligned from the left side to the right side through main siphon (Siphon – 1) for crossing the Muvumba river and then to irrigate the command area on the right side of the river.

Water flow in the entire route (from start to end) of the Primary canals is by gravity. However, in case of pressurized irrigation system, booster pumps may be required at points where the water is tapped from the Primary canals for irrigating lands through center pivot and sprinkler as the operating pressure is not adequate to efficiently manage/apply the water in the whole command area.

The irrigation project will require a peak demand of 7.26 m³/sec from the storage of Muvumba Multipurpose Dam, assuming 24 hours designed for main irrigation canal. The annual water abstracted will be up to 115 million cubic metres (MCM) when the scheme is cultivated at 100%. The average water consumption per hectare in a dry year will be approximately 729 mm per annum.

For livestock water use component, it is designed to provide livestock water through the construction of trough. According to the feasibility study conducted within the command area, it was observed that, one trough shall be constructed within 40ha, and from that 225 troughs will be constructed to cover the whole command area.

POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The Muvumba irrigation scheme development and livestock water use project is meant to be implemented in full compliance with both national regulations and AfDB Integrated safeguard system.

This ESIA was conducted following national legislations, namely policy, strategies, and legal instruments as well as international conventions and AfDB operational safeguards requirements to assess their applicability to the project and highlight their relevance. Among others, National Environmental and Climate Change Policy, (2018); The law on Environment (2018), REMA general guidelines and procedures for Environmental Impact Assessment (2006); Expropriation Law in the public interests (2015); Ministerial Order No N°003/MoE/25 of 19/08/2025 that establishes the list of projects that must undergo environmental impact assessment, instructions, requirements, and procedures to conduct environmental impact assessment.

The project also shall comply with African Development Bank Group's Integrated Safeguards System (ISS) and its nine (9) applicable Environmental and Social Operational Safeguards requirements (OS1) for Assessment and Management of Environmental and Social Risks and

Impacts, OS2 for Labour and Working Conditions, OS3 for Resource Efficiency and Pollution Prevention and Management, OS4 for Community Health, Safety and Security, OS5 for Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement, OS6 for Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources, OS7 for Vulnerable Groups, OS8 for Cultural Heritage, and OS10 related to Stakeholder Engagement and Information Disclosure).

Other key national policies, laws, orders and strategies relevant to the project include those related to environmental management and protection, land use and management only to mention some. The international treaties and conventions as signed and rectified by the GoR applicable to the project were also consulted as detailed in this report.

Different national institutions for environmental management were identified to play key roles in project implementation and include but not limited to the, Ministry of Environment, Rwanda Environmental Management Authority, Rwanda Development Board, the Ministry of Agriculture and Animal Resources (MINAGRI), Rwanda Agriculture and Animal Resources Development Board (RAB), Rwanda Water Board (RWB), Eastern Province, Nyagatare District, etc. Same line, institutions relevancy to the project has been mentioned and their missions reported:

- **Project Implementation Unit (PIU) Safeguards Team:** This will play a crucial coordination and oversight role. This team consolidates site-level reports and prepares submissions to AfDB, ensuring that documentation reflects compliance with Bank policies and national regulations. Beyond reporting, the PIU safeguards team monitors systemic safeguard adherence and provides strategic support for grievance redress, stakeholder engagement, and training facilitation.
- **Contractor:** The contractor serves as the primary actor on site, responsible for implementing all prescribed mitigation measures in line with the ESMP. They are tasked with ensuring that construction activities comply with environmental and social safeguards, preparing regular E&S reports, and collaborating with supervision consultants to adjust practices when non-compliance issues arise. The contractor's daily footprint shapes much of the safeguards reality on the ground.
- **Supervision Consultant:** The consultant on behalf of the client shall perform functions as the intermediary between contractor and client, ensuring that E&S requirements are met and continuously monitored. Their role involves reviewing contractors' reports, verifying the adequacy of mitigation actions, and facilitating integration of RAP components where relevant. The consultant also provides technical support to ensure environmental and social compliance throughout implementation.
- **District Authorities:** Nyagatare District will play a pivotal role in ensuring localized compliance and oversight
- **Rwanda Environment Management Authority (REMA):** REMA will bring national-level regulatory power to the project. It is responsible for providing environmental enforcement and licensing, ensuring that all actors uphold Rwanda's environmental policies. It also oversees inspections beyond the immediate project zone, validating compliance.

ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

The Muvumba irrigation command area is located downstream in an area of grassy plains and low hills with a high temperature and low precipitation which sometimes leads to drought. Rainfall is ranging between 800 and 900 mm distributed in two rainy seasons, with a dry period that may be extended to 130 days (mid-May to mid-September with monthly rainfall below 50 mm during that period) and an annual average temperature varying between 25.3°C and 27.7°C. The annual rainfall is quite less (827 mm/year) and unpredictable to satisfy the needs for agriculture and livestock. According to the Soil Map of Rwanda, pedo-climatic conditions in the region indicate that soil moisture and temperature regime is an Ustic Isohyperthermic type, an arid soil moisture regime with a mean soil temperature of 22°C or higher.

The soil survey investigation and land suitability studies conducted by the consultant showed that the irrigation command area is not very open to gravels but is dominated by fulvic materials mixed with clays which is favoring upward movement of water when water table rises due to irrigation or river water of the 40% of the investigated Muvumba area showed acidic soil and hence liming is needed.

To evaluate the suitability of Muvumba River water for the proposed irrigation scheme, water quality was analyzed near the dam site using FAO irrigation guidelines. The electrical conductivity (EC) was 174.6 µs/cm and total dissolved solids (TDS) were 105 mg/L, both well below FAO thresholds for salinity risk, indicating no salinity-related concerns for crops or soils. Infiltration issues, often linked to high sodium content and low calcium in irrigation water, are unlikely since the EC is below the 700 µs/cm threshold that typically signals risk.

Trace metal analysis showed that most parameters were within permissible limits set by the Rwanda Standards Board (RSB) and FAO. However, elevated levels of cadmium (Cd), manganese (Mn), and iron (Fe) were observed. Cadmium exceeded FAO's recommended limit of 0.01 mg/L and poses toxicity risks to crops like beans and turnips, with potential for harmful accumulation in soils and plants. The pH of the water ranged from 6.97 to 7.05, which is within the acceptable range for irrigation. Overall, Muvumba River water is suitable for irrigation, though trace metal concentrations, particularly cadmium require close monitoring and possible mitigation.

The project beneficiaries are intended to be the smallholder farmers living in and using the cultivable land in the command area. These are totaling to 1657 affected households (PAHs) and one (1) government land plots equivalent to 189.7 ha of which 2.280 ha belongs to the Government of Rwanda (Nsheke Primary School). Some land users will be affected by canal construction proposed in the layout plan. Irrigation development includes some settlements in the command area. Therefore, some residents of the command area must be considered project-affect people (PAPs), together with people who live outside the command area but are dependent on resources within it (land and grazing). The principal vulnerable groups identified to date are female-headed households and elderly groups.

KEY ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

The project implementation is subject to cause both positive and negative environmental and socio-economic impacts. Positive environmental impacts expected from project implementation include but not limited to: increased productivity and income generation, boosting livestock products, temporary and permanent employment opportunity, adaptation to climate change through provision of water in drought seasons, environmental protection, crop diversification along the year, increased value of agricultural production, and improved wise use of water resources etc.

The project adverse impacts during construction and operation include those associated with:

- Reduction in downstream flow as a result of diversion of water, which could compromise water availability to satisfy other aquatic habitats and biodiversity downstream the project site especially.
- Reduction in water quality due to application of agrochemicals or oil spills,
- Possible soil erosion caused by scheme excavation works and/ or poorly managed upper catchment areas, leading to loss of cultivable land and/or siltation;
- Soil degradation and salinization due to improper application of agrochemicals, overwatering and poor drainage;
- Community health and safety risks from: construction activities; storage, handling, use and disposal of agrochemicals; failure of dam structures; increase prevalence of water-borne diseases such as malaria;
- Loss of biodiversity and ecological imbalances caused by: clearing works, installing of irrigation infrastructure such as construction of siphons,
- Land acquisition and population displacement causing negative consequences on the residents of the project location, and Disruption of economic and social activities (temporary),
- Soil compaction and destabilization of the geological balance during excavations for construction materials;
- Air pollution during construction works and transportation of construction materials;
- Creation of borrow pits and earth ponds due to excavation for construction materials. The borrow pits may result into water ponds that may result in increased water-borne diseases as well as being death traps for animals and people, especially children;
- Land and water pollution due to oil spillage, chemicals, etc.;
- The project is likely to lead to increased greenhouse gas emissions hence contributing to negative impacts of climate change. The gases may include CO₂, particulate matters and hydrocarbons from fuel powered equipment and vehicles whose impact is air pollution;
- Serious clearance of vegetation and inundations leading to extensive loss of biodiversity and habitats for both small and large animals;
- Anticipation of high generation of wastewater and solid wastes especially during construction phase
- Spreading of HIV, AIDs, COVID and other transmissible diseases

Table 0-1 Impacts significance during pre-construction, construction and operation phases of this project

Assessed negative E&S impacts	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Pre-construction phase						
Loss of land and physical displacement	Short-term ¹	Site specific ² to Local ³	Moderate ⁴ to High ⁵	Reversible ⁶	Definite ⁷	High ⁸
Loss of graves	Short-term	Site specific	Moderate	Reversible	Definite	Medium
Loss of infrastructure service	Short-term	Local	Moderate	Reversible	Definite	Medium
Loss of livelihood	short-term	Local	Moderate ⁹	Reversible	Definite	Medium
Construction phase						
Impacts on terrestrial ecosystems & biodiversity	Short-term	Regional ¹⁰	Moderate	Reversible	Probable ¹¹	High
Impact on aquatic ecosystem and biodiversity	Short-term	Regional ¹²	Moderate	Reversible	Probable ¹³	Medium
Loss of natural vegetation	Short-term	Local	High	Reversible - irreversible	Highly probable ¹⁴	High
Modification of Muvumba water flows downstream of the constructed dam	Short-term	local	Moderate	Reversible	Possible	Medium
Impacts on wildlife (migration of bird and fishes)	Short-term	Local	Moderate	Reversible	Probable	Medium

¹ Impact is expected to last in the short term (<5 years)

² within the site boundary (less than 500m)

³ limited to specific individuals or communities or environmental receptors at or close to the site (within a radius of 0m-5km)

⁴ observable-impacts reversible with rehabilitation

⁵ Has a measurable and sustained positive or negative impact on social or environmental aspects.

⁶ Impact requires mitigation and rehabilitation to ensure reversibility

⁷ Impact with over 85 % probability to occur.

⁸ The impact is unacceptable and further mitigation measures must be implemented to reduce the significance

⁹ Effects observable-environmental impacts reversible with time

¹⁰ extends substantially beyond the site boundary

¹¹ between 40 % and 60 % sure that the impact will occur

¹² extends substantially beyond the site boundary

¹³ between 40 % and 60 % sure that the impact will occur

¹⁴ between 60 % and 85 % sure that the impact will occur

Assessed negative E&S impacts	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts on air pollution	Short-term	Local	Moderate	Reversible	Probable	Medium
Noise and vibration effects	Short-term	Local	Moderate	Reversible	Definite	Medium
Impacts from access roads	Short-term	local	Moderate	Reversible	Definite	Medium
Impacts from quarry sites and borrow area,	Short-term	Local	Moderate	Reversible	Probable	Medium
Workers' health and Safety	Short-term	Local	Moderate	Reversible-irreversible	Probable	Medium
Risk of traffic incident and community injury on/offsite	Medium	Local	High	Reversible	Probable	Medium
Increased risks of communicable diseases	Short-term	Regional	Moderate-High	Reversible-irreversible	Probable	Medium
Labour Influx and Conflict among workers and local people	Short-term	Local	Moderate	Reversible	Probable	Medium
Disruption of public utilities	Short-term	Local	Moderate	Reversible	Probable	Medium
GBV, SH, SEA related impacts	Short-term	Local	Moderate	Irreversible	Possible	Medium
Child abuse and exploitation	Short-term	Local	Moderate	Reversible	Possible	Medium
Poor hygiene and sanitation	Short-term	Local	Moderate	Reversible	Probable	Medium
Creation of slopes and accumulation of earth materials during excavation works	Short-term	Local	Low	Reversible	Probable	Low ¹⁵
Poor solid and liquid waste management	Short-term	Local	Moderate	Reversible	Probable	Medium
Disruption of existing access	Short-term	Local	Low	Reversible	Highly Probable	Low
Cultural disruptions and protection of archaeological and historical sites	Short-term	Local	Moderate	Reversible	Possible	Medium
Impacts from the Construction of temporary site installations	Short-term	Site specific	Moderate	Reversible	Highly probable	Medium
Impact on water quality, Possible contamination and competition over water	Short-term	National	Moderate	Reversible	Probable	Medium
Other impacts from construction of temporal sites installations	Short-term	Local	Moderate	Reversible	Probable	Medium

¹⁵ little effect- negligible disturbance

Assessed negative E&S impacts	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts from high job expectation	Short term	Local	Low to moderate	reversible	Highly Probable	Medium
Infrastructure Sustainability Challenges	long-term	local	Moderate	Reversible	Probable	Medium
Operation phase						
Impacts on environmental flow	Short-term	National/inter national	Moderat	Reversible	Probable	Medium
Increased health impacts	Short-term	local	Moderate	Reversible	Probable	Medium
soil and water contamination by farming method and chemicals and waste disposal	Long-term	Regional	Moderate	Reversible	Probable	Medium
Impacts on soil salinity and decrease in soil fertility	Long-term	Regional	Moderate	Reversible	Probable	Medium
GHG emissions	Long-term	National	Moderate	Reversible	Definite	Medium
Poor flood management in the command area	Short-term	local	Moderate	Reversible	Probable	Medium
Siltation and clogging of irrigation infrastructure	Short-term	Site specific	Moderate	Reversible	Probable	Medium
Loss of traditional landraces	Short-term	local	Moderate	Reversible	Probable	Medium
Biotic constraints	Short-term	local	Moderate	Reversible	Probable	Medium
Introduction of invasive species	Short-term	Local	Moderate	Reversible	Unlikely	Low
Conflict between water users	Short-term	Local	Moderate	Reversible	Highly probable	Medium
Diseases transmission in cattle and decrease of livestock productivity	Long-term	Local	Moderate	Irreversible ¹⁶	Highly probable	Medium
Decommissioning phase						
Waste generation	Short-term	Local	Low	Reversible	Probable	Low
Air pollution	Short-term	Local	Low	Reversible	Probable	Low
Occupational health and safety risks	Short-term	Local	Low	Reversible	Probable	Low
Termination of labors and loss of income	Medium	Regional	Medium	Reversible	Definite	Medium

¹⁶ between 60 % and 85 % sure that the impact will occur

The bidding documents, of any activity source of E&S risk and impact as assessed in this ESIA, will be advertised only when the construction phase's impacts, mitigation measures and EOHS clauses are fully taken into consideration

STAKEHOLDERS AND PUBLIC CONSULTATIONS

Before updating the project design, previous stakeholder's consultations were conducted between 21 and 30th September 2022 with farmers, livestock keepers and different cell and village authorities to make the project participatory and transparent. The meetings were attended by 1458 (45% women and 55% men) participants from seven sectors of project intervention area. At this stage, the project covered seven sectors of Nyagarate including Rwempasha, Rukomo, Karama, Tabagwe, Rwimiyaga, Nyagatare, and Krangazi. The project design was later updated to fit phase one (1) of implementation covering five sectors namely Rwempasha, Rukomo, Karama, Tabagwe and Nyagatare. New stakeholder's engagement was required. These consultations were carried out between June 12 and July 05 2025, and the participatory analysis in the recent consultation shows that 293 males, 282 females participated making a total of 575 participants.

Summary of key findings in terms of potential positive and negative environmental, social, safety and health impacts generated by project implementation with proposed mitigations measures for adverse ones were shared with the audiences in order to receive their views and attitudes accordingly. After interactive exchanges and responses to their queries, stakeholders and the public have appreciated the project and took engagement to participate in its successful implementation.

Concerns were raised by the participants in consultation meetings and the team of consultant assisted by experts from RWB provided answers accordingly.

Table 0-4: Raised concerns and responses provided during consultations

Issues raised by participants	Responses provided
Will the project create fair and accessible job opportunities for local residents?	Employment opportunities created by the project will prioritize members of the local community. We are committed to ensuring that local residents, especially youth and vulnerable groups are given first consideration for both skilled and unskilled roles. This approach not only supports community development, but also strengthens local ownership and sustainability of the project.
Community asked to clarify about expropriation and compensation of the properties to be affected by project activities.	- The Consultant team together with experts from RWB and local authorities explained the processes of expropriation; - Valuation will be continuing for all assets to be affected by the project; - Collection of expropriation documents is still ongoing for the remaining PAP that are not yet consulted; - In accordance with the expropriation Law and AfDB Policy, the project implementation will start after completion of compensation procedures.

Issues raised by participants	Responses provided
What are the anticipated benefits offered by the project dedicated to stakeholders?	• Project benefits were explained and identified as for water and infrastructures for irrigation, livestock watering, jobs opportunity etc. • The project is located in areas that suffer lack of water during dry season. This project will be a solution of water problem during dry season; • Increasing of agricultural productivity in accordance with the irrigation plan (about 9,900 Ha will be irrigated in the five sectors); • Increasing of livestock products and income generation for farmers; • A contribution to the local economic development through employment increasing and salaries paid; • Increasing income for local companies for different paid services that will contribute to the development of their families.
What mechanisms will be put in place to ensure that all willing stakeholders can effectively participate in resource mobilization and contribute meaningfully to the success of the project?	RWB appreciates the strong commitment expressed by all stakeholders toward supporting the project. To ensure effective participation in resource mobilization, we propose establishing a transparent coordination framework that outlines roles, responsibilities, and contribution mechanisms. This will include regular stakeholder meetings, clear communication channels, and a shared action plan to align efforts. By fostering collaboration and accountability, we aim to translate this collective willingness into tangible support that drives the project's success.
How will the proposed project ensure that farmers whose lands are located far from the planned irrigation canals also receive equitable access to water and agricultural benefits?	Secondary and tertiary canals are planned to be installed within the command area. With agreement from the District and local authorities, people may be permitted to connect to the installed irrigation network.
People asked if the new irrigation project is related to the previous ones already implemented in the District.	The consultant explained that the new irrigation project is a standalone project that will target hillside irrigation, which is different from the existing surface irrigation in Muvumba marshland

The Grievance redress mechanism is one of the strategies that will be put in place to monitor and resolve complaints that may arise during or after the Project implementation by the affected people. The Grievance Redress Mechanism (GRM) ensures that complaints are received, reviewed and addressed by the elected Grievance redress committee.

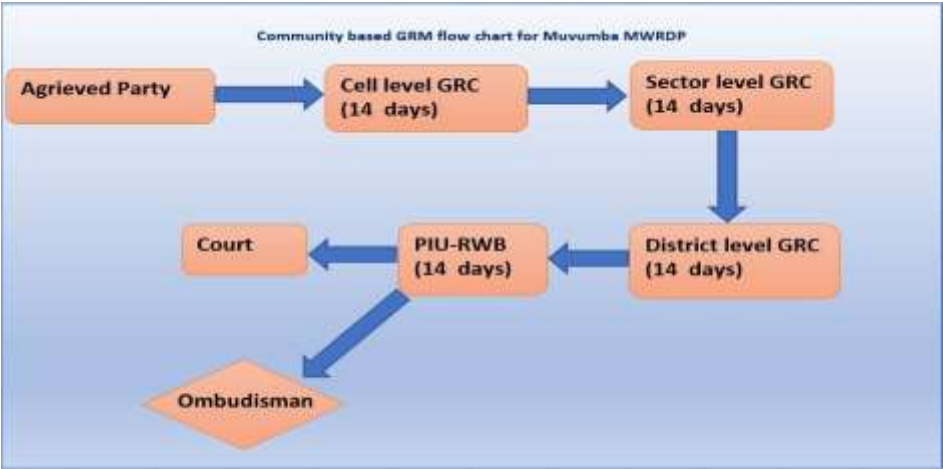


Figure 0-1: Chart of community GRM at different levels

ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORY PLANS

Solutions to the key impacts outlined above are summarized in the table below, based on a standard impact assessment approach of (i) avoid, (ii) minimize, (iii) compensate, and (iv) enhance. Full details are provided in the main text of this report. The Environment and Social Management Plan (ESMP) prepared under this ESIA provides a budget of equivalent to ~~6,390,901,018~~ ~~6,763,701,018~~ **Frw** for mitigation of environment and social impacts identified during preconstruction, construction, decommissioning, and operation phase.

Commented [U1]: This is the cost for ESMP only according to the ESMP table.

For the successful implementation of the project ESMP, it is mandatory to undertake periodic monitoring of the project activities to assess the project's compliance to environmental and social indicators and ensure corrective actions are taken. The total budget for implementing this ESIA is equivalent to 6,764,701,018 Rwf covering both ESMP, ESMoP, annual and project completion E&S performance audit as well as capacity building. monitoring activities was estimated to 25,900,000 Frw for Environmental and Social Monitoring Plan implementation as well as capacity building costed to 7,900,000 Frw. Additionally, annual and project completion E&S performance audit costs were also added and are equivalent to ~~160,000,000 Frw~~ and ~~180,000,000Frw~~ respectively. Therefore, the total implementation cost for this ESIA is equivalent to ~~6,565,550,593 Frw.~~

Commented [U2]: This is how I framed the text and I included the revised ESIA cost.

IMPLEMENTATION AND MONITORING ARRANGEMENT

RWB is the lead agency in the implementation of the developed ESMP and the overall project monitoring. Its main role will be to implement mitigation measures, building the capacity of other actors in SPIU, and in environmental management. The capacity building activities should be through hands-on experience approach. The Muvumba program safeguards staffs shall be responsible to oversee the implementations of environmental and social management plan on a routine basis and will have E&S implementing staff from the construction contractor, and these will include the implementation of mitigation measures available in the ESMP.

RWB is in charge of implementing the commitments contained in this ESIA. This responsibility will be implemented through contractor and supervising engineer in some instances. Therefore:

- RWB, contractor and supervising consultant will hire full-time Environment and Social safeguards experts to implement and to monitor the implementation of the plan.
- The Bid Documents to be prepared for the project will incorporate the Environment, Social provisions discussed under Chapter 6, 7, 8 and 9 (Environment and Social Impact Assessment and Mitigation Measures, and ESMP). The Project contract document should include provisions for the contractor preparing and implementing Contractor Environment and Social Management Plan (C-EMSP) to outline in further detail soil and sedimentation control, dust management, labour management and Gender/VMG inclusivity strategy, Gender-based Violence Action Plan, COVID -19 Protocols etc.
- Monthly E&S reports will be provided to AfDB on the implementation of the safeguard's provisions
- Annual E&S audits will also be prepared and submitted to AfDB to track Project Environment and Social Compliance. At the end of the completion of the implementation, an ESMP Completion report is to be done.

Other key parties with a role in the monitoring of the implementation of this ESIA include:

- Rwanda Environment Management Authority (REMA): Under supervision of the Ministry of environment, REMA has the legal mandate for national environmental protection, conservation, promotion, and overall management, including advisory to the government on all matters pertinent to the environment and climate change. All project's activities that are anticipated to cause environmental change around the project area are monitored by REMA. Nyagatare DistrictNyagatare District will work closely with the Rwanda Water Resources Board (RWB) and other stakeholders to mobilize communities, monitor project progress, and facilitate compensation and resettlement where needed. The district will also play a role of facilitating community engagement through meetings and discussions, to ensure that concerned stakeholders are consulted, fostering ownership, transparency and accountability.
- Established to ensure the growth of forest resources, their management and protection for sustainable development purpose. In case were cutting of trees is unavoidable, Nyagatare district will authorize the removal of the trees followed by implementing mitigation measures, especially removing these trees at minimum and offsetting the removed ones.

- Rwanda Development Board (RDB): RDB is a one stop institution bringing together several government bodies in Rwanda focused at promoting investment in Rwanda. RDB is a key partner in this project as it will be responsible for reviewing the ESIA report and issuing the ESIA certificate before project implementation.
- Rwanda Agriculture and Animal Resources Board (RAB): RAB is entrusted with the implementation of agriculture and livestock policies and plans. The vision of RAB is to improve food security and livelihoods by transforming agriculture from subsistence into modern farming through generating research and extension innovations that generate sustainable crop, animal husbandry and natural resource management. In close collaboration with Rwanda Water Resources Board, RAB will be responsible to provide technical expertise to ensure a successful implementation of this project.
- Establishment of irrigation project may also raise complaints among local communities mainly due to water conflicts, conflict between workers or / and conflicts between workers and local community. In this situation, community-led GRCs, and Grievance procedures will be established to ensure that PAPs are able to share complaints or concerns, without cost and with the assurance of a timely and satisfactory resolution of the issue.

CONCLUSION AND RECOMMENDATIONS

Subject to full resourcing and effective implementation of the measures identified in this report, the project is considered to be in compliance with AfDB operational safeguard as well as national regulations regarding environmental and social protection.

Compliance with the Bank's policy on Involuntary Resettlement is the subject of a separate Resettlement Action Plan for the command area consistent with the Bank's policy and Rwandan legislation. In addition, The ESIA study team identified in the command area the protected forest along the Muvumba river as well as some sensitive animal species. So, the Operational safeguard (OS3) will apply.

The project is a bold attempt to transform agricultural production methods and yields and at the same time radically change living conditions and socially conservative rural society living in a difficult physical location with sensitive ecological values. This approach carries with it a number of risks, economic, institutional, social and biophysical. Major risks of which the project's developer should be aware include:

- Ecological: negative impacts are expected on woodlots, agroforestry, and grasses due to installation of pivot structures, and excavation of the irrigation channels.
- Physical: groundwater rises, and secondary salinization, etc.
- Social: involuntary resettlement (Physical and economic) as a result of canal construction

Given the nature, the location and planned project works, the consultant has identified a number of impacts pertaining to the project and has recommended their mitigation measures with a detailed Environmental and Social Management Plan (ESMP) that provides a way forward for their implementation. Project benefits are found to be far outweighed the negative impacts and for which a mitigation plan has been prepared. To this extent, the consultant is the view that the project be implemented with careful implementation of proposed measures.

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ACRONYMS AND ABBREVIATIONS

AfDB: African Development Bank
ARAP: Abbreviated Resettlement Action Plan
CAE: Child Abuse and Exploitation
CBO: Community Based Organization
CBP: Capacity Building Plan
DDP: District Development Plan
DDS: District Development Strategy
CDAT: Commercialization and De-risking for agricultural and transformation project
ESIA: Environment and Social Impact Assessment
ECD: Early Childhood Development
EICV: Integrated Households Living Conditions
ESAP: Environment and Social Assessment Procedures
ESMoP: Environment and Social Monitoring Plan
ESMP: Environmental and Social Management Plan
GBV: Gender based Violence
GIS: Geotechnical Investigation System
HIV: Human Immunodeficiency Virus
IEE: Initial Environment Examination
INRM: Integrated Natural Resources Management
ISS: Integrated Safeguards System
IWUA: Irrigation Water Users Associations
LF: Landfill
MINALOC: Ministry of Local Government
MINAGRI: Ministry of Agriculture and Livestock
MININFRA: Ministry of Infrastructure

MINISANTE: Ministry of Health
MoE: Ministry of Environment
MPL: Ministry of Public Labor
NAR: National Attendance Rate
NGO: Non-Governmental Organization
NISR: National Institute of Statistics of Rwanda
NRM: Natural Resources Management
NST: National Strategy for Transformation
OHS: Occupational Health and Safety
OS: Operational Safeguards
PAPs: Project Affected Persons
PPE: Personal Protective Equipment
RDB: Rwanda Development Board
REMA: Rwanda Environment Management Authority
NLA: National Land Authority
RPHC4: Fourth Rwanda Population Housing Census
RSB: Rwanda Standards Board
RURA: Rwanda Utility Regulatory Authority
RWB: Rwanda Water Resources Board
SC: Supervision Company
TD: Tender Document
ToRs: Terms of Reference
TS: Technical Services
TVET: Technical and Vocational Education and Training
UNFCCC: United Nations Framework Convention on Climate Change
WASAC: Water and Sanitation Corporation Ltd
WTP: Water Treatment Plant

1. INTRODUCTION

1.1. Background of the project

Rwanda's economy relies heavily on agriculture with the sector contributing around 30% to the Gross Domestic Product (GDP) of Rwanda. The Government of Rwanda in its national policies clearly indicates agriculture as a vehicle for economic growth. In fact, the National Strategy of Transformation Two (NST2) and the Strategic Plan for Agriculture Transformation (PSTA) IV emphasize agriculture development to achieve the goal of poverty reduction and ensuring food security.

To intensify agriculture, Rwanda commissioned an Updated Irrigation Master Plan (2020) which identified close to 501,509 hectares of potential irrigation areas covering various domains, including rivers, lakes, dams and underground water resources. The Plan undertakes Prioritization of irrigation sites with Nyagatare District falling in Priority 1 and 2 (see table below).

The philosophy behind this prioritization is that in the areas that there is high rainfall, there is no need for infrastructures to support the irrigation, since rainfed irrigation is considered efficient to cover the needs. Thus, priority for development is wherever there is no rainfall and supporting infrastructures should be implemented to cover this gap.

Table 1-1: Priority based on the annual rainfall

Ranking	District name	Score
Priority 1 (up to 850mm)	Bugarama, Bugesera, Kirehe, Kayonza, Gatsibo (the east of the road Kayonza-Kagituma), Nyagatare (the east of the road Kayonza-Kagituma)	3
Priority 2 (850mm – 1100mm)	Gisagara, Huye, Nyarugugu (low land), Nyamagabe (low land), Nyanza, Ruhango, Muhanga, Kamonyi, Kigali, Rwamagana, Ngoma, Gatsibo (the west of the road Kayonza-Kagituma), Nyagatare (the west of the road Kayonza-Kagituma), Rubavu, Nyamasheke (marshland only)	2
Priority 3 (above 1100mm)	Nyaruguu, Nyamagabe, Rusizi, Nyamasheke, Karongi, Rutshiro, Ngororero, Gakenke, Rulindo, Gicumbi, Burera, Musanze, Myabihu, Rubavu.	1

Source, *Irrigation Master Plan, 2020*

Nyagatare District is in the Eastern Province of Rwanda which is generally known to be prone to frequent shortage of water for crops and livestock. The District is particularly vulnerable to drought; it has immense flat lands but much drier and therefore unsuitable for rain-fed crop production without irrigation. This high vulnerability to drought has justified the mobilization of public investments for the development of irrigated agriculture and livestock water use. Many irrigation projects are operational such as Rural Sector Support Project (RSSP) but not enough to overcome such drought vulnerability in Nyagatare District and surroundings.

The Government of Rwanda through Rwanda Water Resources Board (RWB) is implementing the construction of Dam and hydropower project since October 2023 under the Muvumba Multipurpose Water Resources Development Program and the construction is currently at 31.96 % as at end of July 2025. Subsequently, Rwanda Water Resources Board (RWB) appointed Tata Consulting Engineering (TCE)- International Business Center (IBC) Joint Venture to prepare the detailed designs and tender documentation for irrigation of a command area estimated at about 10,206 ha in the District under the umbrella of the larger ongoing Muvumba Multipurpose Water Resources Development Program (MMWRDP). The proposed irrigation project will contribute towards increasing agriculture and livestock products and by the way reduce poverty as well as improve local and regional economy directly through: (i) intensification of cropping, (ii) change to higher value crops and diversification of crops, (iii) increasing agricultural wage employment, (iv) import substitution and bridging the gap to reduce the deficit of food grain to meet the current and future demand etc.

The Government of Rwanda is currently seeking financing from the African Development Bank (AfDB) to develop Phase 1 of the irrigation component targeting a total of 3,073 hectares out of 10,206ha total hectares. In line with AfDB's Integrated Safeguards System (ISS), the project is classified as High Risk (Category 1). Category 1 are High-risk operations likely to cause significant and/or irreversible adverse environmental and/or social impacts on a large scale, or to significantly affect environmental or social components that the Bank or the borrowing country considers sensitive. This includes projects classified as high risk under national legislation or moderate-risk projects financed by the Bank in a low environmental and social (E&S) implementation capacity or fragile context. Considering all planned activities, project implementation is likely to generate adverse impacts which should be avoided, minimized, reduced, mitigated, or compensated during all stages of project execution. Therefore, it is imperative to elaborate an Environmental and Social Impact Assessment (ESIA) which will propose adequate preventive and/or mitigation measures to offset these adverse impacts and risks to be encountered in return. The ESIA is also undertaken in cognizance of national laws and donor policies. Based on the Rwanda national Law on environment, this sub-project is classified under the projects that must undergo an Environmental Impact Assessment before obtaining authorization for its implementation.

1.2. Objectives of ESIA assignment

The objective of this ESIA study (focused on Phase I of the irrigation sub-project and covering only 3,073ha) is to identify and assess the environmental and social risks and impacts of the proposed sub-project throughout the project life cycle, then enhance, avoid, minimize or mitigate/manage the potential impacts generated through the sub project's planned activities, on the human community and the environment in general, while improving human livelihood and promoting sustainable development.

1.3. ESIA Rationale

Rwanda Water Resources Board (RWB) has proposed irrigation project as part of the ongoing Muvumba Multipurpose Water Resources Development Program (MMWRDP), and the feasibility

study was conducted. The feasibility study report has recommended a detailed environmental and social impact assessment to inform detailed design of the whole project. Rwanda environmental law, No. 48/2018 of 13/08/2018 determining modalities of protection, conservation, and promotion of the environment in Rwanda and requires that all projects that may have negative impacts on the environment and community should undergo an Environmental and Social Impact Assessment.

Further reference is made to the Ministerial Order N°003/MoE/25 of 19/08/2025 that establishes the list of projects that must undergo environmental impact assessment, instructions, requirements, and procedures to conduct environmental impact assessment. The initial screening has shown that the overall impact level (IL) of this component/project falls under category of projects that should conduct full ESIA (according to the annex 1 of the Ministerial order that shows a list of projects subject to full ESIA).

According to AfDB's Integrated Safeguards System (ISS) categorization, the project falls into category 1 (High Risk) and needs to comply with its Environmental and Social Operational Safeguard 1: Assessment and Management of Environmental and Social Risk and Impact which requires an environmental and social impact assessment (ESIA) If the undertaking involves new activities (e.g. irrigation infrastructure).

1.4. Scope of the ESIA Study

This environmental and social assessment (ESA) was undertaken with the intention to produce a comprehensive Environmental and Social Impact Assessment (ESIA) document, which includes an Environmental and Social Management Plan (ESMP). The scope of the work included, to:

- Identify which legislation, and policies (both local and international) are likely to influence the project implementation and assess impacts caused by this project and how the project will comply with these regulations;
- Develop an overview of the baseline environment of the project areas of influence; i.e. study area description, physical, biological, and social- economic-environment etc.
- Develop an overview of likely impacts (positive or negative, direct/indirect/cumulative) that could be caused by water diversion, construction of irrigation canals, and water storages, land husbandry works, irrigations, and use of fertilizers in farming.
- Engage different stakeholders whether directly or indirectly affected by the project, or those interested in the sub-project
- Propose mitigation measures against the predicted adverse impacts identified, and enhancement measures for the positive impacts
- Propose a well costed Environmental and Social Management Plan (ESMP) and an Environmental and Social Monitoring Plan to ensure the sustainability of the project.
- Suggest recommendations and possible measures to fix gaps if any.

This ESA is restrained to areas located in Nyagatare District covering an area of 3,073ha, especially in the five sectors of Tabagwe, Karama, Rukomo, Nyagatare, and Rwempasha in the

Eastern Province of Rwanda. It is restricted to the project main components such as temporal site installations, installation of canals network and livestock water use infrastructures, set up of other irrigation structures such as cross-drainages, inverted siphons, box culverts, access roads, construction of 6 temporal site installations (hosting offices and storage yards)¹⁷ and intakes.

1.5. Study approach and methodology

This ESIA study used the following approach:

- Scoping study/ preliminary assessment
- Review of secondary data gathered in the baseline information report as well as technical reports on the project;
- Review of policies, laws and regulations relevant to the implementation of the project
- Use of hydraulic study information necessary to assess the impacts of the canal and water irrigated within the command area and surroundings¹⁸
- Conducting consultations with public, key stakeholders and get their concerns on the project
- Conduct field surveys along the entire project site in order to collect data on various environmental and social aspects of the project
- Preparation of maps and/or photographs of the Site's location, land cover as well as proposed infrastructures to be constructed for a comprehensive understanding of the area and project activities.

1.5.1. Scoping study/ preliminary assessment

A scoping study was done by involving consultations with RWB, RAB technical staff in based in Nyagatare District on 02/07/2025, from 07, 18-19 June 2025 and local authorities in entities covering the project as well as key persons among local community. The scoping exercise entailed preliminary visits to the various sites of the project for:

- Exchange and establish clear boundaries of the study in order to focus on the relevant issues of the project.
- Sites reconnaissance to understand the spatial coverage of the project;
- Identification of the likely stakeholders who will be involved in the additional public and stakeholder consultations.
- Preliminaries on the existing environment (physical, biological and socio-cultural);
- Preliminary predictions of likely positive and adverse impacts.

1.5.2. Public and key stakeholders' consultations

Consultations for the ESIA study applied different participatory methods like (i) exchange with one-to-one key informants with Rwanda Rural Rehabilitation Initiative (RWARRI) undertaken on

¹⁷ These will largely be structures supporting the construction works and include contractor offices, storage yards and thus temporary and will be decommissioned after the works.

¹⁸ Since the canal is impacting the water flow depending on its size and design, the hydraulic information was used to see if the canal is trapezoidal and concrete lined will impact the flow of water through the command

30th June 2025 (ii) focus group discussions with the Manager and chairman of Water User Association (WUA) of the existing irrigation scheme and (iii) conducting eight community meetings with different community stakeholders. Consultation meetings (eight) were conducted from 07/06, 18-19/06 and 01-03/07/2025 with the communities from the five administrative sectors of the project intervention area. 533 participants including 213 females attended the community meetings.

During consultation, stakeholders were informed about components and planned activities of the project, the advantages and potential impacts likely to be encountered during project implementation and proposed mitigation measures. The team of the Consultant offered them an opportunity for expressing their concerns, raising their opinions and worries through different questions. Any issue which was raised by one individual or a group of people were cross-checked through discussion with other individuals or group. The minutes and attendance list of consulted persons is provided in the list annexes of this report.

1.5.3. Review of secondary data gathered on baseline information

Information on the physical, biological, socio-economical, institutional and legal framework was collected from various sources like ESIA studies conducted in the region, literature review of published and miscellaneous documents etc. was undertaken.

1.5.4. Field data collection

Fieldwork was conducted between 18 June and 2 July 2025 in order to capture:

- Additional physical and environmental conditions of the project sites and sensitive areas likely to be impacted by project activities. Baseline data on Muvumba water quality fluctuations, bio-cover in study area, fauna, climate, topography, soils, local drainage/hydrology etc.
- A field work was conducted on 02/07/2025 with the REMA and RAB staffs to appraise the existing irrigation system in the Muvumba perimeter-8 (Muvumba P-8) implemented by RAB and assess its interaction with the proposed irrigation project
- Appraisal of land use at adjacent plots to selected sites dedicated to irrigation infrastructures construction and assessment of other relevant socio parameters.
- Collecting opinions and point of views during community meetings held on 07/06, 18-19/06 and 01-03/07/2025 from local population and project affected persons (PAPs), their expectations and concerns in relation to positive and adverse impacts likely to be generated by implementation of the project.

1.5.5. Impacts identification and assessment

The environmental and social impacts identification and assessment was done by superimposing project elements onto the existing environmental conditions of the project site. Environmental impacts were then identified, their significance assessed, and mitigation/enhancement measures proposed in order to properly eliminate or reduce negative environmental and social impacts as

well as suggest remedial measures for positive ones. To execute this assignment, both qualitative and quantitative methods were employed.

The identification and evaluation of impacts was based on qualitative criteria, and thus the importance of each impact was assessed against the following:

- Degree of sensitivity
- Occurrence

The degree of sensitivity or intensity of the environmental and social impact corresponds in this case to the relative importance of the disturbance/alteration induced by a project activity on an environmental or social component. The degree of sensitivity of the impact can be Very high, High, or Low.

With regards to the occurrence criterion, this is the probability of the occurrence of the impact over the entire period during which the activity is carried out. In this case, the occurrence is considered to be either very limited, Limited or Permanent for the entire duration of the activity.

The assessment criteria and ratings for determining the impact significance are the following:

- (i) **Nature or status of the impact:** the type of the effect the activity would have on the environment that can be:
 - *Positive:* has a benefit to the holistic environment
 - *Negative:* has a cost to the holistic environment
 - *Neutral:* has no cost or benefit
- (ii) **Duration of the impact:** the lifetime of the impact:
 - *Short term:* less than 5 years
 - *Medium term:* 5 to 10 years
 - *Long term:* Beyond 10 years
 - *Permanent:* cannot be remedied
- (iii) **Extent or scale of the impact:** the distance from the source that impacts may experience:
 - *Site specific:* within the site boundary (less than 500m)
 - *Local:* affects immediate surroundings areas (within a radius of 500m-5km)
 - *Regional:* extends substantially beyond the site boundary
 - *National:* affects country
 - *International:* crosses international borders
- (iv) **Reversibility of the impact:** to what degree its influence on the relevant environment can be negated:
 - *Completely reversible:* reverses with minimal rehabilitation and negligible residual effects
 - *Reversible:* requires mitigation and rehabilitation to ensure reversibility
 - *Irreversible:* cannot be rehabilitated completely/ rehabilitation not viable
- (v) **Intensity or magnitude of the impact:** severity of the negative and magnitude of positive impacts:
 - *Low:* little effect- negligible disturbance/benefit.

- *Low to moderate*: effects observable-environmental impacts reversible with time
 - *Moderate*: effects observable-impacts reversible with rehabilitation
 - *Moderate to high*: extensive effects – irreversible alteration to the environment
 - *High*: extensive permanent effects with irreversible alteration
- (vi) **The probability of the impact describes the likelihood of the impact actually occurring:**
- *Unlikely*: less than 15 % probability of an impact occurring
 - *Possible*: between 15-40 % sure of an impact occurring
 - *Probable*: between 40-60 % sure that the impact will occur
 - *Highly probable*: between 60-85 % sure that the impact will occur
 - *Definite*: Over 85 % sure that the impact will occur.
- (vii) Criteria for determining impact significance

Table 1-2: Criteria for determining impact significance

Impact scale	Descriptors
High	Irreversible, widespread, covering local, regional and global indirect influence area. Will lead to high mortality of important endangered species on site and off site. Exceeds limits set by environmental standards both national and international. Major contribution to known global environmental problem with tangible effects. Causing widespread nuisance both onsite and offsite. Leading to the release of hazardous wastes which lethal effects in the environment. Permanent loss of livelihoods for entire community. Leaves permanent and irreparable scars on the landscape.
Medium	Noticeable effects on the environment which are reversible over the long term Localized degradation of resources restricting potential for further usage. Limited effects on locally or globally endangered species with no long-term effects on their reproduction and migratory behaviors. Increased pollution of water bodies in the short term but drops with time. Noise and air pollution above maximum levels accepted in the environment. Disruption of livelihoods in the short term but no long-term effects. Leads to a repairable scar on the landscape but repairable over time.
Low	Noticeable effect on the environment, but returning naturally to original state in the medium term. Minimum degradation of resources but does not constrain future use Disruption of the behavior of threatened/endangered species but returns to normal in the short term. Release of periodic particulate matter that is circulated in the short term Intermittent noise nuisance Changes in water and air quality levels not above maximum acceptable limits.
Very Low	No noticeable or limited local effect on the biophysical environment that rapidly returns to its original state.

	Unlikely to lead to any changes in ambient air and water quality. Unlikely to affect resources in any noticeable way. No anticipated effect on livelihoods Will not change the landscape in any way.

1.6. Report structure

This report is arranged as follows in accordance with the AfDB ISS Environmental and Social Operational Safeguard 1:

- ♣ Chapter 1: Introduction
- ♣ Chapter 2: Policy, Legal and Institutional Framework
- ♣ Chapter 3: Analysis of Project Alternatives
- ♣ Chapter 4: Project Description
- ♣ Chapter 5: Environmental and Social Baseline Conditions
- ♣ Chapter 6: Environmental and Social Impacts Analysis
- ♣ Chapter 7: Environmental and Social Management and Monitoring Plan
- ♣ Chapter 8: Institutional Arrangement for the implementation of ESMP
- ♣ Chapter 9: Public and stakeholder consultation
- ♣ Chapter 10: Implementation schedule and Budget
- ♣ Chapter 11: Conclusion
- ♣ References
- ♣ Appendices

2. POLICY, LEGAL AND INSTITUTIONAL ARRANGEMENTS

2.1. Introduction

This chapter describes the policies, main legal and regulatory texts and standards relating to the protection of the environment applicable to this project, as well as provides an overview of the main institutions concerned by the project. It summarizes the applicable national policies, laws and regulations and notes the international requirements including applicable African Development Bank Policies.

2.2. Legal Framework

A summary of the national legal framework applicable to the project is presented in Table 2-1 below.

Table 2-1: Legal framework

Legislation	Requirements	Relevance to the project
Rwandan Constitution (2003 and amended 2015)	It articulates the rights and responsibilities of all citizens and the role of the state regarding the environment by providing that every citizen is entitled to a healthy and satisfying environment and that every person has the duty to protect, safeguard and promote the environment respectively.	ESIA is a starting point in safeguarding the right to a clean environment as it provides for various mitigation measures for identified impacts.
Law No 48/2018 of 13/08/2018 on environment	The law sets out the general legal framework for environmental protection and management in Rwanda. It also constitutes the environment as one of the priority concerns of the Government of Rwanda. This law applies in all aspects of the intervention project including among others Waste management, aerial emissions, effluent discharge practices, excessive noise and vibration, etc. The developer and the contractor on the ground is required to closely work with districts and REMA to ensure environment, health and safety guidelines are considered. Defines projects that must undergo an Environmental Impact Assessment	Based on this law, this project is classified under the projects that must undergo an Environmental Impact Assessment before its implementation. The present ESIA report serves as proof of compliance to the requirements of this law.

Legislation	Requirements	Relevance to the project
	before its implementation. ESIA reports are submitted to RDB for review and the stakeholders work closely with REMA, being the environmental authority.	
Ministerial order establishing the list of works that requires EIA studies (2025)	Article 3 of this ministerial order states that no public institution is authorized to take a decision, to warrant a certificate, approve or authorize the commencement of a project mentioned in the annexes of this Order without prior environmental impact assessment.	Irrigation system is among the activities mentioned in annex 1 of this law requiring full EIA. Therefore, a full ESIA study has been undertaken as per this law.
Law determining the use and management of water resources in Rwanda	Article 7 of the law stipulates that water resources should be used and managed by avoiding pollution with priority to source, taking precaution to activities that are suspected to have negative impacts on water resources and considering interests of water users, land and other natural resources and related ecosystems. Article 16 specifies that the state establishes mechanisms of coordinating the monitoring of water resources quantity, quality and use of water resources of each catchment. Prohibits pollution of water bodies by dumping, spilling or depositing chemicals of any nature above tolerable limit for human health or aquatic life	The proposed project will require water during the construction and operation phases. Therefore, the project will ensure that water resources are sustainably utilized in accordance with this law i.e. It will be implemented in context that avoids contamination of water resources and overuse of water during its different phases
Ministerial Order no 001/MoE/24 of 02/04/2024 relating to water resources use permit	The primary objective is to regulate the use of water resources through a structured permit system, ensuring: • Efficient and equitable allocation of water among users • Protection of aquatic ecosystems and water quality • Monitoring and accountability of water abstraction and usage • Maintenance of water infrastructures installed	Specifically, for the irrigation component of the Muvumba Multipurpose Water Resources Development Program (MMWRDP), a water use permit will be obtained after ESIA clearance and prior to the construction phase, ensuring that water abstraction and utilization for irrigation are conducted in a sustainable and regulated manner
Law N° 064/2021 of 14/10/2021 governing	Law N° 064/2021 of 14/10/2021 governing biological diversity in Rwanda underscores the importance of	In line with Law N° 064/2021 of 14/10/2021 governing biological diversity in Rwanda, the Muvumba

Legislation	Requirements	Relevance to the project
biological diversity in Rwanda	landscape restoration by requiring that any cutting of trees be balanced with afforestation and reforestation initiatives. The law promotes replacement planting as a means of restoring degraded ecosystems, conserving biodiversity, and maintaining ecological resilience, thereby ensuring that tree harvesting activities contribute to long-term environmental sustainability.	Multipurpose Water Resources Development Program (MMWRDP) will ensure landscape restoration through afforestation and reforestation measures wherever tree cutting is required. Specifically, some agroforestry trees located within the right of way of irrigation canals will be cut to allow construction works; however, these will be replanted in collaboration with the local authority (District) to restore vegetation cover, conserve biodiversity, and maintain ecological resilience in the project landscape.
Land law (2021)	The law determines modalities of allocating, acquisition, transfer, and management of land in Rwanda. It also institutes the principles that are to be respected on land legal rights accepted on any land in the country and all other appendages whether natural or artificial.	This project will consider the ownership and use of land, specifically taking note of land tenure and related requirements on compensation for land.
Law N° 18/2016 of 18/05/2016 governing the preservation of air quality and prevention of air pollution in Rwanda	This Law determines modalities for preservation of air quality and prevention of air pollution in Rwanda. Article 8 provides specific tolerance limit of pollutants from industries and states that without prejudice to the provisions of this Law, tolerance limit of air pollutants from industries into the air, must be the same as the tolerance limit in the specific quality standards in force determined by the national Authority in charge of setting up regulations for quality standards.	The project activities will comply with the law as stipulated in Article 10 provide requirement on air pollutants from construction works and states that any person transporting or storing construction materials or materials from construction works, or carrying out demolition of a building or part of a building must avoid air pollution by complying with relevant quality standards. Project will institute regular air quality tests.
Ministerial Order N°. 003/16.01 of 15/07/2010 Preventing Activities that Pollute the Atmosphere	The purpose of Ministerial Order No. 003/16.0133 is to prevent activities that pollute the atmosphere. It provides in its annex, ambient air quality tolerance limits, which are based on, and consistent with, the Air Quality Specification of the Eastern African Standard Guideline (CD/T/66/2010).	The project will implement strict air quality control measures during construction and operation phases, including regular air quality monitoring, dust suppression (e.g., water spraying), use of well-maintained low-emission machinery, proper waste management to avoid open burning, and community safety measures. All activities will adhere to the ambient air quality tolerance limits specified in the Eastern

Legislation	Requirements	Relevance to the project
		African Standard Guideline (CD/T/66/2010), with monitoring results reported to relevant authorities.
Water law (2018)	The Law indicates that the use and management of water resources in Rwanda (No 49/2018 of 13/08/2018) places strict regulations governing the protection and use of Rwanda's wetlands and water resources. Specifically, according to Article 21, the use of water resources that may modify the flow rates, reduce water levels, degrade water quality, or threaten related ecosystems, wetlands, and the environment, are subject to water use permits	The project will avoid water pollution of the river, and maintain required environmental flow downstream.
Law No 47/2013 of 28/06/2013 determining management and utilization of forest in Rwanda	The law provides modalities for protecting the State forests and isolated trees. The law also stresses on planting trees in urban areas and on roadsides, protection and conservation of protected trees. It also assigns duties to local authorities, institutions, and individuals in forest stewardship.	Though no forest will be affected, the project contractors will record the number of trees to be cut or removed and get approval from the Nyagatare District authority. Trees cut will be offset (planting new nurseries nearby) upon completion of civil works, including in quarry sites after their closure. The ESIA/ESMP provides for replacement trees to be planted.
Ministerial order No 007/2008 establishing the list of protected animals and plant species in Rwanda	The order classifies and publishes protected animals in three categories as Mammals, birds, and reptiles. It specifies that the listed animals and plant species shall not be destroyed without permission of the competent authorities.	The consultant conducted a baseline survey on biota and flora, and did not find any critical species or IUCN endangered species in the project's command area of 3073ha as shown in Table 5-9 and Table 5-11. Although no critical species or those listed in the ministerial order were identified in the project command area of 3073 ha, the project team sited the grey crowne crane in the Muvumba wetland/irrigation scheme which borders the project command area. Given the proximity of some of the communities to the forest/wetland (during the operation of the irrigation scheme as Fig. 5-17 and 5-18 shows), mitigation measures were established to protect them e.g. sensitise the community on the importance of the

Legislation	Requirements	Relevance to the project
		grey crowne and need to preserve it should they sight any in their fields in the future.
Guidelines for EIA for water resources Management in Rwanda, 2009	The objective of these guidelines is to provide direction and information for decision making, provide advice on EIA as regard to water resources management and are intended to apply to all proposals that will affect water resources.	The EIA process followed the procedures set out in these guidelines as the Muvumba irrigation system falls under the category of activities that must conduct EIA according to the law No 001/2019.
Ministerial Order No. 004/16.01 of 24/05/2013 determining the list of water pollutants	Provide the list of water pollutants and require everyone to avoid any discharge of such pollutants in water bodies.	The contractor will avoid discharging the list of pollutants in water bodies
The Law 66/2018 of 30/08/2018 regulating Labour in Rwanda	The law requires to provide a conducive working environment for the employee and comply with labour and working standards including minimum age, prohibition of child labour, Prohibition of forced labour, Prohibition of sexual harassment, Protection against discrimination at workplace, right to freedom of opinion and association, employment contracts etc.	The project will ensure a safe and conducive working environment by enforcing fair labor practices, including written employment contracts, prohibition of child and forced labor, and zero tolerance for discrimination or sexual harassment. All workers will be treated equally, regardless of gender or background, and will have the right to freedom of opinion and association. The project will also respect the legal minimum working age and ensure health, safety, and welfare standards are met throughout the irrigation project. In addition, a labor management procedure will be prepared by the contractor as standalone document after project appraisal and before project implementation.
Expropriation law for public interest (2015)	The law determines the procedures relating to expropriation in the public interest. Every project, at any level, which intends to carry out acts of expropriation in the public interest, shall budget for valuation of the property of the person to be expropriated and for fair compensation".	The implementation of this project will require the acquisition of land privately owned by local people. Further, loss of income is also expected during construction of irrigation and livestock water use infrastructures. Therefore, fair compensation shall be made to those affected. A Resettlement Action Plan has been prepared.

Legislation	Requirements	Relevance to the project
Law No 71/2018 Relating to the Protection of the Child	The law provides protection for children against shows, records and adverts of child pornographic images, picture or voice and images	For instance, the project will strictly prohibit the employment of anyone under 18 years of age, verify age during recruitment through official identification, and conduct awareness sessions for contractors and workers on child protection laws. Additionally, the project will ensure that no project-related materials or activities involve or expose children to harmful content, including pornographic images, and will implement monitoring mechanisms to prevent and report any violations in line with Law
Prime Minister's order No 001/03 of 11/01/2012 determining modalities in which government institutions prevent and respond to GBV	The law gives responsibility for all Government institutions for GBV prevention and Response and Reporting.	GBV prevention and response will be the responsibilities of both the contractor, RWB, District and any other project stakeholder. Additionally, a GBV action plan will be prepared by the Contractor.
Law No 68/2018 determining offences and penalties in general	The law penalizes crimes related to child defilement, adultery, physical and sexual violence on his/ her spouse; concubinage; bigamy or officiating at bigamy; playing a role in forced cohabitation; harassment of a spouse; sexual harassment; fraudulent use of family property and denial, on grounds of marriage, of freedom to practice family planning.	The project will prohibit all forms of physical and sexual violence on site, and sensitizing workers on the same. All workers will be required to sign a code of conduct
Law No 59/2018 on prevention and punishment of GBV	This Law is aimed at preventing and suppressing the gender- based violence	All forms of GBV will be prevented throughout project phases. All workers will be required to sign a code of conduct
Law No 51/2007 determining the responsibilities, organization and functioning of Gender Monitoring Office (GMO) in Rwanda	This law is set to be an icon observatory for gender equality that promotes accountability for sustainable development in Rwanda.	Throughout its implementation, the project will comply with all legal provisions aimed at promoting gender equality, gender mainstreaming in the project, avoiding GBV and other gender related aspects.

Legislation	Requirements	Relevance to the project
LAW N° 71/2019 OF 29/01/2020 Establishing Rwanda Water Resources Board	RWB was established to ensure the availability of enough and well managed water resources for sustainable development.	RWB will be responsible to ensure that water resources in this project are managed in accordance with relevant laws and policies
Law No. No. 14/2017 of 01/05/2017 establishing Rwanda Agriculture and Animal Resource Development Board	Some of its functions include: • Conduct research on crops, livestock, agroforestry, and climate change impacts. • Promote agricultural productivity and quality. • Support farmers through extension services and capacity building.	RAB will provide technical expertise including capacity building. For instance, water users' capacity building. It will also assist in the development of pest and vector management plan (V/PMP).
Law No 58/2018 on mining and quarry operations	The law provides the process of acquiring quarries for mining activities, the licensing process and the environmental consideration in exploiting a quarry.	The law is relevant to the project as no quarry activities would be exploited prior to its approval. Tentative Quarry and borrow pit sites have already been identified but final list will be determined later. Before they are used, the contractor must prepare an ESIA as well as Rehabilitation Management Plan. The Rwanda Mining Board will grant authorization for their use only after reviewing and approving all necessary requirements.
Law No 30/2012 governing agro-chemicals in Rwanda	This law focuses on both pesticides and mineral fertilizers and aims at regulating manufacturing, importing, distribution, use, storage, sale, disposal and burial of expired agrochemicals.	During operation phases, project will ensure that all agrochemicals (fertilizers and pesticides) used are registered, approved, and applied by trained personnel in recommended quantities. Storage facilities will be secure and properly labeled, expired products will be safely collected and disposed of in line with the law, and farmers will be sensitized on safe handling, use, and environmental risks of agrochemicals to prevent contamination of soil, water, and harm to human health. In addition, Pest management plan was prepared and the project should stick to it.
Ministerial order determining	The order requires every employer to ensure the health, safety and welfare at the workplace for all persons working in his/her workplace, installation of safety	Safety measures must be respected through project life spans: such as proper handling and storage of agrochemicals, use of personal

Legislation	Requirements	Relevance to the project
conditions for OHS, 2013	signs, control of air pollution, noise and vibration, Fire-fighting measures, Personnel protective equipment etc.	protective equipment (PPE), emergency preparedness, and hygiene facilities, must be respected throughout the entire project lifespan, from construction to operation and maintenance phases.
Wetland's Law Prime Minister's order No 006/03 of 30/01/2017	Wetlands (and lakes) are protected by levels of exploitation published in a list of swamp lands, their characteristics and boundaries, determining modalities of their use, development and management. The order prescribes three management levels for specific lakes and wetlands: "Full Protection"; "Use under Specific Conditions" and "Use without Specific Conditions"	The Muvumba wetland is under full protection without specific conditions. As agriculture is the existing activity in this wetland, The Muvumba wetland will be protected in full compliance with this Order by ensuring that all project activities avoid intrusion into strictly protected zones, maintaining natural vegetation buffers, and promoting sustainable agricultural practices already existing in the area. No construction, waste disposal, or harmful chemical use will be allowed within the wetland, and all irrigation activities will be designed to preserve the wetland's ecological integrity through controlled water use, pollution prevention, and regular environmental monitoring.
Ministerial Order determining modalities of establishing and functioning of occupational health and safety committees, 2012	This Order determines modalities of establishing and functioning of occupational health and safety committees.	As a good practice, Health and safety committees will be established and governed by this ministerial order during project implementation.
Ministerial Order determining conditions for Occupational Health and Safety, 2012	This Order determines the general and specific rules and regulations relating to health and safety at workplace to secure the safety, health and welfare of persons at work and protect them against risks to safety and health arising from works	As good practice, health and safety will be given a priority by ensuring regular toolbox meetings on health and safety during execution of activities. Health and safety committees will be established and governed by this ministerial order during project implementation.
Law No.28/2016 of 22/7/2016 on the preservation of	This Law determines the preservation of cultural heritage and traditional	During Preliminary studies, Feasibility study and ongoing study of irrigation project, there was no cultural heritage

Legislation	Requirements	Relevance to the project
cultural heritage and traditional knowledge	knowledge. The cultural heritage is composed of the following: (i) Tangible cultural heritage and (ii) Intangible cultural heritage. The tangible cultural heritage is composed of the following: (i) movable and immovable heritage, (ii) mixed cultural and natural heritage and (iii) underwater heritage. The intangible cultural heritage is composed of: (i) oral tradition, oral literature, songs, cultural dances, rituals and taboos, intangible art, crafts and folklore, festivals, cultural events, knowledge and practices, (ii) documentary heritage: rare manuscripts, pictures, slideshows and speeches. There are restrictions on classified cultural heritage. Apart from routine tasks of maintaining cultural heritage, no person shall destroy, move, repair or modify in any way classified cultural heritage without prior written approval of the Minister within sixty (60) days from the date of receipt of the complete file.	found on the sites planned installation of irrigation infrastructures. Nevertheless, as good practice, once cultural heritage is discovered during project implementation, it will be given a priority to write to the Minister in charge for approval of its move or any other disposition. Chance finds procedures have also been prepared (as shown in Annex 6).

2.3. National Policy Framework

2.3.1. Rwanda's Vision 2050

The Vision 2050 sets a new pathway that will lead the country to the living standards of upper middle income by 2035 and high-income countries by 2050. The Vision 2050 has overarching objectives of promoting Economic Growth and Prosperity and High Quality of Life for Rwandans.

The proposed project complies with Vision 2050 as the irrigation project supports the transformation of agriculture into a driver of economic growth and improved livelihoods. It is now more accurately aligned with NST2, which serves as the current implementation framework for Vision 2050. Under NST2, the project contributes to climate-resilient agriculture, sustainable natural resource management, and enhanced rural productivity, all of which are central to improving the quality of life for Rwandans. The project's focus on irrigation and livestock water

use promotes efficient land and water use, and addresses challenges related to climate variability, thereby strengthening community resilience and advancing long-term environmental sustainability.

Furthermore, the project aligns with Pillar 3 of Vision 2050, “Agriculture for Wealth Creation,” which is reinforced in NST2 through strategic investments aimed at transforming subsistence farming into a market-oriented, high-productivity sector. By enabling the shift to high-value crops, supporting multiple cropping seasons, and creating employment opportunities in agriculture and related sectors, the proposed project directly contributes to NST2’s objective of accelerating inclusive economic transformation and reducing rural poverty. Its implementation supports both national development priorities and Rwanda’s long-term aspiration of achieving prosperity and a high standard of living for all citizens.

2.3.2. The National Strategy for Transformation (NST2) 2024 -2029

The Irrigation Project aligns strongly with Rwanda’s National Strategy for Transformation (NST2), which emphasizes climate-resilient agriculture, increased productivity, and sustainable rural development. By developing over 3,073 hectares of irrigated land and improving livestock water use infrastructure in Nyagatare District, the project supports NST2’s priorities of enhancing agricultural transformation, climate adaptation, and rural livelihoods. Through modern irrigation systems and improved water access, the project will enable year-round farming, promote high-value crop production, reduce vulnerability to drought, and strengthen food security. These outcomes directly contribute to NST2’s goals of increasing agricultural output, building resilience to climate shocks, and improving the lives of farmers in rural communities.

In addition, the project supports NST2’s commitment to sustainable infrastructure development and inclusive economic growth. The construction of irrigation canals, livestock water systems, access roads, and temporary installations facilitates better market connectivity, improves rural infrastructure, and creates employment opportunities. The inclusion of a comprehensive Environmental and Social Impact Assessment (ESIA) ensures that development is environmentally sustainable and socially inclusive, in line with NST2’s emphasis on safeguarding natural resources while accelerating economic transformation. Overall, the Muvumba project is a strategic intervention that directly contributes to NST2’s vision of a modern, resilient, and inclusive agricultural sector that drives national development.

2.3.3. The National Environment and Climate Change Policy, 2019

This Environment and Climate Change Policy reaffirms commitment to address climate change and lessen the potential hardships that climate change may pose to the sustainable development of Rwanda. The policy, therefore, seeks to provide strategic direction on environment and climate change in Rwanda, bearing in mind its linkages with socio-economic development.

The proposed project will ensure that improved development and wellbeing of the citizens of Rwanda are considered, while including environmental aspects into the decision-making process. This Policy is relevant as the project will contribute to climate change adaptation response through provision of water for irrigation during dry periods. Further, the proposed project may have impacts on the environment and natural resources considering the use of fertilizers, modifying water flow and quality, where mitigation measures have been provided etc.

2.3.4. Green Growth and Climate Resilience Strategy (GGCRS), 2022

The revised Green Growth and Climate Resilience Strategy (GGCRS) reaffirms Rwanda's long-term vision of becoming a developed, climate-resilient, and low-carbon economy by 2050, in line with Vision 2050. The project will align with this updated strategy by contributing to its three strategic objectives: (1) promoting sustainable land use and water resource management that enhance food security, support appropriate urban development, and preserve biodiversity and ecosystem services; (2) strengthening social protection, public health, and disaster risk reduction to minimize vulnerability to climate change; and (3) ensuring energy security and advancing a low-carbon energy supply to drive green industry and services.

2.3.5. The National Land Policy, 2019

The objective of the National Land Policy is to establish a land tenure system that guarantees occupational security of land for all Rwandans and guides land reform initiatives that will establish good management with reasonable use of land. As a complement to the Constitution of Rwanda, the land policy and land law have been drafted to safeguard, protect and enforce land rights of women and female orphans in different regions of the country. As the proposed project will be utilizing land for the development of structures and infrastructure, objectives of the National Land Policy must be considered and implemented during the ESIA process including provision for compensation for land taken.

2.3.6. The Mining Policy, 2010

The aim of the Mining Policy is to optimize local extraction and processing of minerals and aggregates. The policy places emphasis on achieving conformity of key activities, including supporting and facilitating environmental plans for the protection and rehabilitation of damaged environments.

This includes balancing the protection of flora and fauna and the natural environment with the need of social and economic development. Quarries to be used for construction activities are selected before the project implementation thus, mining activities will comply with law and regulations governing the mining sector. After quarry exploitation, mining policy will be implemented to ensure the protection and rehabilitation and after works borrow pits will be rehabilitated and closed.

2.3.7. The National Water Supply and Sanitation Policy, 2016

The vision of this policy is to ensure sustainable, equitable, reliable and affordable access to safe drinking water for all Rwandans, as a contribution to improving public health and socio-economic development while the mission is to plan, build and operate water and sanitation services in a sustainable, efficient and equitable manner.

The proposed project will ensure no water supply infrastructures are affected by the project construction works, and where affected, these are re-instituted.

2.3.8. The National Policy on HIV/AIDS, 2003

The National Policy against HIV and AIDS is an expression of the GOR's commitment through strategies to reduce risk, impact, and vulnerability on the citizens of the country. This expression of commitment is proof of the GOR's determination to preserve the Rwanda population, resident foreigners and visitors to Rwanda from HIV/AIDS. This has resulted in the development and implementation of the National Rwanda Policy and the National Strategic Plan against HIV/ AIDS, to which the GOR is strongly committed. The objective of the policy is to provide guidance for the implementation of the national strategic plan that is structured on the following:

- To reinforce measures for the prevention of HIV and AIDS transmission.
- To ensure that the national response to HIV and AIDS is adapted to Rwanda's evolving socio-economic and health conditions by using surveillance, research and experience.
- To improve HIV and AIDS related treatment for persons infected and affected by HIV and AIDS.
- To reduce the detrimental effects of HIV and AIDS on Rwanda's micro and macro socio-economic conditions; and
- To coordinate multi-sector responses with increased efficiency.

The project will primarily involve the local community in construction activities, giving priority to hiring local skilled and unskilled workers. However, the project will also require specialized personnel such as drivers, engineers, and suppliers/sub-contractors, who are not necessarily always available within the project area. While this may result in a limited influx of external workers, measures will be put in place to minimize social risks, including sensitization sessions for both workers and the local community to reduce the risk of communicable disease transmission and promote peaceful interactions. This approach ensures that labor influx is managed while safeguarding community health and social cohesion.

2.3.9. Water Resource Management Policy, 2011

Water policy in Rwanda is led by: (i) the National Policy for Water Resources Management, June 2011; (ii) the Water Law of 2018 that regulates the use, conservation, protection and management of water resources; (iii) the National Water Resources Master Plan (NWRMP), adopted in 2015 which identifies nine national catchments, available water resources and water-needs projections

as well as specific issues facing the sector. The project will deliver the following actions to achieve different policy statement:

- Policy statement on water allocation: This irrigation project will ensure that water abstraction meets ecological functions. Seeking water use permit before construction is also a proof of to the achievement of this policy statement
- Policy statement on policy, legal and institutional framework: Like for other irrigation projects, in the operational phase, the project will establish water users' associations and ensure their participation in water resources protection and conservation.
- Policy statement on shared water resources: To ensure that shared water resources management is done in compliance with regional and international rules and procedures; the project will respect environmental flow, avoid any forms of water pollution
- Policy statement on water resources conservation: As part of the Muvumba water resources development program, RWB is planning to mobilize funds for the protection of Muvumba upper catchment restoration through soil erosion control and rainwater harvesting to avoid siltation of canals. In addition, a 5 m buffer zone along the canals will be established to avoid bank erosions.

2.3.10. Rwanda Biodiversity Policy, 2011

The policy provides an overarching framework for the conservation, sustainable utilization, access to biodiversity resources and fair equitable sharing of benefits derived from the resources. This fits in the vision of Rwanda to be a prosperous nation, whose people live and work in harmony with the natural environment, and which derives lasting benefits from the conservation and sustainable use of its rich biological diversity. It considers the rehabilitation of degraded ecosystems in Rwanda as an urgent and major task that requires the commitment of significant resources from both national budgets and other sources.

The objectives of this policy are to:

- Provide a comprehensive and cohesive policy framework that will strengthen the Government's ability to conserve and protect Rwanda's natural and cultural resources.
- Provide a legal and institutional framework for biodiversity conservation and management throughout the country.
- Promote partnerships, incentives and benefit sharing to enhance biodiversity conservation and management.
- Promote generation, management of conservation knowledge, including traditional knowledge, and its application in the conservation of biodiversity.
- Provide a framework for access to genetic resources and the sharing of benefits derived from those resources.
- Promote positive attitudes towards biodiversity conservation and management.

This policy partly articulates Rwanda's policy options and strategies towards the implementation of the CBD and other international agreements as well as linking national biodiversity

management with regional, sub-regional and bilateral initiatives.

This policy shall apply to not only construction at the project sites but also its surroundings and affiliated areas such as preserving soil health, restoration of borrow pits for stabilized soils and mined quarries for construction materials.

2.3.11. National irrigation master plan, 2020

It aims to bridge fundamental performance gaps in the irrigation sector and to propose key reforms necessary to structure a highly modern and productive irrigation sector that contributes effectively to the national economy. The project will contribute to the increase of irrigated land as the policy identified high priority schemes at the East of the country as one of the priorities of food security.

2.3.12. Strategic plan for Agricultural Transformation (PSTA 5) 2024/25-2028/29

Through PSTA 5, Rwanda seeks to build resilient and sustainable agri-food systems to underpin Rwanda's continued economic and social progress. It adopts a holistic agri-food systems approach, recognizing the interconnectedness of agriculture with health, environment, trade, infrastructure, and other sectors.

PSTA 5 states that irrigation is critical for increasing land productivity and mitigating the risk of droughts, which is increasing due to climate change, and increasing land productivity. The PSTA 5 contributes to the Vision 2050 goal of irrigating 100% of all irrigable land, approximately 600,000 hectares.

2.3.13. National Agriculture policy, 2018

The vision of the Rwanda National Agriculture Policy is to become "a nation that enjoys food security, nutritional health and sustainable agricultural growth from a productive, green and market-led agricultural sector.

The implementation of this project will promote high value addition for Rwandan agriculture because the establishment of livestock infrastructure will:

- (i) Trigger the development of livestock production which in turn contribute in addressing food security and malnutrition,
- (ii) Improve soil-fertility with livestock manure to sustainably increase at the same time the quality of soil/land and the agricultural productivity,

Promoting sustainable water management for climate-resilience in farming and rural areas is among the policy actions under the second pillar of this policy. As Rwanda's agriculture is dependent upon rainfall with two rain seasons and intervening dry periods, establishment and operationalizing such large-scale irrigation will reduce crops and livestock vulnerability to water-related stress, thus contributing to climate resilience in Agriculture.

2.3.14. National Biodiversity strategy, 2016

The revised and updated Rwanda National Biodiversity Strategy (NBS) of 2016 has a long-term vision which is in line with the Convention on Biological Diversity (CBD) strategic plan to 2020 and states that: "by 2040, national biodiversity be restored and conserved, contributing to economic prosperity and human well-being through delivering benefits essential for Rwandan society in general." NBS as a 'living document', responsive, flexible and practical, including biodiversity conservation in economic decisions and turning it into a driver for national development. Relevant economic development sectors such as agriculture and animal resources, fisheries, forestry, mining and infrastructures will incorporate biodiversity conservation activities into their planning systems as well as in the annual budgets of upcoming years.

In line of safeguarding the existing biodiversity in the project area, this policy lays out a robust framework for safeguarding critical biodiversity, especially in areas impacted by development projects like irrigation schemes. As shown in Fig. 5-17 and 5-18, the nearest identified critical biodiversity area was the forest gallery which is nearby the proposed irrigation command, and which hosts a number of crowned cranes and other birds' species. This forest will not be directly affected as it is not within the 3073ha -project command area and no project structures of the project will be implemented in the Muvumba perimeter 8 and in the nearby gallery forest. Other non-critical species identified in the project area during baseline field survey conducted, this ESIA has proposed clear mitigation measures.

2.3.15. National sanitation policy, 2016

Requires enhance storm water management to mitigate impacts on properties, infrastructure, human health and the environment and implement integrated solid waste management. The project will be implemented in a way that minimizes the generation of solid waste and appropriate measures will be established for generated solid wastes.

2.3.16. Revised National Gender Policy, 2021

The policy requires measures to ensure equal and effective participation of women and men in all environmental protection and natural resources programs and ensure effective dissemination and enforcement of the land law. During the project works, men and women will be equal and participate in project activities without any gender segregation.

2.3.17. National policy on occupational health and safety, 2019

The objective of this National Policy on OSH is to reduce the number of work-related accidents and diseases in Rwanda and to provide equitable compensation benefits to those who may get injured in work-related accidents or contract Occupational diseases. This policy creates and provides a clear direction on the Government mandates in OHS, greater understanding on how the government will facilitate and promote OHS activities in Rwanda and a basis on which enterprises and partners will develop and implement OHS programs. This project will comply with this policy as it will involve activities which could expose OHS related risks. Therefore, preventing workplace injuries and accidents is of priority during project construction and operation phase.

2.3.18. National policy on elimination of child labour, 2013

Therefore, the vision of the National Policy on Elimination of Child Labour is to achieve a Rwandan society that is free of child labor, a society in which all children continue to enjoy their rights to education, health, and development in a dignified manner. To promote the policy objectives, the project will prevent all worst forms of child labor (WRFCL) during worker's recruitment and throughout project implementation.

For an effective prevention of child labor, the project shall implement the following actions:

- Ensure that recruited workers are of legal working age
- Putting in place written notice at the project sites prohibiting child labor
- Regular monitoring of all workers to ensure no child labor on site

2.3.19. Rwanda HIV and AIDS National Strategic Plan 2018-2024

The 2018-2024 NSP was developed based on an extension of the 2018-2020 NSP with updated epidemiological facts on HIV, and includes new policies. It is also aligned with other key national priorities and strategies such as the national strategy for transformation Vision 2020(1), EDPRS 3(2), the Health Sector Strategic Plan (HSSP IV) (3), as well as international priorities like the Sustainable Development Goals (SDGs). This plan sets ambitious goals for its time frame of execution, including: (i) Reducing new infections, (ii) Reducing the number of HIV-related deaths and (iii) Ensuring that people living with HIV (PLHIV) have the same opportunities as all others.

In line with achieving these goals and as a part of mitigating the spread of HIV/AIDS in the area, the project shall prevent new infection through fostering voluntary medical test on quarterly basis, counselling, increasing the use of condoms and conducting regular sensitization awareness meetings among workers and the community on HIV/AIDS prevention. In addition, to align with this strategy, the project shall reduce stigma and discrimination as well as sexual and GBV. Labor influx shall be given attention and continue to be monitored as it is perceived as the main factor for high infection rate.

2.3.20. Revised national employment policy, 2019

The overall objective of the National Employment Policy is to create sufficient and productive jobs to reduce labour underutilization and enhance productivity and competitiveness. Through this National Employment Policy, the Government of Rwanda fully recognizes that productive employment and decent work cannot be achieved through fragmented and isolated interventions. On the contrary, this requires sustained, determined and concerted efforts by all stakeholders by focusing mainly on youth, women and people with disabilities. This policy therefore seeks to provide a framework for enhancing coherence among national and sectoral policies towards the goal of creating productive and decent employment. To achieve the policy objective, the project implementation will comply with different relevant legal frameworks including among others, labour rights, preventing child labor and creating a conducive, safe and healthy working environment for employees.

2.4. International Policies

2.4.1. AfDB Integrated Safeguard System

The African Development Bank (AfDB) updated its Integrated Safeguards System (ISS) 2023, aims to improve clarity, coherence, and operational effectiveness in managing environmental and social (E&S) sustainability across its projects. This update was informed by strategic frameworks such as the AfDB's Climate Change and Green Growth Strategic Framework (2021), sector policies covering forestry, agriculture, rural development, water, and health infrastructure, and incorporated lessons from a 2019 independent evaluation. The revised ISS introduces 10 Operational Safeguards (OSs) that provide comprehensive guidelines for borrowers and clients to identify, assess, and manage E&S risks and impacts throughout the entire project lifecycle.

These 10 Operational Safeguards cover critical areas including environmental and social assessment, labor and working conditions, biodiversity conservation, pollution prevention, community health and safety, land acquisition, vulnerable groups, cultural heritage, financial intermediaries, and stakeholder engagement. The updated system emphasizes the importance of meaningful stakeholder engagement, gender considerations, and the protection of vulnerable groups, aligning the Bank's standards with international best practices. It ensures that projects are designed and implemented in ways that maximize development benefits while preventing or minimizing potential adverse impacts on both the environment and affected communities.

To facilitate implementation, the AfDB developed a series of Borrower Guidance Notes for each OS, offering practical tools and techniques to support compliance with ISS requirements. While these guidance notes do not replace mandatory policy obligations, they serve as valuable resources for stakeholders to meet the Bank's E&S Operational Safeguards. The AfDB's ISS also formalizes environmental and social assessment procedures established in 2013, including an Integrated Safeguards Policy Statement, revised Environmental and Social Assessment Procedures (ESAPs), and Integrated Environmental and Social Impact Assessment (IESIA) Guidance Notes. The overall goal is to promote sustainable project outcomes by avoiding, minimizing, mitigating, or compensating adverse impacts on the environment and affected people, while strengthening borrowers' capacities to manage environmental, social, and safety risks effectively.

Further, as per the ISS, Muvumba is categorized as a high-risk category 1 project. Category 1 is applied to Bank funded projects likely to cause significant environmental and social impacts. Category 1 projects are likely to induce significant and/or irreversible adverse environmental and/or social impacts, or to significantly affect environmental or social components that the Bank or the borrowing country considers sensitive.

The AfDB updated 10 Operational Safeguards (OS) under the Integrated Safeguards System are summarized below:

OS1: Assessment and Management of Environmental and Social Risks and Impacts

This overarching safeguard governs the comprehensive process for determining a project's environmental and social category and establishing the corresponding assessment requirements.

It covers critical elements such as the scope of application, project categorization, use of appropriate Environmental and Social Assessment (ESA) tools including Strategic Environmental and Social Assessments (SESA), Environmental and Social Impact Assessments (ESIA), Environmental and Social Management Frameworks (ESMF), and Environmental and Social Management Plans (ESMP) as well as climate change vulnerability assessments, public consultations, community impacts, consideration of vulnerable groups, and grievance mechanisms. OS1 consolidates and updates the Bank's environmental policy commitments to ensure a robust framework for managing project-related risks.

The safeguard requires that assessments comply, to the extent possible, with relevant local laws and standards, taking into account equivalence with Bank requirements. It also emphasizes alignment with national and regional programming documents under implementation or development. OS1 prioritizes a mitigation hierarchy approach that anticipates, avoids, minimizes, mitigates, and, where necessary, compensates or offsets residual environmental and social risks and impacts. This approach ensures that projects systematically manage risks, addressing issues such as gender, climate change, and the needs of vulnerable populations.

The objectives of OS1 include identifying and assessing environmental and social risks across the project's area of influence, ensuring meaningful stakeholder engagement and consultation throughout the assessment process, and adopting differentiated measures to avoid disproportionate impacts on vulnerable groups. Additionally, OS1 encourages the use and strengthening of national environmental and social institutions and systems, aiming to build the capacity of regional member countries to meet the Bank's Integrated Safeguards System (ISS) requirements. Through these provisions, OS1 fosters responsible project design and implementation, enhancing sustainable development outcomes while safeguarding communities and ecosystems.

OS2: Labor and Working Conditions

According to the Bank's principles, labor is one of a country's most valuable assets in the pursuit of poverty reduction and economic growth. Respecting workers' rights is fundamental to developing a strong, motivated, and productive workforce. This operational safeguard outlines the core requirements for borrowers or clients to protect workers' rights and ensure their basic needs are met, thereby contributing to fair and equitable labor practices throughout the project lifecycle.

OS2 establishes clear standards regarding workers' conditions, rights, and protection from abuse or exploitation. It addresses a broad spectrum of issues including working conditions, occupational health and safety, freedom of association, and the prevention of child and forced labor. The safeguard explicitly protects vulnerable workers such as women, persons with disabilities, migrant and contracted workers, community workers, and primary supply workers, ensuring fair treatment, non-discrimination, and equal opportunity in the workplace.

The objectives of OS2 include safeguarding workers' rights, promoting safe and healthy working environments, and supporting freedom of association and collective bargaining aligned with international standards such as the ILO's Fundamental Principles and Rights at Work and the UN

Convention on the Rights of the Child. It also requires accessible grievance mechanisms for workers to raise concerns and mandates timely reporting to the Bank and national authorities of any significant labor-related incidents or adverse impacts. Through these provisions, OS2 aims to foster responsible labor practices that uphold dignity, equity, and safety for all project workers.

OS3: Resource Efficiency and Pollution Prevention and Management

Operational Safeguard 3 (OS3) establishes the key pollution prevention and control requirements for borrowers or clients to ensure high environmental performance and promote the efficient and sustainable use of natural resources throughout the life of a project. This safeguard requires that pollution control measures be consistent with national laws, international conventions, and recognized good practices. In cases where national standards differ from the Environmental, Health, and Safety (EHS) Guidelines, borrowers are generally expected to meet the more stringent requirements to protect human health and the environment.

Throughout all project phases planning, design, construction, commissioning, operation, and decommissioning borrowers must assess, evaluate, and implement resource efficiency and pollution prevention techniques. These measures should balance technical feasibility, financial viability, and cost-effectiveness to minimize negative environmental impacts. The safeguard also stresses the importance of managing emissions of both short- and long-lived climate pollutants, as well as reducing the generation of hazardous and non-hazardous wastes associated with project activities.

The objectives of OS3 include promoting sustainable use of energy, water, and raw materials, minimizing pollution and its effects on human health and ecosystems, and managing risks linked to pesticide use. By integrating these principles into project design and management, OS3 supports environmental sustainability, climate resilience, and the health and safety of affected communities, thereby contributing to the overall success and sustainability of development projects.

OS4: Community Health and Safety

Operational Safeguard 4 (OS4) is designed to protect the health, safety, and well-being of communities affected by development projects. It addresses both environmental and social risks that can arise throughout the project lifecycle from planning and construction to operation and closure. OS4 recognizes that development activities can introduce a range of health and safety risks, such as exposure to pollution, road accidents, communicable diseases, hazardous materials, and unsafe construction practices. The safeguard emphasizes that these risks must be anticipated, avoided where possible, or minimized through appropriate design, planning, and mitigation strategies.

The objectives of OS4 are comprehensive and proactive. They include: (i) anticipating and avoiding adverse impacts on community health and safety during routine and non-routine project activities; (ii) promoting public health by supporting programs to prevent the spread of major communicable diseases; (iii) ensuring quality and safety in infrastructure design, with attention to climate change considerations; (iv) minimizing community exposure to risks related to traffic,

hazardous materials, and diseases; (v) establishing effective emergency preparedness and response mechanisms; (vi) ensuring that the deployment of public or private security personnel is conducted in line with international human rights standards; and (vii) preventing Sexual Exploitation, Abuse, and Harassment (SEAH) of community members by project workers. These objectives form the foundation for integrating community safety into every stage of project development.

In operational terms, OS4 requires borrowers or clients to carry out detailed risk assessments and incorporate community health and safety measures into Environmental and Social Management Plans (ESMPs). Emergency preparedness, climate-resilient infrastructure, and occupational health protections are central to effective implementation. The safeguard also places significant emphasis on managing social risks such as labor influx, gender-based violence, and SEAH through community engagement, behavior protocols, and grievance mechanisms. Where security forces are used, borrowers must ensure that operations respect local populations and align with human rights principles. OS4 promotes not only risk reduction but also strengthened community resilience and well-being in areas affected by development interventions.

OS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement

This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and it incorporates refinements designed to improve the operational effectiveness of those requirements.

In particular, it embraces comprehensive and forward-looking notions of livelihood and assets, accounting for their social, cultural, and economic dimensions. It also adopts a definition of community and common property that emphasizes the need to maintain social cohesion, community structures, and the social inter-linkage that common property provides.

The specific objectives of this OS are to avoid involuntary resettlement where feasible, or minimize resettlement impacts where involuntary resettlement is deemed unavoidable after all alternative project designs have been explored.

The safeguard retains the requirement to provide compensation at full replacement cost; reiterates the importance of a resettlement that improves standards of living, income-earning capacity, and overall means of livelihood; and emphasizes the need to ensure that social considerations, such as gender, age, and stakes in the project outcome, do not disenfranchise project-affected people.

The affected populations are offered a range of different compensation packages, resettlement assistance, and livelihood improvement options, as well as options for administering these measures at different levels (e.g., family, household and individual), and the affected persons themselves are given the opportunity to express their preferences.

OS6: Biodiversity Conservation

Operational Safeguard 6 (OS6) establishes the requirements for borrowers or clients to identify, conserve, and sustainably manage biodiversity, natural habitats, and ecosystem services affected by development projects. It underscores the importance of protecting biological diversity and

ecosystem integrity through early assessment and integration of biodiversity considerations into project planning and execution. The safeguard promotes the identification and implementation of conservation opportunities while ensuring projects adhere to relevant environmental standards and policies aimed at protecting natural, modified, and critical habitats.

A core principle of OS6 is the application of the mitigation hierarchy to avoid, minimize, restore, and offset to reduce potentially harmful impacts on biodiversity. The safeguard also endorses the precautionary approach, encouraging borrowers to anticipate risks and act in a manner that prevents irreversible harm. Where impacts are unavoidable, borrowers are expected to implement biodiversity offsets aimed at achieving “no net loss, but net gain” outcomes. Protecting ecosystem services is emphasized as essential to sustaining local livelihoods, especially for vulnerable groups, and ensuring the long-term performance and resilience of development projects.

The specific objectives of OS6 are to conserve biodiversity and habitats; to promote the sustainable management of living natural resources; and to support inclusive economic development that aligns conservation needs with local priorities. OS6 also aims to ensure that the benefits of ecosystem services such as clean air, water, and fertile soil are sustained for the benefit of affected communities. Through proactive and integrated planning, the safeguard seeks to embed environmental sustainability into the broader development agenda, contributing to climate resilience and the protection of critical global environmental assets.

OS7: Vulnerable Groups

Operational Safeguard 7 (OS7) is dedicated to ensuring that the rights, interests, and well-being of vulnerable or disadvantaged groups are adequately recognized, protected, and promoted throughout the lifecycle of development projects. Vulnerable groups may include women, children, persons with disabilities, ethnic minorities, the elderly, and individuals living in poverty or remote, underserved areas. The safeguard calls for early identification of these groups and their proactive inclusion in the planning, implementation, and monitoring phases of projects. It acknowledges that such populations often face systemic barriers to participation and may be disproportionately affected by development activities if not appropriately consulted or considered.

OS7 outlines clear objectives to guide project developers and borrowers. These include identifying vulnerable individuals and communities as early as possible; ensuring meaningful, accessible, and culturally appropriate engagement; and affirming the rights of vulnerable groups throughout all project phases. The safeguard also seeks to preserve the culture, knowledge, and practices of highly vulnerable rural minorities, including indigenous peoples, and emphasizes the need for their Free, Prior, and Informed Consent (FPIC) in specific cases. A gender-sensitive approach is mandated, with particular attention to the differentiated impacts on women and girls. In cases where negative impacts cannot be avoided, the safeguard calls for appropriate mitigation, compensation, or remedy measures to protect livelihoods and welfare.

Beyond protection, OS7 actively promotes the inclusion of vulnerable groups in the development process to ensure they benefit equitably from project outcomes. This includes tailored livelihood restoration plans, inclusive access to project services, and culturally relevant benefit-sharing mechanisms. The safeguard stresses the importance of building long-term relationships based on trust and continuous consultation with vulnerable populations. Ultimately, OS7 aims to enhance project quality and sustainability by promoting social inclusion, preventing marginalization, and ensuring that all voices, especially those of the most at risk, are heard and respected throughout the project's lifespan.

OS8: Cultural Heritage

Operational Safeguard 8 (OS8) is dedicated to the protection, preservation, and promotion of cultural heritage as a fundamental component of sustainable development. Cultural heritage includes both tangible and intangible forms, such as archaeological sites, historical structures, sacred places, traditional knowledge, and cultural expressions. The safeguard recognizes that these resources are integral to the identity, continuity, and cohesion of communities and must be respected throughout all phases of project development. OS8 requires borrowers or clients to identify and assess cultural heritage as part of the Environmental and Social Assessment (ESA) process, and to avoid or mitigate adverse impacts through well-defined management plans.

The objectives of OS8 are fourfold: (i) to protect cultural heritage from the adverse impacts of project activities and support its long-term preservation; (ii) to address cultural heritage as an essential element of sustainable development; (iii) to promote meaningful consultation with stakeholders regarding cultural heritage, enabling effective identification of risks and opportunities; and (iv) to promote equitable sharing of benefits derived from the use of cultural heritage with affected stakeholders. These goals ensure that development projects do not erode cultural values but instead respect, protect, and where appropriate integrate heritage assets in ways that contribute to community development and resilience.

OS8 also encourages the positive integration of cultural heritage into project design where feasible, such as through heritage-based tourism, education, or cultural revitalization initiatives that benefit local communities. The safeguard emphasizes early and inclusive stakeholder engagement, including consultations with local communities and cultural authorities, to ensure that heritage concerns are appropriately addressed. In addition, chance-find procedures must be implemented during construction to protect any previously unidentified heritage discovered on-site. Ultimately, OS8 safeguards not just physical sites but also the living traditions and histories that define a community, ensuring that cultural values are not lost in the pursuit of development.

OS10: Stakeholder Engagement and Information Disclosure

Operational Safeguard 10 (OS10) outlines a structured approach to stakeholder engagement that ensures open, inclusive, and transparent communication between borrowers and all stakeholders, especially project-affected communities. It emphasizes the need for early identification of stakeholders and the development of meaningful, ongoing engagement processes throughout the project lifecycle. This includes the preparation and implementation of a

Stakeholder Engagement Plan (SEP) that reflects the diverse perspectives and concerns of affected people, with a strong focus on vulnerable groups and equitable inclusion of women's voices.

The safeguard's objectives are to build and maintain constructive relationships, enhance project benefits, and minimize harm to local communities. It aims to ensure stakeholder views are considered in project design and implementation, and that environmental and social risks are communicated effectively. OS10 also mandates that relevant project information is disclosed in a timely, accessible, and culturally appropriate manner. The safeguard promotes mechanisms that allow stakeholders to provide input, raise concerns, or lodge grievances safely and without fear of retaliation ensuring that such feedback is addressed fairly and efficiently by the borrower.

Accountability and transparency are the cornerstone principles of OS10. It requires that engagement be meaningful, continuous, and adapted to local contexts, with special attention to historically marginalized or disadvantaged populations. By fostering inclusive dialogue, promoting mutual understanding, and encouraging participation, OS10 not only reduces the risk of social conflict but also strengthens community ownership and support for the project. Ultimately, this safeguard contributes to improved environmental and social performance while upholding the rights and interests of all stakeholders, particularly those most vulnerable. From the above stated AfDB's operational Safeguards, Table 2-2 analyses the applicability or relevancy to the project.

Table 2-2: AfDB Operational Safeguards triggered by irrigation project

No	Operational Safeguard (OS)	Triggered (Yes or No)	Relevance of irrigation project to the OS
1	OS1: Assessment and Management of Environmental and Social Risks and Impacts	Yes	irrigation project triggers OS 1 because it is likely to generate a considerable number of environmental and social impacts during construction phase, hence requires an Environmental and social Impact Assessment for all Category 1 projects as an integrated development project. This ESIA report will serve as an important tool used to manage the impacts generated through different activities of the project.
2	OS2: Labor and Working Conditions	Yes	The irrigation project will trigger the OS 5 because several hundreds of unskilled and skilled workers shall be recruited locally or outside the project areas for specific works. With their presence, potential social, safety and health positive and negative impacts are likely to occur. Their management will be following Occupational Safety and Health Management Plan. Moreover, the project's ESIA report provides mitigation measures related to abuse of workers' rights, social exclusion, and gender-based violence etc. The Labor Management Procedures (LMP) will be prepared as a standalone document after project appraisal and before the start of project implementation, and will be shared with the Bank for clearance

3	OS3: Resource Efficiency and Pollution Prevention and Management	Yes	The irrigation project triggers OS 4 because four types of pollution will be likely mitigated in the area, namely: (i) water pollution by accumulation of debris and deposition of sediment inflow from cultivated lands; (ii) water polluted by potential sewage released from contractor's temporal site and other facilities; (iii) water polluted by inflow of night soil, agricultural chemicals from fertilizers, pesticides as well as (iv) pollution by spillage of oil leakage from stores and transport trucks. In that line, the elaborated ESMP will provide appropriate mitigation measures for their control and efficient management.
4	OS4: Community Health and Safety	Yes	The Irrigation Project triggers OS 4: Community Health and Safety due to potential risks arising from pollution during construction and operation. These risks include water contamination from sediment runoff, sewage discharge from contractor camps, agricultural chemicals (fertilizers and pesticides), and oil spills from machinery and transport. Such pollution can negatively impact the health and well-being of surrounding communities. To address these concerns, the project's Environmental and Social Management Plan (ESMP) outlines mitigation measures such as proper waste management, pollution control systems, safe handling of hazardous materials, and emergency response mechanisms to ensure community health and safety is safeguarded throughout the project lifecycle.
5	OS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	Yes	The irrigation project triggers OS 2 because for the construction of intakes, installation of irrigation canals, installation of temporal sites construction, and other infrastructure of the project, several hectares of individual lands will have to be acquired, so that fair expropriation/compensation procedures will be followed. In this regard a resettlement action plan is prepared for the irrigation project and it will establish the list of Project Affected People (PAPs) corresponding to their social economic status.

6	OS6: Biodiversity conservation	Yes	The irrigation project triggers OS 3 because during preparation works for different infrastructures construction, vegetation etc will be cleared, , and their biodiversity migrated or lost. Establishment of limited buffer zones and reconstitution of natural habitats have been proposed in the present ESIA report as appropriate measures for recovering of biological diversity in this zone. Therefore, ecosystem services will be reconsidered in the whole environment. Also due to the protected animal species i.e. the grey crowned crane found in the much larger Muvumba catchment area (beyond the 3073ha project command area), a sensitisation plan will be developed by RWB/RAB prior to the commencement of the operation phase of the project to e.g. sensitise the target irrigation community on the importance of the grey crowned crane. Although the crane Was only cited in the wetland/irrigation schemes nearby/bordering part of the 3073ha project command area, this will be key to increase overall awareness, and regulating the use of key sites through management plans etc. The plan will be developed in consultation with recognised experts.
7	OS7: Vulnerable Groups	Yes	The Irrigation Project triggers OS 7: Vulnerable Groups because the project activities may disproportionately affect individuals or communities who are socially, economically, or physically disadvantaged. These may include women-headed households, the elderly, persons with disabilities, children, and low-income or landless populations living within or near the project area. To ensure their rights and interests are protected, the project's Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) include targeted measures for identifying and engaging these groups. While, the consultant recognizes the presence of vulnerable group, highly vulnerable groups (indigenous peoples) are not applicable in the project area and in the country's context. Specific attention will be given to inclusive consultation, equitable access to project benefits, and the provision of tailored support during land acquisition, compensation, and livelihood restoration processes. RWB is also expected to implement grievance redress mechanisms that are accessible and responsive to the unique needs of vulnerable groups.

8	OS8: Cultural Heritage	Yes	The Irrigation Project triggers OS 8: Cultural Heritage due to its potential to affect cultural assets through activities such as excavations, demolition, earth movement, and changes to the physical environment, including flooding. These activities pose a risk of disturbing sites of historical, archaeological, or spiritual significance. In the Rwandan context particularly considering 1994 Genocide against Tusti there is a possibility of encountering human remains or other culturally sensitive materials anywhere in the country. Therefore, the project includes a Chance Finds Procedure (as shown in Annex 6) within its Environmental and Social Impact Assessment (ESIA), outlining the steps to be taken if such discoveries occur. This procedure ensures that any cultural heritage or human remains found are handled respectfully and in compliance with national laws, in consultation with relevant authorities and local communities.
10	OS10: Stakeholder Engagement and Information Disclosure	Yes	The Irrigation Project triggers OS 10: Stakeholder Engagement and Information Disclosure, recognizing the importance of involving stakeholders throughout the project lifecycle. The consultant advises the project developer, Rwanda Water Resources Board (RWB), to prepare a Stakeholder Engagement Plan (SEP) that will be disclosed as early as possible preferably before project appraisal. This SEP should be developed in consultation with stakeholders, allowing them to provide feedback on the plan itself, including the identification of key stakeholders and proposed engagement approaches. If any significant changes are made to the SEP during the project, an updated version must be disclosed to maintain transparency and accountability. The SEP clearly outlines the timing, methods, and frequency of engagement activities throughout the project's duration, as agreed upon with the financing institution. It will distinguish between project-affected parties such as local communities, landowners, and vulnerable groups and other interested parties, including local authorities, NGOs, and the general public. Additionally, the SEP will define the type and timing of information to be shared with stakeholders and specify what input or feedback will be sought from them. This structured approach aims to promote inclusive participation, manage expectations, and ensure that stakeholders are adequately informed and involved in decision-making processes that may affect them.

Table 2-3: Comparative Analysis between AfDB's Operational Standards and National Legislations

OS1: Assessment and Management of Environmental and Social Risks and Impacts				
Principles	AfDB safeguards	Rwanda Regulations	Gaps in National Laws	Measures to bridge the gap
Environmental and Social Assessment	Establishes a comprehensive ESIA system to identify and manage potential E&S risks early in the project cycle. Includes environmental, social, health, climate change, and cumulative impacts.	Rwanda's ESIA Law (Law No 48/2018 on Environment) and Ministerial order N°003/MoE/25 of 19/08/2025 establishing the list of projects that must undergo environmental impact assessment, instructions, requirements and procedures to conduct Environmental Impact Assessment. The regulations require ESIA for the identified lists of projects in the Order, with public consultation and mitigation measures.	Rwanda's ESIA includes many core elements but lacks detailed guidance on cumulative impacts, climate resilience, and ecosystem services.	The report has included climate risk screening and adaptation planning ecosystem services, cumulative impacts analysis and strategic alternatives analysis, risk assessment and management
Categorization of Projects	Projects are classified as Category 1 (high risk), Category 2 (medium risk), or Category 3 (low risk), based on type, scale, and sensitivity.	Rwanda also categorizes projects but mainly into Category 1 requiring full ESIA and 2 requiring partial ESIA assessments.	Rwanda does not consistently apply a risk-based approach with social sensitivity.	ESIA ha aligned risk classification with AfDB methodology. Include social risk considerations vulnerability, resettlement risks and gender dynamics
Stakeholder Engagement and Disclosure	Requires public consultation throughout the project lifecycle. Emphasizes meaningful, inclusive engagement and timely public disclosure of E&S information.	Public consultation is required under national ESIA law (Law No. 48/2018 and Ministerial Order N°003/MoE/25 of 19/08/2025, but it is typically limited to the ESIA stage and disclosure is mainly to authorities.	National laws lack of continuous stakeholder engagement and limited guidance on FPIC and disclosure. The laws do not require continuous engagement, nor specify community-	A Project Stakeholder Engagement Plan (SEP) has been prepared to ensure continuous, culturally appropriate, and inclusive consultations. Disclosure will be made in local languages and formats accessible to affected

			level disclosure formats or procedures to ensure inclusivity and accessibility.	communities throughout the project lifecycle.
Grievance Redress Mechanism (GRM)	A project-level GRM must be in place, accessible to affected communities, with clear procedures and timelines.	No mandatory GRM in Rwandan ESIA law and related regulations, though informal systems may exist via local authorities.	GRM is not standardized or formalized in national ESIA process.	GRM will be established at national, Sector and project level considering gender sensitivity
OS2 – Labor and Working Conditions				
Principles	AfDB safeguards	Rwanda Regulations	Gaps in National Laws	Measures to bridge the gap
Working Age	Minimum working age is 14, based on ILO Convention 138, under specific protections.	Labour Law No. 66/2018 sets the minimum working age at 16, prohibiting child labor in hazardous conditions.	Discrepancy: AfDB permits work from 14; Rwanda law only from 16.	Minimum working age for this project is set at 18 to ensure strong child protection and alignment with best practice.
Labor Management Plan (LMP)	Requires a Labor Management Plan (LMP) to guide worker recruitment, OHS, grievance procedures, and employment terms throughout the project lifecycle.	No legal requirement for project-specific LMPs under Rwandan law.	Rwanda does not mandate LMPs for infrastructure/development projects.	A full LMP will be developed for the project, covering employment terms, OHS, and grievance procedures.
Grievance Redress Mechanism (GRM)	Requires an accessible, confidential, and non-retaliatory GRM specifically for workers.	General grievance rights exist in law, but no provision for a project-level, dedicated GRM for labor issues.	Absence of formal, project-specific worker GRM in Rwanda's legal framework.	A project-level GRM for workers is included in the ESMS, with training provided to workers and contractors on its use.
OS3 – Resource Efficiency and Pollution Prevention and Management				
Principles	AfDB safeguards	Rwanda Regulations	Gaps	Measures to bridge the gap
Resource Efficiency (Energy, Water, Raw Materials)	Promotes sustainable use of resources throughout the project lifecycle. Requires design choices that minimize energy and water use and apply best practices in resource efficiency.	Law No. 48/2018 on Environment and the Ministerial Order on EIA (2025) promote sustainability but do not mandate detailed project-level strategies for energy and water efficiency.	Lack of specific implementation frameworks or enforcement mechanisms for resource efficiency at project level (e.g.,	The project has adopted best practices for energy and water use efficiency in project design and operations. Capacity-building activities will help institutionalize efficient resource use among contractors and environmental teams.

			water or energy saving technologies).	
Pollution Prevention (Air, Water, Soil, Noise)	Requires projects to avoid, reduce, or control pollution to air, water, and land. Emphasizes the "polluter pays" principle and managing emissions and noise from operations.	National environmental law supports pollution control and provides general environmental protection principles. Some sector-specific guidelines exist, but they may lack detailed enforcement or coverage for all project types.	Inconsistent sectoral standards for emissions, hazardous waste, and noise pollution. Weak enforcement in some industries due to institutional capacity constraints.	Pollution control measures have been integrated into the Environmental and Social Management Plan (ESMP), including hazardous waste management, air quality, and noise control. The project will also align with REMA's future regulatory developments and involve them during implementation.
Waste Management and Hazardous Substances	Requires adequate waste handling and safe management of hazardous substances during the project. Encourages reuse, recycling, and responsible disposal to avoid environmental contamination.	Waste management is required under Law No. 48/2018 and related ministerial orders. While general provisions are available, technical guidelines for hazardous waste handling and disposal are still limited for some sectors.	Limited sector-specific guidance and lack of detailed protocols for hazardous waste in some industries. Some gaps in enforcement and institutional oversight for chemical/hazardous material management.	Hazardous waste management plan shall be prepared among other MSIPs by the contractor prior to construction phase, in line with AfDB guidelines. Contractors will receive training on waste handling procedures from the Rwanda Environment Management Authority (REMA) and the Rwanda Utilities Regulatory Authority (RURA), who are mandated to oversee waste management, together with the respective District authorities to ensure strong oversight and technical capacity building.
Monitoring and Reporting	Emphasizes continuous monitoring of pollution levels and regular environmental performance reporting. Ensures transparency and accountability during implementation.	Monitoring is required by EIA regulations, but there are weak or inconsistent systems for ongoing project-level environmental monitoring and enforcement.	Weak environmental data collection and inconsistent enforcement of monitoring plans across projects.	The project will establish continuous environmental monitoring and reporting systems as part of its ESMP. Reports will be shared with relevant authorities and stakeholders. Monitoring will track pollutant levels, emissions, and waste, and

				support corrective actions as needed.
OS4: Community Health and Safety				
Principles	AfDB safeguards	Rwanda Regulations	Gaps in National Laws	Measures to bridge the gap
Risk Management (Traffic, Disease, Hazards)	Requires assessment and management of health and safety risks to communities during all project phases, including traffic safety, communicable diseases (e.g., HIV/AIDS), and construction-related hazards.	Law No. 48/2018 and the EIA Ministerial Order N°003/MoE/25 of 19/08/2025 require environmental assessments that consider risks to community health and safety.	No holistic legal framework addressing all community health and safety issues during project implementation.	The ESMP includes mitigation measures for traffic accidents, communicable diseases, and construction safety. A traffic and road safety management plan was developed and implemented by contractors.
Emergency Preparedness and Response	Requires preparation of emergency response plans to manage fire, spill, flood, or accident scenarios.	National legal framework provides general emergency response guidance but does not impose detailed project-level requirements.	Absence of regulatory obligations for project-based emergency plans.	Emergency preparedness and response mechanisms are integrated in the ESMP, including response teams and protocols, in coordination with local authorities and first responders.
Communicable Disease and GBV Awareness	Promotes community awareness and prevention of diseases and gender-based violence (GBV), particularly during large-scale construction works.	Addressed in health policies and district strategies, but not required in project-specific terms.	Lack of specific regulation mandating awareness campaigns or community health outreach under EIA procedures.	The project includes awareness campaigns on communicable diseases (e.g., HIV/AIDS, COVID-19) and GBV prevention targeted at communities and project workers. These are conducted with local health centers and NGOs.
Institutional Coordination and Monitoring	Encourages coordination with local institutions (health, police, roads) and continuous monitoring of safety risks and measures.	Implemented through local government plans and decentralized health services, though monitoring mechanisms are weak or inconsistent.	Institutional capacity for monitoring and enforcement is limited, especially at district level.	The project works with district authorities and health centers to support enforcement. Regular monitoring of safety measures is conducted by safeguards specialists in collaboration with local institutions.
OS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement				
Principles	AfDB safeguards	Rwanda Regulations	Gaps in National Laws	Measures to bridge the gap

Eligibility criteria	OS5 Clause C.15 defines three categories of displaced persons: a) Those with formal legal rights to land; b) Those with recognizable claims under national law; c) Those with no recognizable legal rights or claims. The third category is entitled to compensation for loss of non-land assets and livelihood support.	Rwandan law (Expropriation Law No. 32/2015) only recognizes people with documented land rights or ownership. Those illegally occupying land or engaging in prohibited activities after legal enactment are not entitled to compensation.	The Rwanda's law excludes persons without legal rights (informal/illegal occupants) from eligibility for compensation—even for assets—while AfDB OS5 includes them for non-land assets and resettlement support.	All affected persons, including those without legal land rights (e.g., tenants, informal users), will be compensated for assets and receive resettlement and livelihood assistance in accordance with AfDB OS5. This reflected in the Resettlement Action Plan (RAP) and communicated during consultations.
Assessment of alternatives	The OS5 requires borrower to consider feasible alternative project designs to avoid or minimize land acquisition or restrictions on land use, especially where this would result in physical or economic displacement, while balancing environmental, social, and financial costs and benefits, and paying particular attention to gender impacts and impacts on the poor and vulnerable.	The national law on environment and ESIA procedures requires the developer to explore project alternatives but is silent about avoiding, minimizing involuntary resettlement.	While OS5 requires the borrower to explore alternatives that avoid or minimize resettlement impacts, the national regulations only requires the provision of compensation	The proposed project is designed in a way that minimize physical relocation and land acquisition through site and design alternative assessment as discussed in chapter 4. Where minimization is not applicable or feasible (i.e.: land acquisition and relocation are unavoidable) mitigation measures were proposed. .
Compensation and Benefits for Affected Persons	Compensation must be at replacement cost and include additional livelihood support to help affected persons improve or at least restore their living standards.	Article 27 of the Expropriation Law defines compensation to include: 1° Land; 2° Activities on land; 3° Disruption compensation. Does not explicitly cover income loss or livelihood restoration.	National law lacks provision for livelihood restoration and does not cover income loss or support for vulnerable groups.	(i) Livelihood restoration measures will be included in the RAP. (ii) Special support and compensation will be provided to vulnerable groups to ensure improved or restored livelihoods.

Cutoff date	Specifies a clear cutoff date after which new occupants or users are not eligible for compensation or resettlement benefits. This helps prevent opportunistic claims and ensures fairness in compensation.	Rwanda applies cutoff dates typically based on official land registration or project-specific notifications. However, enforcement can be inconsistent, and some spontaneous settlers may not be well accounted for.	The OS5 requires compensation measures before land is taken while the national Regulations allows the project developer to take the land even before the compensation as long as the compensation is made in 120 days. Verification of occupancy dates is challenging; lack of awareness among communities about the cutoff date; potential exclusion of vulnerable or informal settlers.	Conduct public consultations and awareness campaigns to clearly communicate cutoff dates; perform thorough social surveys to verify occupancy before cutoff; establish grievance mechanisms to handle disputes.
Grievance Mechanism	OS5 requires borrowers to ensure that a grievance mechanism for the project is in place, in accordance with OS10 as early as possible in project development to address specific concerns about compensation, relocation or livelihood restoration measures raised by displaced persons (or others) in a timely fashion. Where possible, such grievance mechanisms will utilize existing formal or informal grievance mechanisms suitable for project purposes,	Article 33 of expropriation law state that Within seven (7) days after the approval of the valuation report by the expropriator, any person to be expropriated who is not satisfied with the assessed value of his/her land and property incorporated thereon shall indicate in writing grounds for his/her dissatisfaction with the valuation report. Any person contesting the assessed value shall, at his/her own expense, engage the services of a valuer or a valuation firm recognized by	While OS5 requires the establishment of Grievance Redress mechanism for the proposed project, National regulations provides only steps and timeframe for contesting valuation report	GRM have been established at national, Sector and project level considering gender sensitivity.

	supplemented as needed with project-specific arrangements designed to resolve disputes in an impartial manner.	the Institute of Real Property Valuers in Rwanda to carry out a counter-assessment of the value. When the person to be expropriated is not satisfied with that decision, he/she can refer the matter to the competent court within fifteen (15) days from the day he/she appends his/her signature to the minutes indicating points of disagreement.		
OS6: Biodiversity				
Principles	AfDB safeguards	Rwanda Regulations	Gaps in National Laws	Measures to bridge the gap
Avoiding Biodiversity Loss	Projects must avoid or minimize significant impacts on biodiversity and natural habitats. If avoidance is not possible, apply mitigation hierarchy and use biodiversity offsets.	Law No. 48/2018 and the EIA Ministerial Order (2025) require biodiversity impact assessment. Law No. 70/2013 supports conservation of biological diversity.	No explicit legal requirement for biodiversity offsets or no-net-loss approach in national laws.	The project includes habitat restoration and species protection measures in the ESMP. Where impacts are unavoidable, the project adopts offset measures in alignment with OS6.
Critical Habitat Identification	Requires identification and protection of critical habitats, with avoidance of conversion or degradation.	REMA and RDB enforce protected area and species regulations. Biodiversity assessment is part of EIA, but enforcement capacity is limited.	Limited technical capacity to identify, assess, and monitor critical habitats at local or institutional level.	A baseline on biodiversity study/ assessment was conducted under this ESIA to identify sensitive species and habitats. Monitoring will be carried out with the support of REMA.
Ecosystem Services Valuation	Recognizes and protects ecosystem services (e.g., water provisioning, soil fertility, pollination) essential to local livelihoods and ecosystems.	National policies acknowledge ecosystem services conceptually, but detailed planning or valuation methods are lacking in project-level regulation.	No formal guidelines or tools for ecosystem service valuation or integrating their protection into project design.	The project integrated ecosystem service mapping into planning, especially for agriculture and water use.
Institutional Capacity	Emphasizes the need for capacity building and	REMA, RDB, and other agencies are responsible for	Weak institutional coordination and	The project includes training for local environmental officers and

	institutional coordination to manage biodiversity and ecosystems effectively.	enforcement, but limited financial and technical resources hinder consistent application and monitoring.	insufficient technical staff to oversee implementation at district or project level.	support to institutions to strengthen monitoring and reporting related to biodiversity conservation. Project to prepare a plan for community sensitization on the grey crowned crane to ensure protection and safeguarding during operation phase of the irrigation scheme
OS7: Vulnerable Groups				
Principles	AfDB safeguards	Rwanda Regulations	Gaps	Measures to bridge the gap
Inclusive Development for Vulnerable Groups	OS7 ensures that development processes are inclusive of vulnerable groups—such as those facing disadvantages due to gender, age, disability, ethnicity, poverty, or social status. Projects must identify these groups early, assess potential impacts, and guarantee their equitable participation and protection.	Rwanda's Constitution (2015) guarantees equal rights and protection. The National Social Protection Strategy (2013), Law N° 01/2007 on Disability, and Child Protection laws support inclusion. MINALOC oversees support for vulnerable individuals. The Environmental Law and EIA Ministerial Order (2025) mandate consideration of these groups in project planning and public consultation.	1. No explicit requirement for a Stakeholder Engagement Plan (SEP) within Rwanda's EIA system. 2. Limited tools for tracking benefit distribution and inclusion during project implementation. 3. Vulnerability often defined administratively (e.g. Ubudehe categories), which may not fully reflect AfDB's broader understanding.	1. A dedicated SEP was developed to ensure direct and culturally appropriate engagement with vulnerable groups, including the poor, elderly, persons with disabilities, and women-headed households. 2. ESMP outlines concrete steps to prevent discrimination, enhance accessibility, and promote equitable participation. 3. Monitoring systems will disaggregate data by age, gender, and vulnerability to better track inclusion. 4. Social safeguard staff have been trained to support participatory processes and continuous feedback loops. 5. The RAP identifies vulnerable groups for consideration
OS8: Cultural Heritage				
Principles	AfDB safeguards	Rwanda Regulations	Gaps in National Laws	Measures to bridge the gap

Protection of Cultural Heritage	OS8 mandates safeguarding both tangible and intangible cultural heritage potentially impacted by Bank-financed projects. It requires community consultations, development of a Cultural Heritage Management Plan (CHMP) if needed, and use of a "chance finds" procedure shown in Annex 6 to prevent damage or loss.	Law No. 22/2016 governs cultural heritage protection, including prohibition of unauthorized destruction and obligation to report chance finds. The Rwanda Cultural Heritage Academy (RCHA) is the lead agency. The 2025 Ministerial Order on EIA includes cultural heritage as part of the assessment process.	1. No explicit legal requirement for a CHMP. 2. Limited engagement with communities on intangible cultural heritage. 3. Chance finds protocols may not be well understood or consistently applied by contractors.	1. The ESIA identified potential cultural heritage sites and embedded chance finds procedures in line with OS8. 2. Contractors will receive training on recognizing and responding to chance finds. 3. During the public consultation with local communities, the topic of cultural heritage was also discussed, and community members shared their views. The consultant explained the chance finds procedure to be followed during project implementation. He also requested anyone with information regarding possible graves within the project area to share it. Information on such graves had already been gathered during the socio-economic survey. During the public consultation, participants were organized into groups to allow them to express their views more freely. These discussions included elderly community members who are often knowledgeable about both tangible and intangible cultural heritage. The questions raised regarding cultural heritage, along with the consultant's responses, are documented in the consultation minutes, which can be found in Annexes 9A–9H.

OS10: Stakeholder Engagement and Information Disclosure				
Principles	AfDB safeguards	Rwanda Regulations	Gaps in National Laws	Measures to bridge the gap
Stakeholder Engagement Plan (SEP)	A formal SEP must be developed early, implemented throughout the project lifecycle, with updates. It should identify stakeholders (including vulnerable groups), engagement methods, frequency, and responsibilities.	Rwanda's ESIA Law (Law No 48/2018 on Environment) requires "public participation," but it is limited to one or two consultations during ESIA preparation. No formal requirement for a SEP.	Rwanda does not require a structured SEP or continuous engagement. Vulnerable groups often overlooked.	Stakeholder Engagement has been developed in alignment with OS10; through identification of all stakeholders, planned engagement methods, timelines and responsibilities.
Timing and Continuity of Engagement	AfDB OS10 requires stakeholder engagement to begin early (prior to final design) and continue throughout project preparation, implementation, and closure, with adaptive updates as needed.	Rwanda's ESIA Law (Law No. 48/2018) and the Ministerial Order N°003/MoE/25 of 19/08/2025 require public consultation during ESIA preparation, typically before RDB approval, but do not mandate continuous engagement throughout the project lifecycle.	Lack of continuous, lifecycle-long stakeholder engagement. This Gap exists in Rwanda's national legislation, which lacks a requirement for lifecycle-long, structured stakeholder engagement beyond the ESIA approval phase.	A continuous engagement plan has been included in the SEP (as per AfDB OS10), detailing engagement at key phases: planning, construction, post-construction, and including community engagement for catchment restoration.
Disclosure of Information	Project documents (ESIA, mitigation plans, SEP, GRM procedures) must be disclosed in accessible formats and languages. This includes online and in community centers.	Rwanda requires ESIA summary disclosure during review but does not guarantee access to full documents or multiple language versions. Most disclosures are in Kigali or sector offices.	Limited disclosure, mostly centralized and not always accessible to affected communities.	ESIA summary, SEP, and mitigation plans will be disclosed in Kinyarwanda, through sector offices, radio, community meetings,
Documentation of Engagement	Detailed records must be kept, including dates,	Rwanda requires basic reporting of consultations but	Documentation is inconsistent and rarely	Details of public consultations including dates, stakeholder list, main concerns raised, and project

	participants, issues raised, and responses provided.	lacks strict format or verification.	includes responses to community feedback.	responses have been included in the ESIA report
Grievance Redress Mechanism (GRM)	OS10 mandates a functioning, accessible, and culturally appropriate GRM from project inception. It should handle E&S complaints during all phases.	Rwanda does not mandate a GRM for ESIA, though complaints can go through local authorities. LODA and MINEMA use GRMs for social protection, but these are not project-specific.	No formal, standalone GRM tied to ESIA or project implementation.	GRM had been established in the ESIA and SEP with clear procedures, responsible personnel, and communication methods. It will be communicated during community meetings and during public disclosure. Appeal options and documentation processes will be in place.

2.4.2. AfDB Gender Policy

The African Development Bank (AfDB) Gender Policy, especially its 2021–2025 Gender Strategy, is relevant to the irrigation project in the following ways:

1. Gender-Responsive Infrastructure (Pillar 3): AfDB emphasizes integrating gender equality into infrastructure projects to ensure women not only benefit from but also participate in these developments. In the Muvumba project, this means designing irrigation systems and services that are accessible and useful to women farmers, particularly in water access, plot allocation, and livestock watering infrastructure.

2. Economic Empowerment and Job Access (Pillars 1 & 2): AfDB's strategy promotes women's economic empowerment through access to financial resources, skills development, and job creation. In our project, this translates into targeting at least 50% of local employment opportunities for women and providing training in irrigation management, agronomy, and livestock water use.

3. Mainstreaming Gender into Project Design: The AfDB applies a Gender Marker System classifying projects by the extent of gender integration, from principal objective (GEN I) to marginal inclusions (GEN IV). The project is expected to meet at least GEN II or GEN III standards, embedding gender considerations in outcomes and outputs, including gender-differentiated targets, indicators, and monitoring.

4. Capacity Building & Knowledge Management: AfDB promotes strengthening institutional capacity on gender. At project level, this means training RWB, RAB, and field extension agents on gender equity, women's participation in decision-making, and GBV prevention, aligned with MIGEPROF coordination.

5. Accountability & Monitoring: AfDB now tracks gender integration through its Gender Marker Dashboard to monitor performance across projects. The project will adopt similar reporting mechanisms, documenting participation, benefits, and outcomes for women and vulnerable groups, and providing regular gender-responsive monitoring data to AfDB.

The AfDB Gender Policy ensures that women and marginalized groups benefit equitably from the proposed project, not only by providing access to irrigation and livestock water services but also by participating meaningfully in project implementation, capacity development, decision-making, and protection from gender-based risks.

The project will comply with the AfDB Gender Policy by ensuring equal opportunities. As per statistics (NSIR, 2022) shows employment gap in women, this project will commit at least 30% of employment and training opportunities target women, incorporating gender-responsive design in irrigation and livestock water infrastructure, and implementing monitoring and reporting mechanisms to track gender outcomes throughout the project lifecycle.

2.4.3. Policy on Disclosure and Access to Information (the "DAI Policy")

The African Development Bank's Policy on Disclosure and Access to Information (DAI Policy) also applies to the irrigation project as it commits the Bank to a principle of maximum transparency. The DAI Policy ensures that all information held by the Bank is disclosed unless it falls under a clearly defined list of exceptions, such as confidentiality, commercial sensitivity, or personal privacy. This approach promotes trust and openness between the Bank and its stakeholders.

Key documents such as the Environmental and Social Impact Assessment (ESIA), Environmental and Social Management Plan (ESMP), stakeholder consultation reports, and project summary notes will be proactively published on the AfDB website or made available upon request. This proactive disclosure supports awareness, informed decision-making, and inclusive dialogue throughout the project cycle.

Project beneficiaries, local communities, government agencies like RWB and REMA, and civil society organizations will all benefit from access to these documents. This enhances accountability and enables meaningful stakeholder engagement in the planning, implementation, and monitoring of the project. Public access to information also helps ensure that concerns are addressed early and that social and environmental safeguards are respected.

In case a request for information is denied, the policy provides a clear appeals process. Stakeholders may first appeal to the Bank's internal Information Disclosure Committee, and if not satisfied, escalate the case to an independent Appeals Panel. This system reinforces the right of access to information and provides recourse for those who feel unjustly denied. Furthermore, the DAI Policy requires simultaneous disclosure of strategic documents, such as country strategy papers or project proposals, on the same date they are submitted to the AfDB Board. Regular monitoring and reporting on the Bank's compliance with disclosure obligations ensures continued transparency. In conclusion, the DAI Policy guarantees that the project is implemented in a transparent and participatory manner, giving stakeholders timely access to critical information and mechanisms to raise concerns or seek redress.

The project will comply with the AfDB's Policy on Disclosure and Access to Information by publicly disclosing this ESIA on the Rwanda Water Resources Board (RWB) website and on the African Development Bank's official website (www.afdb.org). This ensures transparency, facilitates stakeholder engagement, and allows the public to provide input or raise concerns throughout the project cycle.

2.4.4. International and Regional Treaties and Agreements

In alignment with OS 1 Annex 1, the Irrigation Project has been assessed against Rwanda's obligations under relevant international and regional treaties. These include the UN Convention to Combat Desertification (UNCCD), which supports sustainable land and water use in arid regions like Nyagatare; the Paris Agreement under the UNFCCC, emphasizing climate-resilient infrastructure and adaptive measures; the African Union Convention on the Conservation of Nature and Natural Resources, which promotes integrated water resource management and biodiversity protection; and the East African Community Protocol on Environment and Natural Resources Management, which fosters regional coherence in environmental standards.

Given the transboundary nature of the Muvumba River, the project also aligns with Rwanda's commitments under the Nile Basin Initiative and the Lake Victoria Basin Commission, which promote equitable and sustainable water use across member states. These obligations are directly applicable to the project and have informed its design and safeguards, particularly through climate adaptation strategies, ecosystem conservation approaches, and coordinated stakeholder engagement. Relevant provisions from these agreements have been embedded into the ESMP to ensure the project's full compliance with Rwanda's international commitments and its contribution to long-term sustainability, regional development objectives, and peaceful water diplomacy.

2.5. Institutional Framework

2.5.1. Ministry of Environment (MoE)

The Ministry of Environment was established to ensure the conservation, protection and development of the environment. The Ministry is responsible for the development of environmental policies and procedures (including impact assessments), protection of natural resources (water, land, flora, and fauna), environmental legislation, biodiversity, and other environmental aspects informed by the Environment Law among others. It also ensures the safeguard of green and climate resilience for economic growth.

Chapter IV of the Organic Law Article 65 clearly calls for the need to subject projects to mandatory Environmental Impact Assessment. Article 65 Further specifies that every project shall be subjected to environmental impact assessment prior to its commencement. It shall be the same for programs, plans and policies likely to affect the environment. The Ministry will have an impact on the project as it will be regulating and monitoring all the activities through REMA & RDB.

2.5.2. Ministry of Agriculture and animal resources (MINAGRI)

The Ministry of Agriculture and Animal Resources (MINAGRI) will be involved in the design and implementation of the irrigation project because it is responsible for the development, transformation and modernization of the agriculture sector in Rwanda. In addition, through the MINAGRI task force, technical aspects on Irrigation & Mechanization will be provided to RWB to ensure exploitation and management of Muvumba wetland for agricultural purposes as it is in its mandate. Therefore, during this study, it was found that MINAGRI through its implementing partner, RAB, will be fully involved in this project as it is aimed at improving agriculture and livestock productivity.

2.5.3. Ministry of Infrastructure (MININFRA)

The ministry has a specific mission to ensure sustainable infrastructure development covering transport, energy, water supply and sanitation, housing and human settlement sectors aiming to drive Rwanda's economic growth and enhance quality of life of the citizen while the vision is to provide modern infrastructures for sustainable economic growth and socio-economic development.

Part of its mission is also to orient and supervise the functioning and management of public institutions, agencies and companies under the Ministry of Infrastructure including existing agencies such as Rwanda Energy Group (Energy Development Company Ltd), Water and Sanitation Corporation (WASAC) and other agencies to be formed under its sub-sectors.

The project is about water infrastructure including access roads. MININFRA will provide guidance to ensure access roads are constructed by fulfilling the standard requirements(size). As the project will involve pressurized irrigation, to operate the project, REG will supply electricity for pump operation. In addition, as members of the Program steering committee, Both MININFRA, WASAC and REG have participated in the different reviews of the detailed design of this project.

2.5.4. Rwanda Agriculture and Animal Resources Board (RAB)

RAB is entrusted with the implementation of agriculture and livestock policies and plans. The vision of RAB is to improve food security and livelihoods by transforming agriculture from subsistence into modern farming through generating research and extension innovations that generate sustainable crop, animal husbandry and natural resource management. To ensure the success of the project, RWB has signed the MoU with RAB of co-implementation of this project. Under its responsibilities, RAB will provide direct technical assistance to the RWB in the detailed design of the irrigation infrastructures, as it is also mandated to implement irrigation schemes.

2.5.5. Rwanda Environment Management Authority (REMA)

REMA was established to implement the environment related policies and laws in Rwanda. Under supervision of the Ministry of Environment, REMA has the legal mandate for national environmental protection, conservation, promotion, and overall management, including advisory to the government on all matters pertinent to the environment and climate change. All project's activities that are anticipated to cause environmental change around the project area will be monitored by REMA. This institution puts across guidelines for the environmental related issues and how these can be managed. It will be responsible for the environmental audits and implementation of project environmental compliance.

In this project, REMA has a role of verifying environmental compliance by assessing irrigation projects against both national laws and international treaties to which Rwanda is a signatory. Through systematic environmental audits and field visits, REMA ensures that approved ESIA conditions are implemented and that safeguards, like buffer zones requirements, hazardous chemicals, air pollutants, and wastes are actively managed throughout the project lifecycle.

2.5.6. Rwanda Water Resources Board (RWB)

It is the implementing entity of the project. It was established by law N° 71/2019 of 29/01/2020. RWB has legal personality and enjoys administrative and financial autonomy and is managed in accordance with relevant laws and falls within the category of non-commercial public institutions. The mission of RWB is to ensure the availability of enough and well managed water resources for sustainable development. As it is the developer of the project, RWB will play an essential role in the successful implementation of the project.

2.5.7. Water and Sanitation Corporation (WASAC) and Rwanda Energy Group Limited (REG)

The Water and Sanitation Corporation (WASAC) is mandated to develop, operate, and maintain water and sanitation infrastructure and deliver related services across Rwanda. The project will coordinate with the Water and Sanitation Corporation (WASAC) regarding the management of waste generated from construction camps and other project infrastructure. WASAC's guidelines and services will be followed to ensure proper collection, treatment, and disposal of solid and liquid waste, minimizing environmental pollution, protecting public health, and maintaining sanitation standards in the project area. This collaboration will also support compliance with national regulations on waste management and safeguard surrounding water resources. Additionally, WASAC will be responsible to supplying drinking water at temporally sites.

The Rwanda Energy Group Limited (REG), created through the repeal of the EWSA law and comprised of two subsidiaries—the Energy Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL)—is responsible for expanding, maintaining, and operating Rwanda's energy infrastructure. REG's role in this project is to provide reliable and efficient energy services, particularly electricity supply for irrigation infrastructure such as pumping stations and other equipment requiring power. REG ensures that energy infrastructure development is aligned with the project's operational needs and supports cost-effective and timely implementation.

2.5.8. Rwanda Standard Board (RSB)

RSB is a public institution established by Rwanda Government Legislation N° 50/2013 of 28/06/2013 determining the mission, organization and functioning of the Rwanda Standards Board to undertake all activities pertaining to the development of Standards, Conformity Assessment and Metrology services in the country.

It is the only body with power to define and possess national standards. Public services and public or private firms must present their standards to RSB for adoption at national level. RSB is governed by the Board of Directors composed of major stakeholders from government, industry and academic institutions, as well as consumer associations.

RSB publishes standards documents that establish specifications and procedures designed to maximize the reliability of the materials, products, methods, and/or services people use every day. Standards address a range of issues, including but not limited to various processes/systems to help maximize product functionality and compatibility, facilitate interoperability and support consumer safety, trade promotion and public health. The construction materials, chemicals and other equipment need to be following the approved standards.

2.5.9. National Land Authority (NLA)

NLA is responsible for putting in place and operationalizing an efficient system of land administration, use and management that secures land ownership, promotes investment in land for socio-economic development and poverty reduction. The role of NLA in this project is to guarantee the wise use of the land allocated for the project and will play key roles in land re-adjustment and registration as well as the land transfer process (where necessary).

2.5.10. Ministry of Gender and Family Promotion (MIGEPROF)

The Government of Rwanda positioned gender equality at the forefront of national and sustainable development as the country takes gender equality as a strategy for inclusive development, good governance, and respect of human rights. For this cause, gender equality is embedded in different legal frameworks right from the Constitution, which highly positions respect of gender equality among its foundational principles.

MIGEPROF is therefore, the Central Government institution mandated to ensure strategic coordination of the implementation of national policies, strategies, and programs regarding the promotion of the family, gender, and children's rights' protection to facilitate their integration in the socio-economic and political context of Rwanda. The Gender Promotion and Women Empowerment Directorate oversees all interventions related to Gender Equality and Women Empowerment, develops all policies related to the advancement of Gender equality and Women Empowerment. It also coordinates all partners who intervene in the areas of Gender Promotion and Women Empowerment.

MIGEPROF's specific role in the project is to provide strategic coordination and guidance to mainstream gender equality and women's empowerment, oversee gender-related policy implementation, support capacity building on gender issues, and ensure inclusive participation and protection of vulnerable groups throughout the project's lifecycle.

2.5.11. Gender Monitoring Office (GMO)

The mission of the Gender Monitoring Office is to effectively monitor gender mainstreaming and the fight against GBV/injustices in public, private, civil society and religious institutions to achieve gender equality in Rwanda. As the project will encourage gender equality principles, fight against gender-based violence and related injustices, GMO shall monitor the project to ensure compliance of gender mainstreaming activities across project implementation.

2.5.12. National Women's Council

The National Women's Council is a forum for advocacy and social mobilization on issues affecting women to build their capacity and ensure their participation in the development of the country in general, and the development of women. The council is under the guidance and supervision of the Ministry of Gender and Family Promotion. Its vision is to have a Society where both men and women have equal rights and opportunities. The National Women's Council is composed of all women and girls aged from 18 and above and its structures are from village level. The highest organ is the General Assembly at the national level. At each level, there is an executive committee of 7 people.

The Council's main responsibilities are to:

- ❖ Gather and analyze ideas of women.
- ❖ Build the capacity of women.
- ❖ Sensitize women to participate in the country's development programs.
- ❖ Advocate for gender equality.
- ❖ Advocate on serious issues affecting the development and the rights of women.

The National Women's Council's specific role in the project is to mobilize and sensitize women in the Muvumba area to actively participate in the irrigation and livestock water use initiatives, build their capacity to benefit from the project, advocate for gender equality, and ensure women's voices and concerns are integrated into project planning and implementation.

2.5.13. Rwanda Association of Professional Environmental Practitioners (RAPEP)

The Rwanda Association of Professional Environmental Practitioners (RAPEP) is a professional association comprising environmental practitioners licensed to operate in the Republic of Rwanda and recorded on its register; and established by Law No 36/2016 of 08/09/2016. The EA consultant for this project is a RAPEP authorized expert to undertake different environmental assessment studies including ESIA studies.

2.5.14. Rwanda Development Board (RDB)

RDB has a mission of improving the well-being of all Rwandans by fast-tracking development, catalyzing sustainable economic growth, and creating prosperity for all. This is a one stop institution bringing together several government bodies in Rwanda focused at promoting investment in Rwanda. RDB in this project is a key partner as it will be responsible for reviewing the ESIA report and issuing the EIA certificate before project implementation.

2.5.15. Nyagatare District

As per the Article 61 of the law on environmental, Nyagatare District and decentralized entities are responsible for the implementation of laws, policies, strategies, objectives and programs relating to protection, conservation and promotion of the environment in Rwanda. Nyagatare district and local decentralized entities especially the sectors and cells of the project area will play key and different roles through all phases of the project implementation, such as facilitating community consultations, supporting land acquisition and compensation processes, monitoring environmental and social safeguards, coordinating local development activities, resolving conflicts, ensuring compliance with regulations, and promoting participation of vulnerable groups throughout all project phases.

3. ANALYSIS OF PROJECT ALTERNATIVES

This chapter presents a summary of the main irrigation component/project options considered during the design process, for comparison with the do-nothing or no-action scenario.

3.1. Analysis of zero scenario (“without project”) and “with project”

Nyagatare District is in particular vulnerable to drought, in 2016/2017 for example, there was a severe drought that resulted in poor crop yields. During that period, the irregular rainfall pattern was followed by a drought which was far below the 35-year average rain fall in most parts of the country, especially in the Eastern and Southern Provinces (NISR, EICV5). This high vulnerability to drought has justified the mobilization of public investments for the development of irrigated agriculture in Nyagatare District. Many irrigation projects are operational while others are in the pipeline.

A large part of the selected and proposed command area is within the Eastern Savanna Agro-climatic Zone and covers parts of Karama, Tabagwe, Rwempasha, and Rukomo Sectors. The area has immense flat lands but much drier and therefore unsuitable for rain-fed crop production without irrigation. Agriculture farms are mixed up with cattle grazing areas in variable patterns.

Further, the majority of Nyagatare falls within the Muvumba Catchment as per the Irrigation Master 2020 which receives Annual rainfall of less than 850mm. The master plan 2020 estimated the scarcity of water during the dry period of Season C, based on an analysis on demand versus water availability as it is presented in the following table.

Table 3-1: NMUV-Monthly Scarcity of water

Month	Available		Other Demands	Available for irrigation Mm3	Irrigation Demand		Scarcity of water
	193 Mm3				225.86 Mm3		
Oct.	8.1%	15.7	11.5	4.2	5.4%	12.3	8.1
Nov.	9.6%	18.5	11.4	7.1	8.3%	18.7	11.5
Dec.	8.9%	17.2	13.2	4.0	6.6%	14.8	10.8
Jan.	7.6%	14.7	17.1	-2.4	10.6%	24.0	26.4
Feb.	7.3%	14.2	19.4	-5.2	1.6%	3.6	8.9
Mar.	7.8%	15.0	11.4	3.5	1.8%	4.0	0.5
Apr.	10.6%	20.4	10.2	10.2	0.1%	0.2	-
May	10.5%	20.3	9.5	10.8	1.9%	4.3	-
Jun.	7.9%	15.3	8.3	7.0	15.3%	34.6	27.6
Jul.	7.0%	13.5	10.8	2.8	24.0%	54.1	51.3
Aug.	7.1%	13.7	12.1	1.6	14.5%	32.8	31.1
Sep	7.6%	14.6	12.2	2.4	10.0%	22.6	20.2

The above table proves the scarcity of water during the dry period C and period A, the months from June to September and October to January. This scarcity can only be addressed by implementation of water storage infrastructures but also it is important to focus on the areas of Muvumba river, where the volume of water is sufficient by utilizing the quantities coming from Uganda.

3.1.1. Analysis of No Project Scenario

The “No project” option implies that the status quo is maintained of water scarcity and inadequate rainfall. This option will involve several losses on socio-economic condition both to the local population and the nation as a whole. The local farmers will continue facing the constraints they are currently experiencing and food security and poverty reduction will not be attained. For an area facing drought and a country emerging from fighting for poverty alleviation and food security, this option is not desirable considering the need of the population to sustain their livelihood. However, the environmental effects of the proposed activities will be avoided, making the option desirable considering the state of the environment.

The current situation of living conditions in the five sectors concerned of Nyagatare District reveals that population is growing fast, but poverty is still high within several households. Development of modern agriculture and livestock technology is still low although some individuals or farmers’ associations utilize small pumps for water irrigation and livestock water use, especially in dry season.

The District and Sectors have elaborated several plans for development but possess few resources and little knowledge to implement them. There are among the consequences of this situation option:

- Low agriculture productivity, especially with uneven rainfall and climate variability. Dependence on rain-fed production system in a changing and unpredictable climate.
- Continued reliance on hand pumps at community levels, as well as women drudgery in subsistence farming activities.
- Poor water quality and development of water borne diseases in the region, etc.

The ‘with project’ i.e. irrigation alternative will bring important benefits to the residents that would not be accrued if the proposed interventions are not implemented. This project is expected to sustainably increase agricultural productivity in food crop value chains and strengthen market linkages between farmers and other value chain actors. The objective of the present irrigation component/project is to maximize and increase production and productivity of agriculture and livestock by providing water for irrigation throughout the year and modernizing agriculture and livestock, raising incomes and improve livelihood of rural households in line with the Government’s targets. With The dam construction, coupled with irrigation and livestock water use components, Nyagatare District will have a considerable potential for irrigation development and agriculture intensification (including mechanization adoption).

For these reasons, No-option alternative is not recommended. Thus, agriculture intensification and livestock development in the five concerned sectors would be a favorable opportunity to raise income from agriculture and livestock products and will induce a radical change in the ability of farmers to access agricultural and livestock advisory services and inputs and to respond rationally to market opportunities. Therefore, the non-irrigation of crops and livestock water use option is not acceptable on social, economic and environmental grounds.

Table 3-2 discusses the “with” and “without” project scenarios effects on the environment and social economic development.

Table 3-2: Comparison of Environmental and Social Impact with / without the Project

Impact		With project	Without project
Environmental impacts	Direct	Flood control in the Muvumba wetland will be enhanced as storm water will be drained appropriately. Drought events due to water shortage will also reduced	Drought will continue to emerge in the area
	Indirect	Resilience to climate risks (drought vulnerability) will be improved because of scheme establishment	Communities' exposure to climate risks continues with direct impacts on food security
Social impacts	Employment	The project will promote employment to at least 450 people in the area, including youth and women through their involvement in construction works	No job opportunity for residents
	Professional skills	Throughout construction phase, people will get knowledge on the construction and operation of irrigation	No skills improvement will occur
	Livestock products	Through establishment of the livestock water supply, milk production will increase with resultant impacts on nutrition and household income from the sale of surplus	No improvement in milk production
	Impacts on gender	Provide employment opportunity help to lighten women' family and youths drudgery in subsistence farming and create conditions for women to work in irrigation scheme, for instance through water uses association, throughout the project, different training on gender empowerment will be provided to build their capacity	Women's drudgery in subsistence farming activities
	Impact on poverty reduction	Provide employment opportunity and skill training for some poor people, as well as increase in production thus increase their income, and reduce their burden of daily life.	No capital, lack of skills in irrigation and lower income. In addition, living condition of the poor cannot be changed.
	Impact on agriculture production	The implementation of irrigation and livestock infrastructures will ensure sufficient water sufficient availability and reliable access to water, hence boosting crop and animal products in the district	Farmers will continue to suffer from insecure access to water
	Impact on institutional development	The project empowers cooperatives and Water User Associations (WUAs) to manage irrigation and livestock systems, fostering inclusive governance, capacity building, resource efficiency, and long-term institutional resilience across rural communities.	Without the project, cooperatives and WUAs may remain under-resourced, fragmented governance could persist, stakeholder engagement would decline, and institutional learning and climate resilience efforts may stall—hindering long-term sustainable resource management.

3.2. Alternative analysis regarding Irrigation Domain based on the type and nature of water abstraction

Water source Type	Advantages	Disadvantages	Why selected or not selected
SSIT-Small Scale Irrigation Technology - Runoff for small reservoirs domain	- Suitable for household small scale irrigation with the use of small storage facilities. - The technologies and infrastructure used to irrigate the land under this are simple and include: above ground storage tanks, underground tanks, ponds, and simple abstraction methodologies. Irrigation of the small areas in the vicinity of the house or near the water supply, using these practices, is endorsed	- Area a potential is 2931ha - Less reach - Small household reservoirs are recommended for supplemental irrigation during the rainy seasons to be used only as needed during dry spells to boost productivity. It is not feasible to construct small reservoirs for dry season irrigation as the volume of water required is large, making the cost too high	It was not selected due to less reach/coverage potential.
Muvumba and Karungeri Rivers (use of pumping for abstraction of water from the large rivers)	Primary surface water source; supports large-scale schemes	- High cost associated with operation infrastructure - Seasonal variability and less reach potential - Over abstraction	Pumping water directly from the rivers would cause over abstraction leading to water shortage and conflicts downstream. In absence of water storage, the water discharge from rivers vary with season and would have less reach potential
Dam/marshland projects with storage	- In cases where the scarcity is allocated mainly during the dry period, implementation of water storage infrastructures is mainly preferred - Area potential is huge (12,464 for dam and 7735 for marshland) - Preferred for large-scale, publicly-owned and managed scheme	- Costly especially the infrastructure. - Substantive Land acquisition involved	- The multi-purpose dam already exists and is under construction i.e. the cost of the dam is already covered. - The water that flows from Uganda side, through Muvumba river, is sufficient to cover all needs and shall be utilized accordingly. - Large schemes are a priority as they reach more people and area irrigated is large
Groundwater source	- well-suited to private co-investment as they can be broken down into small self-sufficient units, with public sector	- The abstracted water quantities and irrigated area potential (ie 1000ha) is smaller¹⁸	It was not selected due to smaller or less reach potential. Additionally, excessive ground water abstraction could lead to a decline in the water table.

	providing boreholes and conveyance infrastructure (approx. 30-40% of total cost), and users investing in-field conveyance and equipment.	- can be utilized as support to areas that surface water is not enough to support a development but cannot be the main domain as smaller	Ground water are normally saline which is unfavorable for agriculture, and thus pretreatment would be required necessitating addition cost.

3.3. Alternative analysis regarding water transfer methods

In the selected project of irrigation using water from Muvumba Dam, there are two main aspects in the project.

- ❖ Water transfer/conveyance system from downstream of the Muvumba dam to the end of the command area
- ❖ Water application to the fields within the command area.

These are summarized in the following sections.

3.3.1. Water transfer/conveyance system (from downstream of dam)

Alternative I – By primary canal (open channel flow)

This is done through 43.1 km long Primary canals for left and 26.6 km for right canals along Muvumba river. The full supply level (FSL) of the canal at the starting points (left and right side) are decided based on FSL at the outlet pipes coming from the Muvumba dam.

Primary canal intake on the left bank side is 1385.05 m whereas the FSL at the starting point of Primary canal on the right side is 1386.24 m. As the canals progress on the downstream side, the FSLs and bed levels of the canals keep on decreasing due to the longitudinal slope of the main canal.

In this case the water is conveyed by gravity from starting point till end point of the command area with tapings in between for drawing water. The flow in this case head loss is quite less as the flow is by gravity and bed slope is kept at 1 in 4,000 which is quite mild. Thus, it is possible to cover more command area in this case.

Alternative II – By pipe (pressurized flow)

In this option, it is necessary to have large diameter pipe. In fact, this would require two large diameter pipes so as to carry the same discharge in order to restrict the size of pipe. Also, as the flow will be under pressure the head loss will be much more as compared to the alternative I (By primary canal (open channel flow)). This results in reduction in the command area. Apart from this, it will require a more complex arrangement to have tapings for withdrawing water along the route.

In addition, it is more challenging to fabricate and install large diameter pipes during construction. Comparison of water conveyance systems/technology is presented in Table 3-3.

Table 3-3: Comparison of Water conveyance systems/technology

Parameters	Option	
	Primary canal (open channel flow by gravity)	Pressurized flow through pipes
Technical suitability	Head loss is quite less; more areas can be irrigated	More head loss, resulting in reduction in irrigation area
Construction ease	Easier	More complex
Environmental impacts	Minor	Minor
Economy	Cheaper	Costlier
Operation and maintenance	Easier	Efforts are more
Evaporation loss	Some minor loss will be there	Very minimum
Resettlement aspects	There will be some resettlement	There will be some resettlement

Considering the above factors, Alternative I i.e., conveyance of water through open canals (Primary canals) is much better option. Hence this is being adopted.

3.3.2. Water application to the fields within the command area

It is to be noted that while the two Primary canals convey water from starting point of command area to the command area, it is necessary to have regular tapplings in between so as to irrigate the fields that are far off from the Primary canals.

The available irrigation systems can be grouped into two types:

- ❖ Gravity irrigation (surface irrigation)
- ❖ Pressure irrigation (sprinkler, pivot or hose irrigation)

Option I – Gravity irrigation (Hydrant and hose pipe for surface irrigation system)

Surface irrigation is the introduction and distribution of water in a field by the gravity flow of water over the soil surface. The soil acts as the growing medium in which water is stored and the conveyance medium over which water flows as it spreads and infiltrates.

Soils with high infiltration rates (usually the sandy and coarse-textured soils) are not suitable for surface irrigation. Soils with moderate to low infiltration rates (loams and other fine-textured soils) are better for surface irrigation. In case it is essential to obtain a controlled distribution of water, furrow irrigation is the widely used surface irrigation systems. Furrow irrigation is conducted by creating small parallel channels along the field length in the direction of predominant slope.

To achieve high efficiency and uniformity of irrigation using unpressurized gravity water application methods, all parts of the irrigated field should receive water for near-equal lengths of time, with a minimum of water lost to runoff or to deep percolation below the root zone. Since the soil is quite porous, the flow rate of water is continually reduced as it spreads. Thus, getting water uniformly spread over a field requires careful management. Fields should have a uniform grade in the direction of water flow to obtain best results. A uniform grade or level surface prepared through precision land levelling helps to provide equal infiltration opportunity times. Field slopes more than 3% are not recommended.

In this first option, the Consultant considered the hose irrigation system by gravity feed as per the earlier Feasibility Study. In this, the irrigation system is designed to take water from the

Primary canal and then feed the secondary pipes with hydrant along the secondary pipes; irrigation will be done through hose pipes which feed water to the furrow on the terraces or spray water to the crop directly.

This method of irrigation follows the traditional furrow irrigation approach. The water is applied to the furrows through an earthen unlined field channel. When one furrow has been filled up with water, then its entrance is plugged and the entrance of the next one is excavated and so on. The slope of the earthen field channel should be of about 0.3% so as not to cause heavy erosion but be able to convey the water along the channel. The water reaches the terrace outlet with the same way as described above. In this case, since the required water should be apply depending on the soils, the diameter of the pipe connecting the outlet with the secondary pipe at the outlet should be at least 80 mm (D80). In this case the hydrants are placed more densely on the secondary pipe with an agreed distance depend to the land topography and length of the terraces.

A flexible hose pipe D80 is plugged at the outlet to supply the terraces in both sides of the secondary pipe. Rip rap is placed at the head of the field channel to dissipate the energy and prevent erosion at the entrance of the field channel. The advantages of this option are its low cost and the fact that there are no pressure requirements at the terrace outlet. However, breaking the field channel to access each furrow and resealing it again after the channel is full – it increases the possibility of wasting water and in-field erosion. Hence, this option is considered as a highly labor intensive one, and the least efficient given that it is difficult to manage and control its operation. Surface irrigation is inefficient and a cause of soil erosion.

The area has been divided into two main categories of land paddy and hillside in this option. The land with all characteristics of marshland including soil having high moisture holding capacity have been recommended for paddy, considering the fact rice is one of the crop which requires lot of water. The land with gentle slope or high slope will be classified as hillside and have been mapped, with topography survey and the slope the hillside which is beyond 6%, the terraces with different vertical interval where the soil depth allows are recommended in case the hydrant and hose pipes are selected as the best technology for water application system.

The paddy field will be irrigated by a canal passing near the paddy field following an acceptable slope which is connected to the Primary canal. In the present scheme, it is possible to have surface irrigation in only two blocks (one on left side and the other on the right side) having of total area of about 900 hectares. This is less than 10% of the command area.

Advantages

The hydrant and hose irrigation system is low pressure gravity surface system combined with furrow/hose. It is cheap in terms of installation, requires low pressure in operation and can be adopted to any land slope.

Disadvantages

This system is time consuming; farmers need to spend much time in connecting the hose to hydrant and then shifting the hoses to fill up the furrows. Hence its operation is labour intensive. As the hose pipes have a short lifetime (i.e. less durable), the farmers need to replace them after certain time. Also, in the future in case of any design changes it becomes necessary to dismantle all installed system and install the new designed system. The land with

gentle slope which is higher than 6% and high slope will require a making the terraces for smooth water conveyance in those slopes.

Option II - Pressurized irrigation system: Center pivot and sprinkler

At hillside area, as first preference, it is proposed to design center pivot irrigation machine wherever possible. This, since the center pivot only works when the slope of ground is less than 12%. It is proposed to have sprinkler system at locations where the slope is more than 12%. In some cases, where the areas available for installation of centre pivots are less, it is necessary to provide sprinklers to maximize the irrigation area.

In these cases, pumping stations will be installed along the route which will provide necessary operating pressure for running the centre pivots and sprinklers. These pumping stations will withdraw water from the Primary canals.

Advantages

The center pivot irrigation system has proven to be the most water and labor efficient in irrigation systems, and it can easily irrigate vastly flat and wide areas. Managing soil water levels is significantly easier because of the semi-automatic functioning of center pivots and lateral movements. Almost any vegetation, including sugar cane, orchards, and vines, as well as more traditional crops like maize, potatoes, minor grains, alfalfa, and vegetable crops, can and have been irrigated successfully with center pivot systems under a wide range of conditions. Center pivot systems, as against the surface irrigation systems, reduce the amount of labour required for irrigation and distribute water more efficiently and evenly over crops. Since its development, this system has evolved into a very effective way of delivering water to irrigate fields.

Disadvantages

Disadvantages of the center pivot machine are limited to the main constraint of the operating pressure require an installation of pumping station to gain the required operating pressure. However, high initial costs and management issues for small holder farms need to be factored as disadvantages. Comparison of Water application options is made in Table 3-4.

Table 3-4: Comparison of Water application options

Parameters	Option	
	<i>Gravity or surface irrigation</i>	<i>Pressurized irrigation system (Center pivot and sprinkler)</i>
Technical suitability	Ground slope should be less than 3%	Centre pivots: Ground slope up to 12% Sprinklers: Ground slope can be more than 12%
Construction ease	Large number of canals need to be constructed; this means total length of the canals is huge	Though pipelines need to be constructed to convey water, its length is relatively less
Environmental impacts	Minor	Minor
Economy	Cheaper; however less efficient	Costlier; but more efficient
Operation and maintenance	More difficult	Easier
Evaporation loss	More	Minimum
Resettlement aspects	Minor	Very less

Adaptation to climate change	Less adaptable to climate change due to high water losses mainly through evaporation	Is more beneficial to climate change adaptation because it reduces water wastage (as evaporation is reduced) and increase conveyance efficiency.
Pollution downstream	More downstream pollution given that agriculture inputs such as chemical fertilizers goes directly to canals	Minimal
Waste disposal and management	More wastes are generated during excavation of channels and construction of different infrastructures	Generate less wastes during canal construction.
Energy use	No energy use during operation	Electrical energy is more used for pumping water
Suitability under local conditions	Center pivot is suitable for land slope which is less than 12% Irrigating small areas using center pivot is not feasible	Center pivot is suitable for land slope which is greater than 12%. The pressurized system operates even in small land area

Selected option

Overall, Pivot was given preferences and chosen to be used. Considering the full spectrum of technical, environmental, social, and economic aspects, center pivot irrigation remains the preferred method for maximizing agricultural productivity in areas with slopes below 12%. These zones offer optimal terrain uniformity, enabling efficient water distribution and operational scalability. Pivot systems also reduce evaporation losses due to targeted application and minimized surface exposure, supporting water conservation goals under changing climate conditions.

For remaining areas with higher gradients, sprinkler systems are recommended, offering flexibility on uneven terrain and better erosion control. Notably, newly designated blocks for paddy rice, where surface irrigation is traditionally favored, will require customized solutions. These zones present higher risks of water loss through evaporation and runoff, necessitating precise leveling, bunding, and water-use efficiency measures.

From a socio-environmental perspective, center pivot systems minimize the spatial footprint, reducing the need for land acquisition and thus mitigating resettlement pressures. Their centralized operation and automation also contribute to lower labor demand and enhanced safety, especially in vulnerable communities. In contrast, surface and sprinkler methods may trigger localized waterlogging and downstream pollution if not carefully managed—prompting the integration of buffer zones and filtration wetlands where needed.

6.2.3 Alternative analysis for project location

The feasibility study proposed to use Muvumba multipurpose dam as intake of primary irrigation canals. This dam is under construction upstream of the Muvumba command area. The site proposed for the construction of right-side canal is situated at a hilly slope with approximate inclination of 40-50° while the site for left canal is situated at 25-30°. The land areas for these intakes are normally used for Agriculture as depicted in Fig. 3-1. Sites for Intakes were selected because they present minimum energy loss to enable conveyance of water by gravity.



Figure 3-1: Selected site for canal intake: Left) and right sites

Regarding environmental and social impacts, there is no other alternative that would prevent land loss by pivot structures and irrigation canals. However, the project design planned for compensation of the land acquired during canal construction. And this ESIA provides mitigation measures for these avoided impacts.

3.3.3. Alternative analysis for livestock infrastructure

The proposed project encompasses not only irrigation infrastructure but also dedicated facilities to support livestock systems across Rwempasha, Karama, Tabagwe, Nyagatare, and Rukomo sectors. Recognizing the agro-pastoral nature of project area, the design integrates livestock watering points, troughs, access roads, and grazing corridors to enhance animal health, productivity, and resilience. These components are essential for ensuring that water resource development benefits both crop and livestock sectors, aligning with national strategies for integrated land and water management. When comparing livestock infrastructure alternatives located **within** versus **outside** the project area, several technical, environmental, social, and economic dimensions come into play.

3.3.1.1. Alternative A: No livestock infrastructure included

Placing livestock infrastructure *outside* the project area can reduce pressure on irrigated zones and allow for more expansive grazing systems. It may also help mitigate risks of overgrazing and soil compaction near sensitive irrigation structures. Yet, this option often demands additional investment in access roads, water conveyance systems, and fencing, and may pose challenges in terms of oversight and service delivery. Socially, it could affect community access and equity, especially if the external sites are less accessible to vulnerable groups.

3.3.1.2 Alternative B: with livestock infrastructure included

Locating infrastructure *within* the project area such as watering points, troughs, and grazing corridors offers logistical advantages, including proximity to irrigation systems, shared access roads, and integrated land use planning. This setup minimizes travel distances for livestock, reduces operational costs, and enhances synergy between crop and livestock systems. It also allows for centralized monitoring and maintenance, which is crucial for ensuring water quality and animal health. However, it may require careful zoning to avoid conflicts with crop production and to manage manure and runoff effectively.

Considering the agro-pastoral context of project area and the goal of integrated resource management, the **best selection** is to locate livestock infrastructure **within the project area**, provided that spatial planning ensures compatibility with irrigation functions. This approach promotes efficiency, resilience, and inclusive service delivery while leveraging existing project investments.

In case of accommodating the livestock within the command area, there are two options:

Option I (within Alternative B) is to group livestock within the command areas with a considerable number of livestock and feed them in the same location. Only some area will be provided (earmarked) to the livestock for grazing in open land depending on the type of livestock chosen/purposes like dairy cows or beef fattening. Feeding arrangement and water trough constructions are to be made in this area.

With this option the number of troughs will be decided after selection of the system - either small scale for dairy or large-scale communal dairies or large-scale commercial fattening; the number of troughs required for 500 cows are 10 troughs which cover 400 ha in the irrigation command area.

Option II (within Alternative B) is to keep the livestock in the irrigation command areas, all farms which are under command area boundary will be supplied with water for livestock by providing a hydrant and trough constructed and connected to this hydrant in each farm based to number of livestock. The owner of each farm covered by the irrigation system will decide if he/she is going to plant the whole land with the crops or he/she will keep 10, 20 or 30% of the total land for livestock. In this case the land provided for livestock will accommodate all related livestock infrastructures especially shelter and troughs for feeding and watering the cows. This is also supported by Government policies wherein the movement of animals are discouraged to limit the disease transmission from one group to another due to search of food and water.

Option Preference

The unit of 40ha has been designed for one trough and to cover all livestock under this area, this option of 3073ha will be covered by approximately 75 troughs only. Layout showing troughs in the irrigation command area is shown in Fig. 3-2.

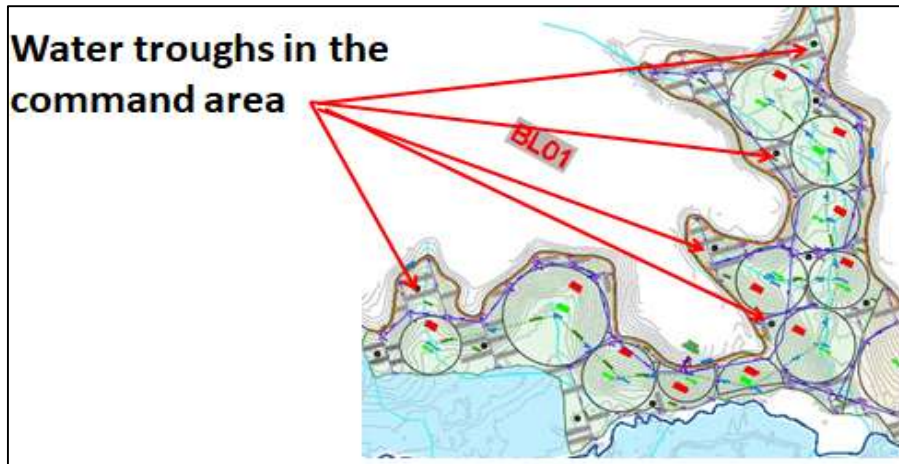


Figure 3-2: Layout showing troughs in the sprinkler area in the irrigation command area

3.3.4. Alternative analysis during construction

Table 3-5: Alternatives analysis for different parameters during construction

Parameters considered	Alternative option 1	Alternative option 2	Preferred option and Remarks
Construction method	Manual	Mechanized	Both manual and mechanized will be used depending on type of work. In all the civil works (i.e. canals, cross drainage structures, roads etc) it will be a mix of manual and mechanized methods. In case of relatively deep and wide excavations as in the case of canals mechanized method will have to be used. Activities such as excavation of canals, manual will be prioritized due to less: - Less noise pollution - Enhancing employment for unskilled and semi-skilled local people
Energy use	Power connection	Diesel run generators	Power connection is preferred to the extent possible: Benefits: - The cost is low compared to diesel - No oil waste generated as the source is on grid electricity - No increase of atmospheric carbon as for diesel - Generation of noise is minimum While there is no plan to use DG sets, small DG

Parameters considered	Alternative option 1	Alternative option 2	Preferred option and Remarks
			sets will be kept as back-up in case of failure of electricity for prolonged periods.
Solid and liquid Waste management in both construction sites and site installations	-Hire a waste collection company for solid waste -Masonry toilets - constructed sewage treatment	Hire a waste collection company for solid waste -Movable pit latrines -movable sewage treatment facility	For solid waste management, a company will be hired to collect waste from collection points to the district landfill For human waste disposal, masonry toilets will be used both at installation sites (camp sites), and where required mobile ones will be established across different work sites Masonry sewage treatment facility will be used for treatment of sewage at campsites
Water sources for construction and sites installations	Surface water source	WASAC	Both options will be applied: Surface water will be used from Muvumba river to supply water that will be used for construction while WASAC will be used to supply drinking water at work site and installation sites. Where permits are required for the abstraction from the river, these will be acquired
Employment	Local employment	Outsource employment	Local employment is preferred. Benefits: - Provided employment to local people along with financial benefits - No residential building/ housing is required - Conflict with migrant workers would be avoided
Access roads	Tarmac	Earth road	Option 2 is preferred: It costs less compared to tarmac road and meets the purpose/requirements

3.4 Application of the Mitigation Hierarchy

Design options were developed and evaluated based on hydrological feasibility, topographic and soil studies, livestock density, environmental and social baseline data, and stakeholder consultations. The selected design ensures technical, environmental, and economic feasibility, while maintaining equity and sustainability.

Design options were developed and evaluated based on:

- **Hydrological feasibility** and optimization of gravity-fed distribution to reduce operational energy requirements.
- **Topographic and soil studies** to determine optimal canal alignments and minimize erosion risks as well as minimizing resettlement impacts where possible.
- **Livestock distribution and density** to determine appropriate locations for water troughs (one trough per 40 ha).
- **Environmental and social baseline data**, highlighting settlement patterns (reduction

of displacement), avoidance of sensitive habitats, and agroforestry zones.

- **Stakeholder input** during consultations to ensure the alignment supports agricultural access, minimizes displacement, and respects local preferences.

The selected design ensures technical, environmental, and economic feasibility, while maintaining equity and sustainability.

3.4.1 Avoidance Measures

Canal alignments were adapted to avoid ecologically sensitive areas and natural habitats, and dense settlements.

- Canal Routing Adjustments: Canal alignments were adapted to avoid loss of ecologically sensitive areas such as acacia planted along the Muvumba river, disturbance of natural habitats, and dense settlements as much as possible. The adjustment was made following the topographic conditions of the site but where possible the settlement and ecological sensitive areas have been excluded in the area to be affected by main canal alignment.
- Infrastructure integration: Existing Road corridors and utility lines were leveraged where possible to reduce new land take
- Avoidance was also applied in the design where many scattered houses within the command area, including small villages have been not affected. The design is taking into account the existence of settlements which will be excluded from the command area.

3.4.2 Minimization Measures

Despite efforts to minimize impacts, 1657 households and one public institution (Nsheke Primary School) will be affected, with 192.9 hectares of agricultural land and 12,345 trees lost. The design minimized footprint through optimal routing, compact canal sections, and efficient infrastructure siting.

- Compact Design of Canal Cross Sections: consideration of designing Concrete-lining and optimal slope (1:4000) reduce canal footprint and seepage losses.
- Siting of Pump Stations and Troughs: Locations selected based on minimizing disruption to productive land and settlements.
- Mitigation of land take and assets: Despite minimization efforts, 1657 project affected households (PAHs) and one institution (Nsheke Primary School) will be affected due to canal routing, along with:
 - **192.9 hectares** of permanent agricultural land lost.
 - **12,345 trees**, predominantly agroforestry species, removed.
 - **4 roads** to be affected, requiring rerouting or relocation

3.4.3 Restoration Measures

The contractor will restore temporary construction zones and ancillary facilities such as borrow sites, stone quarry areas as well as dumping sites.

Utilities irrigation main canal construction as electric poles to be affected during will be reinstated. Drainage systems are integrated into the design.

- Rehabilitation of Temporary Work Areas: Contractor will be required to fully restore construction zones, borrow pits, quarry areas and dumping sites after works following the approved Management Strategies and Implementation plans (MSIPs) and C-ESMP. A high loss of vegetation mainly agroforestry trees within canal corridor shall be restored by planting other agroforestry trees in the 5m buffer zone of the main canals because the design shows 5m buffer zones to protect the canals
- Reinstatement of Utilities: Power lines affected will be reinstated in coordination with relevant government agencies. As per the detailed design of the project, the consultant, IBC Group, indicated that existing roads are in normal conditions while farm roads need to be rehabilitated. The three electric poles to be affected will be relocated in other areas in collaboration with Rwanda Energy Group (REG).

3.4.4 Compensation Measures

These measures will apply as a last resort where the design does not provide any technical measures. As detailed in the Resettlement Action Plan (RAP), full compensation will be provided to PAPs. Tree replanting and livelihood restoration support will also be implemented.

- Resettlement Action Plan (RAP): Full compensation for affected households, land, crops, trees, and structures is included in accordance with national law and AfDB OS5.
- Tree Replacement Plan: The rehabilitation Plans of borrow sites, dumping sites and stone quarries shall integrate the plan for tree placement and the this will be implemented consultation with local authorities, Rwanda Forestry Authority and REMA.
- Livelihood Restoration: Additional support to vulnerable PAPs (e.g., female-headed households, elderly) will be provided, including financial literacy training, linking them with other government livelihood assistance such as Girinka and VUP.

3.5 Integration of Environmental and Social Concerns in Design

The design integrates climate resilience, biodiversity protection, and community safety and accessibility features were guided by public consultations.

- Climate Resilience: Design accommodates future climate variability via erosion protection by sediment traps, and cross drainage structures. To tackle the issue of flooding in the command area, the design proposed cross drainage structures to protect the canal system and the command area from drainage water, storm water runoff and/or overflow in the canals. The concern of soil erosion and flooding have been also addressed during design where the box culverts have been proposed and will be built in reinforced concrete to withstand traffic loads and aggressive weather conditions especially during heavy rain
- Biodiversity Considerations: Ecologically sensitive habitats (e.g., gallery forests along the Muvumba River) were mapped and excluded from infrastructure zones as shown in Fig. 5-17 and Fig 5-18.
- Community Safety and Accessibility: Safe canal crossings by use of footbridges over canals and drainage channels and culverts integrated to maintain mobility.

Design of water trough and linkage to the ES concerns

Animal Welfare and Behavioral Consideration

- **Adequate Space per Animal:** The design provides 0.7 to 1 meter of space per animal, reducing competition and stress during watering. This supports animal health and productivity.
- **Peak Demand Accommodation:** Designing for 10–15% of herd watering at a time ensures that access is timely, avoiding over-concentration and aggressive behavior at watering points.
- **Reduced Travel Distance:** By siting water troughs near grazing areas, the design reduces the walking distance for livestock, which minimizes animal fatigue and potential degradation of vegetated paths (environmental benefit).

Water Conservation and Supply Efficiency

- **Sizing Based on Flow Rate and Storage Needs:** Troughs are designed to meet daily water demand efficiently (e.g., 6000 L for 500 cattle), using supply rates of ~28 L/min. This minimizes overuse of water resources and avoids water loss through overflow or leakage.
- **Storage Capacity in Troughs:** Circular troughs with 30,000 L total storage can act as buffer reservoirs, ensuring water availability even during peak demand or temporary pump failure.

Material Use and Sustainability (Environmental)

- **Efficient Use of Construction Material:** Circular troughs are more material-efficient for water storage, which reduces the environmental footprint of construction materials like concrete or metal.
- **Durability and Maintenance:** Rectangular and circular designs with appropriate heights (0.5–0.7 m) and widths ensure ease of access while also being robust, reducing maintenance needs and waste generation.

Equity and Access (Social)

- **Livestock Owner Inclusivity:** By designing the system to accommodate large herds with distributed troughs, both small and large-scale livestock owners are served equitably.

3.6 Justification of Design Alternatives

This chapter complements the analysis in Chapter 3 of the ESIA. The selected gravity-fed canal system and decentralized livestock troughs were found to be the most sustainable and inclusive alternatives.

Section 3 of the ESIA already includes a detailed “**Analysis of Project Alternatives**”. This Design Measures chapter builds on those findings and shows that:

- The selected gravity-fed canal system is more sustainable and has fewer environmental risks than full pressurized alternatives.
- Livestock troughs spaced at 40 ha intervals were favored over centralized troughing to reduce animal stress and overgrazing near few water points.

- Concrete lining was preferred to minimize water loss and reduce long-term maintenance.

The project design integrates OS1 principles by applying the mitigation hierarchy and responding to environmental and social risks. It is supported by the Environmental and Social Management Plan (Chapter 9) and Resettlement Action Plan (separate document), which guide implementation, monitoring, and compliance with AfDB safeguards.

The Irrigation and Livestock Water Use sub-Project incorporates environmental and social design measures that reflect AfDB's **Operational Safeguard 1** principles. The mitigation hierarchy has been applied systematically, from project conceptualization through to detailed design, ensuring that:

- Sensitive areas are avoided.
- Unavoidable impacts are minimized.
- Restoration and compensation plans are in place.
- Affected communities are meaningfully consulted and supported.

4. PROJECT DESCRIPTION

4.1 Introduction

This section outlines the project's location, components and activities throughout its lifecycle, including the pre-construction, construction, operation, and decommissioning phases. The irrigation project will be in the Eastern Province of Rwanda and is part of the larger ongoing Muvumba Multipurpose Water Resources Development Program (MMWRDP).

4.2 Project Location

The Project is in the District of Nyagatare. This district occupies the Northeast extremity of Rwanda (Fig 4-1) and borders Uganda in the North and West as well as Tanzania in the Eastern area.

This proposed project is located downstream of the Muvumba Multipurpose Dam and Hydropower Plant, which is currently under construction in Nyagatare District under the larger ongoing Muvumba Multipurpose Water Resources Development Program (MMWRDP). The irrigation command area covers approximately 3,073 hectares and spans five (5) sectors of Karama, Tabagwe, Rwempasha, Nyagatare and Rukomo. The main canal runs along both the left and right banks of the Muvumba River, extending from the dam site to its confluence with the Umuyanja River near the Uganda border.

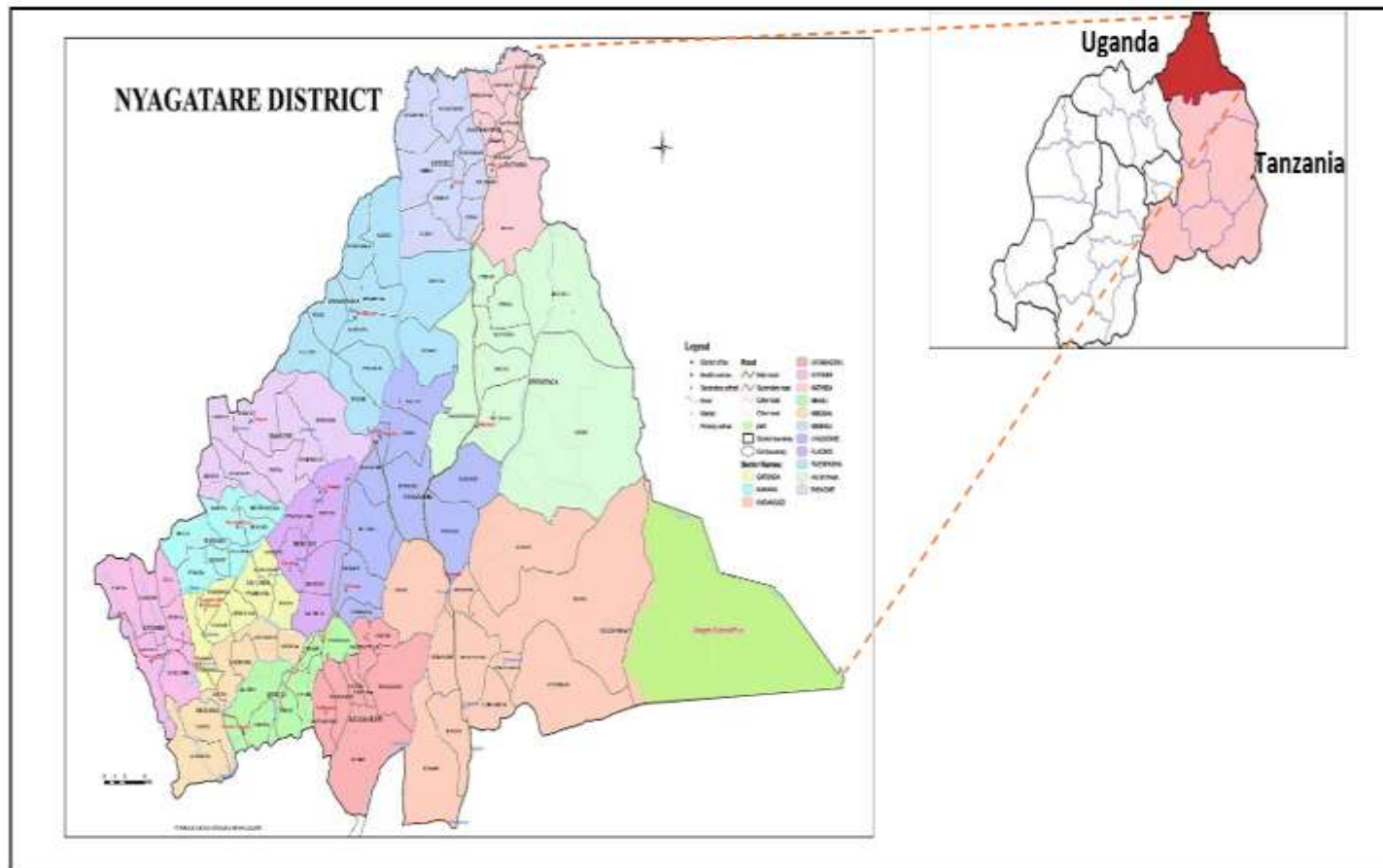


Figure 4-1: Location of the Project area

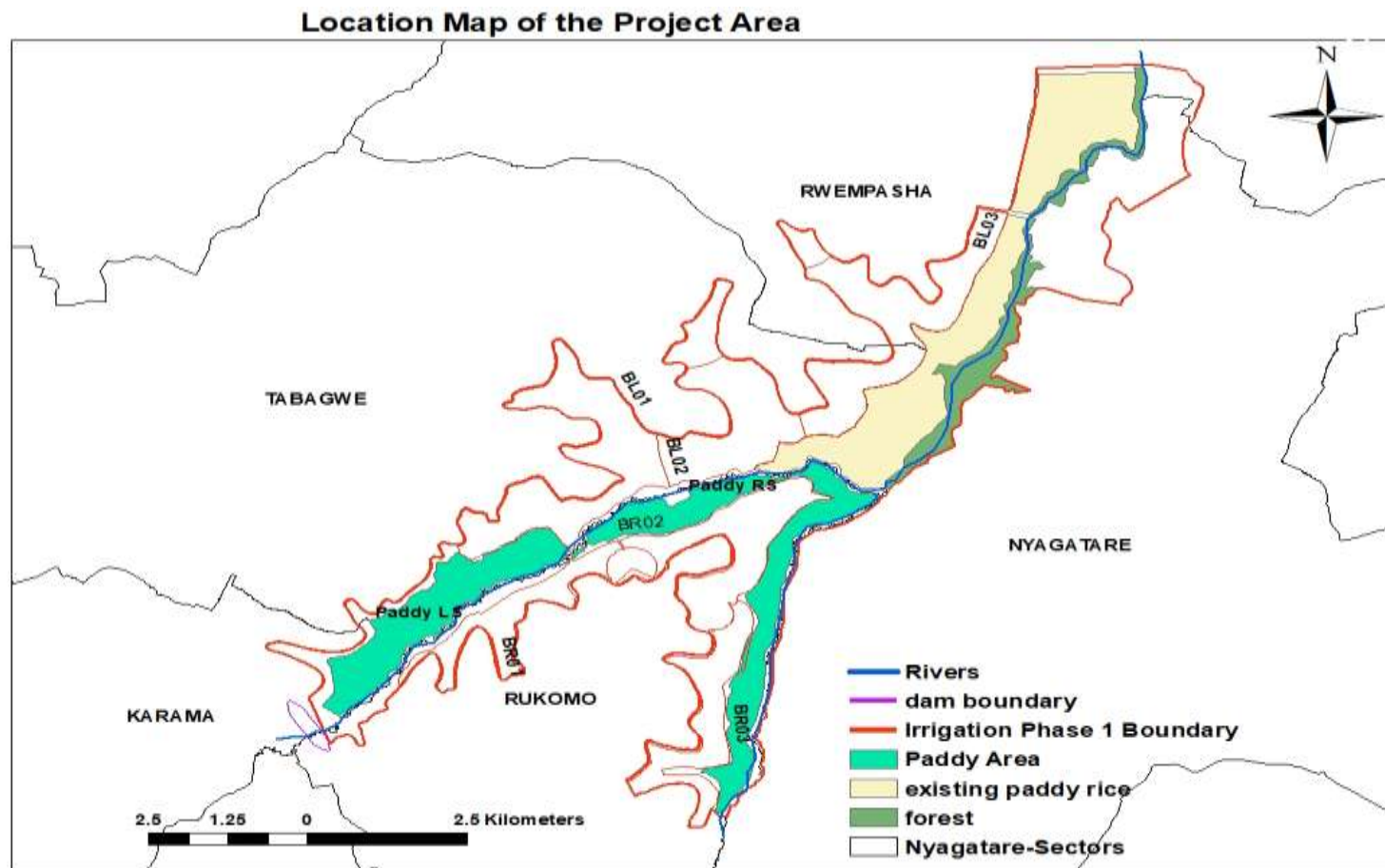


Figure 4-2: The location of the command area within the target sectors

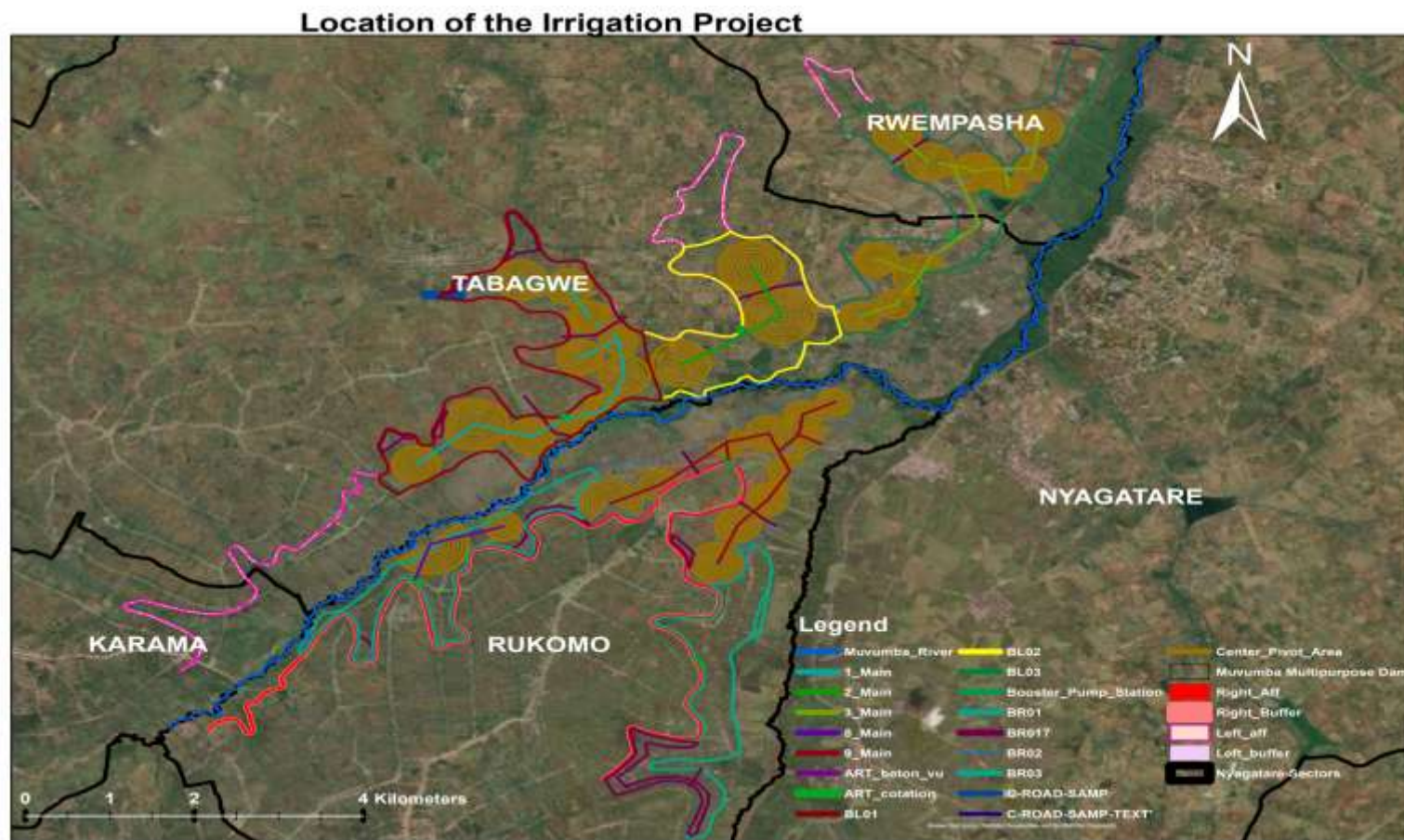


Figure 4-3:: The location of the command area within the target sectors

The width of valley bottom varies from 500 m to 1,600 m. Most of the command area lies below 14 % slopes. The command area is wide where another sub-catchment or valley joins the main valleys. The elevation of the command area varies from 1,329 m to 1,390 m according to the canal level. The main features of the project are summarized in Table 4-1.

Table 4-1: Project main characteristics

Main features	Description
Command area	3,073 ha
Water demand per l/s/Ha	0.76
Total water demand (m ³ /sec)	7.26
Primary canals (left to Umuyanja river)	43.1 km long with a width of 22 m and each side of the main canal will have 5m buffer zone for canal protection
Primary canals (right to Rukomo)	26.6 km long with width of 16 m with additional 5 m each side
Construction of Left CANAL (L_1)	Concrete lined Canal from the dam to the siphon 1 with 43.1 km with bottom width of 4.79, depth 1.54 and side slope of 1:1.5; Q=13.87m ³ /sec
Construction of Pedestrian walkway CL_1	Steel crossing structures proposed at every 250m to allow the farmers to cross the canal (estimated 167 bridges)
Development of Paddy Field on the Left and right Side	810 ha (352 ha on the left side) and 458ha on the right side. Works include secondary canal, tertiary canal, land levelling and feeder roads, metallic sluice gates, control structures and other hydraulic structures (chutes, etc)
Construction and installation of the Booster Pump Station for bloc 1 on the left side (Block-BL1 BPS)	3 Booster pumping stations for 1179ha
Block-BL01 Sprinklers + Centre Pivots	Infield for 1179ha (575.57 ha for center pivots and 603.33 ha for sprinklers)
Construction of post-harvest infrastructures	10 post-harvest infrastructures will be constructed
Construction of water troughs	75 water troughs will be constructed
Construction period	5 years

4.3 Irrigation Project development objective

The main objective of the irrigation project is to improve food and nutrition security by developing an irrigation system covering a total of 3,073 ha downstream of Muvumba Multipurpose Dam in Nyagatare District. Water supply for the irrigation system will come from the Muvumba dam which is currently under construction (31.96% progress by July 2025) and is expected to have been completed (and the dam filled up) by the time the irrigation project construction activities are complete.

4.4 Project Components

Irrigation aspect will comprise three components, namely:

- (i) Component 1: Irrigation infrastructure development
- (ii) Component 2: Institutional support and capacity building
- (iii) Component 3: Project management

Component 1 (Irrigation infrastructure development) aims at developing four (4) irrigation zones as summarized in Table 4-2 below:

Table 4-2: Command area sizes in various zones

Zone	Zones and Description	Area (ha)
1	Zone 1 located on the left side of the paddy area	352
2	Zone 2 located on the left side (hillside irrigation from Muvumba Multipurpose dam to siphon one) with Blocks BL01, BL02 and BL03	1,179
3	Zone 3 on the right side from Muvumba Multipurpose dam to Rukomo with Blocks BR01, BR02 and BR03	837
4	Zone 4 on the right side of the paddy area	458
5	Right B (BR04)	247
Total		3,073

Specific activities to be implemented under Component 1 of the Muvumba Irrigation project include:

- (i) Construction of a 26.6 km concrete lined canal on the right side from Muvumba Multipurpose Dam to Rukomo. This is known as the Right-Side Canal.
- (ii) Construction of a 43.1 km concrete lined canal on the left side from Muvumba Multipurpose Dam to Siphon One. This is known as the Left-Side Canal.
- (iii) Construction of pedestrian walkway bridges on the canals
- (iv) Development of 810 ha paddy field irrigation zone
- (v) Construction and installation of six booster pumping stations
- (vi) Development of infield irrigation with Sprinkler irrigations systems and Centre Pivot irrigation systems on 2,016 ha.
- (vii) Construction of 75 water troughs
- (viii) Construction of 10 post-harvest infrastructures
- (ix) Construction of one siphon of 2km
- (x) Construction of six booster pumps on the main canals: Three on the right and other three along the left canal.

The project will consist of a command area of irrigation scheme covering about 3,073 hectares, with different infrastructures such as concrete lined left and right canals, cross drainage structures, siphon, walkway bridges on the canal, booster pump stations, sprinklers and center pivots.

Component 2 (Institutional support and capacity building) will aim at: (i) establishing and capacity building for Water Users Associations (WUAs) and Farmers groups (cooperatives); and (ii) operationalization of the WUAs including the provision of two-year operating costs of the WUAs.

Component 3 (Project management) will aim at: (i) setting up, staffing and operationalizing the Project Implementation Team (PIT) within the SPIU of Rwanda Water Resources Board, and (ii) providing resources required to undertake a baseline study on agriculture production;

(iii) project Mid-Term Review (MTR); Project Completion Report (PCR); (iv) Annual, mid-term and final financial and environmental and social audits; and (v) project contribution to shared SPIU operating costs for the sustainability of the SPIU because it is in charge of coordinating the implementation of all the projects.

The tables 4-3 below present component outputs.

Table 4-3: Project Components and Outputs

No.	Component	Component Outputs
1	Irrigation infrastructure development	- Design review and construction of irrigation infrastructure - Supervision of construction of irrigation infrastructure - ESMP and RAP implementation (valuation, compensation and expropriation)
2	Institutional support and capacity building	- Establishment of Water Users Associations (WUAs): Executive Committees, Audit Committees, Conflict resolution Committees) - Establishment of farmer groups - Capacity building and training of WUAs, farmer groups - Capacity building and knowledge sharing for core-staff as well as interns recruited on the project - Operationalization of WUAs: two-year salaries, IT equipment, operational costs, purchase of three motor bikes plus two-year fuel costs - Establishment of farmer cooperatives and support to their operations - Training of Cell, Sector, District and RAB staff on Integrated Water Resources Management
3	Project management	- Setting up and staffing the Project Implementation Team (PIT). <i>Actual staff to be hired are to be confirmed to the Bank following review by RAB/RWB</i> - Purchase of three vehicles plus running, insurance and maintenance costs - IT and office equipment - Project audit reports (financial, procurement, environmental and social safeguards) - SPIU contribution for shared operating costs (eg. shared staff's, other SPIU operating expenses).

Project outcomes will include sustainable and climate resilient crop production and increased productivity on 3,073 ha of irrigated agricultural land in Nyagatare District, leading to improved food security and nutrition; improved and sustainable farmer incomes; and improved skills of WUAs members, cooperatives and youth-led organizations in the operation, management and maintenance of irrigation scheme.

4.5. General description of command area

The command area of the Irrigation Project encompasses the valley of the Muvumba River, beginning downstream of the Muvumba Multipurpose Dam. The main water conveyance system for the scheme is proposed as a lined concrete canal, designed to efficiently deliver

irrigation water throughout the area. In addition, since the detailed design includes a pressurized system, pumping stations have also been recommended to support water distribution.

The upper boundary of the command area is defined by the alignment of the primary canal, which is designed with a bed slope of 1 in 4,000 to ensure adequate flow. The command area is divided into four irrigation zones, based on the alignment of the canal along the left and right banks of the Muvumba River.

The irrigation canal is routed from the left bank to the right bank of the river via the main siphon (Siphon-1), which enables the crossing of the Muvumba River and facilitates irrigation on the right side. Water conveyance begins just downstream of the Muvumba Multipurpose Dam, from where water is distributed to the designated irrigation zones through the canal system. The schematic layout of the primary canal and associated zones is illustrated in Fig. 4-4.

4.5.1 Alignment of primary canals

Starting point [X & Y coordinates and Full Supply Level (FSL)] of Primary canal on the left and right bank sides were furnished by the dam designers based on their design requirements. FSL at the starting point of Primary canal intake on the left bank side is 1385.05 m whereas the FSL at the starting point of Primary canal on the right side is 1386.24 m. As the canals progress on the downstream side, the FSLs and bed levels of the canals keep on decreasing due to the longitudinal slope of the primary canal.

The areas of the schemes are 1531 ha located on the left side and 1,295 ha right side towards Rukomo (directly from the Muvumba Multipurpose Dam). The total net command area is 3,073 ha. This does not include Muvumba 8 (M-8) scheme which is already developed as paddy fields. Gross command area which includes areas under belt road, farm roads, Primary canals, dam submergence, pump stations and post-harvest infrastructure works out to about 3,073 ha.

Water flow in the entire route (from start to end) of the Primary canals is by gravity. However, in case of pressurized irrigation system, booster pumps may be required at points where the water is tapped from the Primary canals for irrigating lands through center pivot and sprinkler as the operating pressure is not adequate to efficiently manage or apply the water in the whole command area.

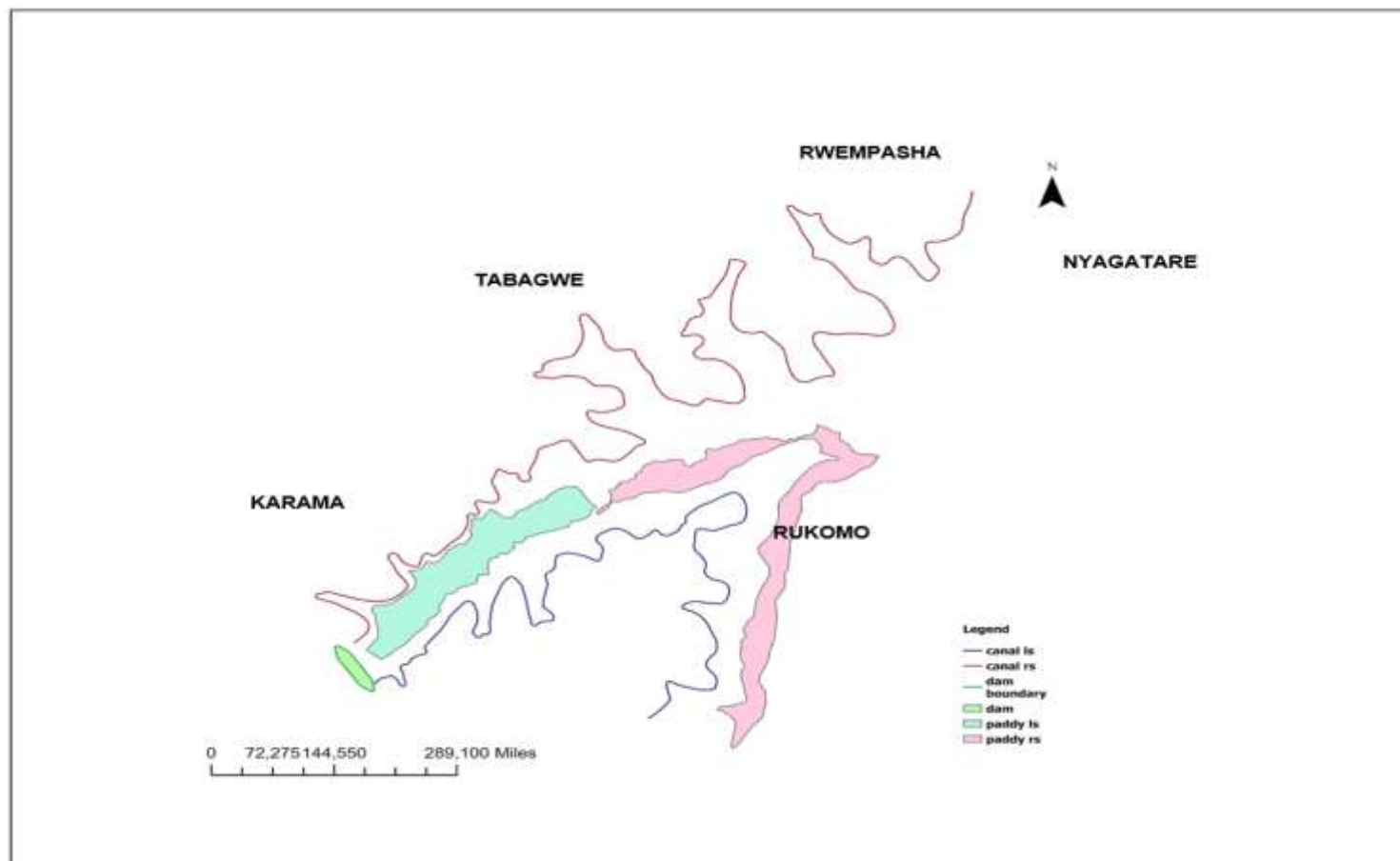


Figure 4-4: Schematic layout showing Primary canals and zone

It is proposed to have reinforced concrete for the whole section (bottom and side walls) which is advantageous as it results in relatively thinner concrete walls. The use of lightly reinforced concrete for the canal bottom and for the side walls helps in reduction of possible leakages and lesser surface roughness resulting in slightly smaller sections as compared to unlined sections.

Irrespective of the above, the size of the canal walls is designed to ensure their stability considering the relatively large quantities of water being conveyed as this is a large/big project irrigating 3,073 ha. As per the design, the main canal (left canal) has a width of 22 m, 43.1km long and each side of the main canal will have 5m of buffer zone for canal protection. This will totalise 32 m of land to be acquired. The right canal has a width of 16 m, 26.6km long with additional 5 m each side, it makes a total of 26 m to be acquired.

Typical cross sections of the Primary canals at different slopes of surrounding areas (when canal passes) are presented in Figs. 5, 6 and 7 showing different types of cut and fill during construction.



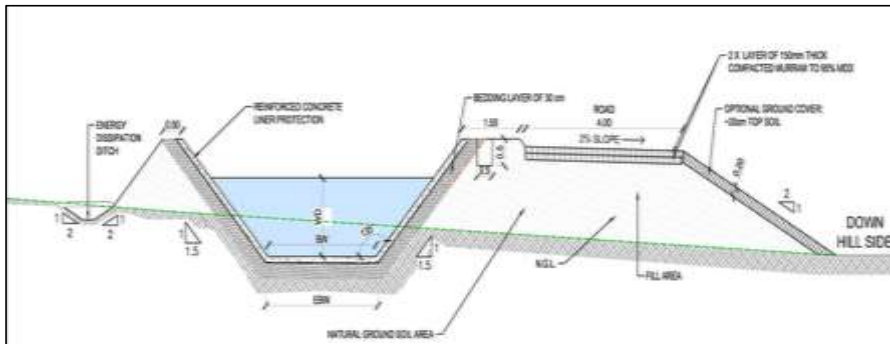


Figure 4-6: Primary canal cross section at moderate slope with half cut and half fill

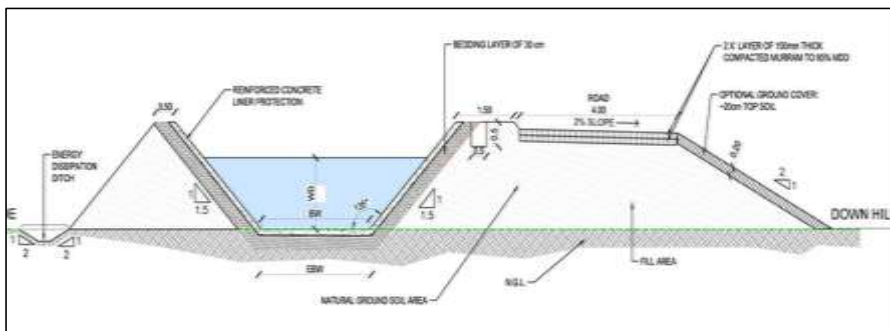


Figure 4-7: Primary (Main) canal cross section at gentle and flat slope with canal in the embankment

4.5.3 Irrigation system layout

The design consultant analyzed different types of irrigation methods such as gravity (surface irrigation), drip irrigation and pressure irrigation using different factors: (i) availability of water resources in terms of quality and pressure, (ii) Topography, (iii) Soil characteristics, Environmental factors, existing policy, costing, etc.

They also analyzed all options in terms of advantage and disadvantages, and recommends to irrigate all areas by center pivot when the slope is less than 12% (i.e. maximizing irrigation through center pivot) and irrigate rest of the areas by the sprinklers except in locations where the land is allocated to the paddy crop. The paddy field will be irrigated by a canal passing near the paddy field following an acceptable slope which is connected to the Primary canal.

The Fig.4-8 shows the layout showing paddy fields in flat lands; Fig.4-9 depicts the general layout of center pivot and sprinklers.

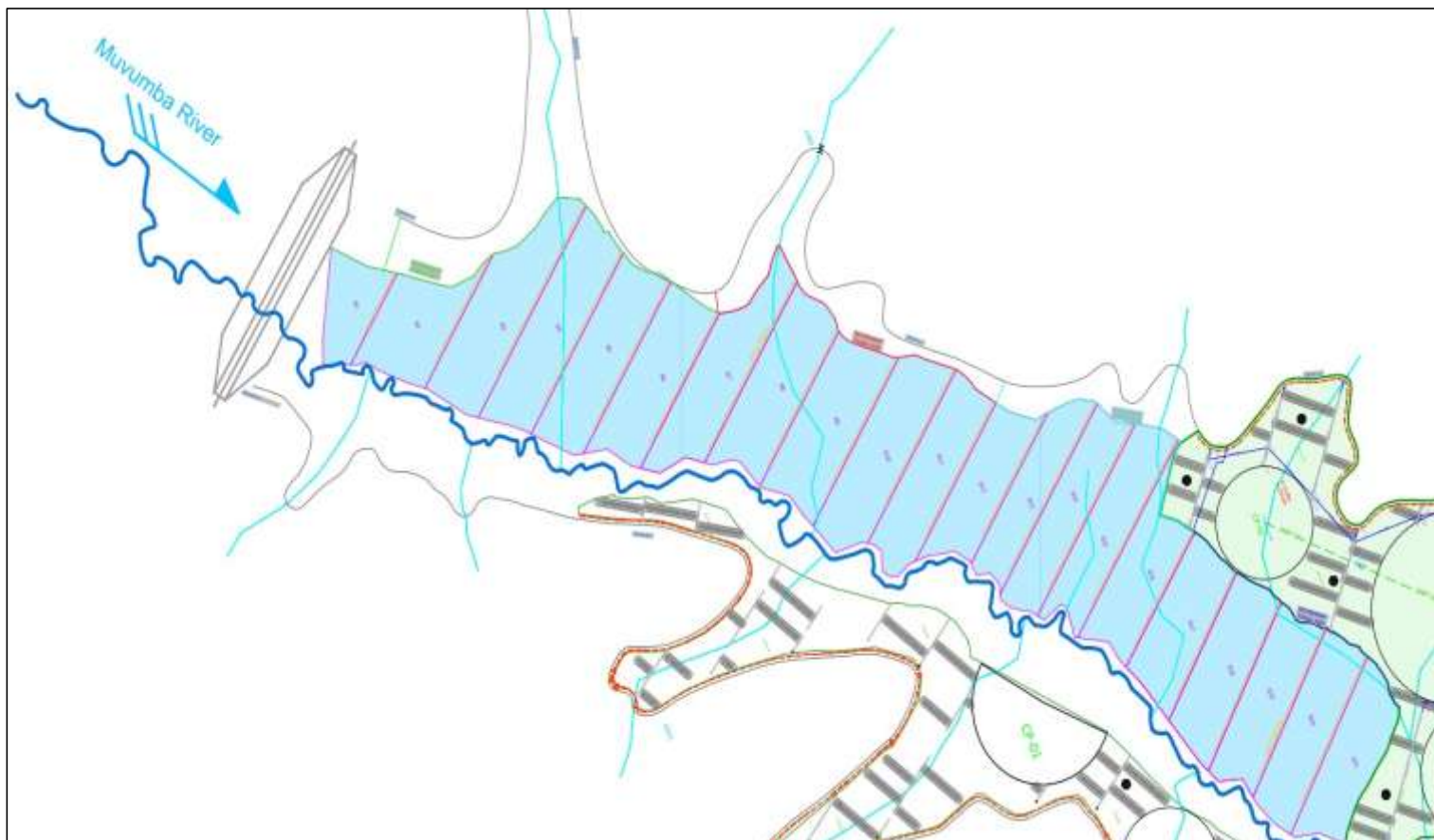




Figure 4-8: Layout showing paddy fields in flat lands (Source: Consultant, 2022)

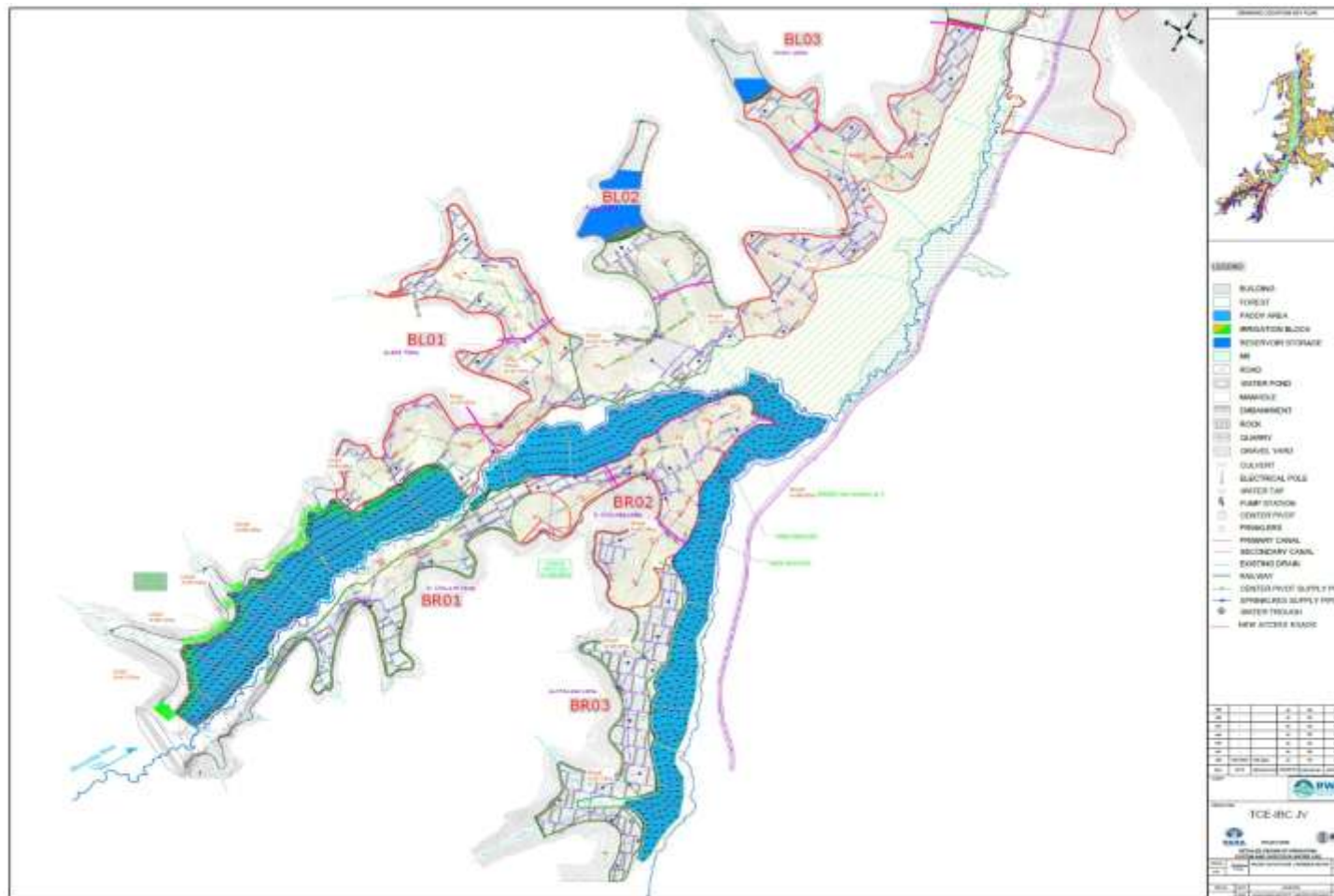


Figure 4-9: General layout of center pivot and sprinklers

4.5.4 Main hydraulic infrastructures

The primary irrigation canal cross water ways with appropriate drainage structures. Primary canals cross the road therefore boxes and other diverse structures have been designed which will be used to protect all the canal system first, the command area and the whole system in general from floods which may come from the uplands system and from excess irrigation water.

The water distribution system from the intake to the level of plot has been designed to allow irrigation water to be delivered at the plot level with minimum losses. The conveyance system will be by canal; the flow will be by gravity from downstream of the Muvumba dam will be through the Primary irrigation canals supplying water on both sides of the command area. Pump stations will be installed along the route which will provide adequate pressure for operation of sprinklers and center pivot system.

4.5.4.1 Inverted siphons

One siphon of 2km will be installed to maintain the level of water flow and facilitate the connection between two different levels. For example, the Rwempasha-Nsheke siphon will over cross the Muvumba cultivated wetland and connect to Nsheke irrigation canal.

4.5.4.2 Road crossing the primary canals

In a large command area such as the proposed irrigation scheme, there would be constructed/rehabilitated access roads. Hence road crossings will be provided in locations where primary canals are required to cross the roads.

Access roads (earth roads) have been planned to be utilized during construction of irrigation infrastructures, facilitating transport of men, materials, equipment and later during operation and maintenance period.

The command area access roads network is expected to be operated to fully facilitate free transport of yield, service road along the irrigation canal, farm equipment and machineries. Their construction will also involve excavation and shaping of drains and soil compaction.

Sizing of Road crossing structures (in RCS)

The Table 4-4 below summarizing the road crossing structures by line/route, type of crossing, and dimensions,

Table 4-4: Road Crossing Structures

Line	Type of Crossing	Length	Number of RCS	Section of the RCS (W x H)	Wall Thickness
L1	Crossing street	6 m	29	4.8 m x 2.35 m	50 cm
	Crossing access road	12 m	14	4.8 m x 2.35 m	50 cm
	Crossing paved road	15 m	4	4.8 m x 2.35 m	50 cm
L2	Crossing street	6 m	10	1.2 m x 1.7 m	30 cm
	Crossing access road	12 m	3	1.2 m x 1.7 m	30 cm
R1	Crossing street	6 m	27	4.5 m x 2.35 m	40 cm
R1	Crossing access road	12 m	10	4.5 m x 2.35 m	40 cm
R3	Crossing street	6 m	1	4.8 m x 2.35 m	50 cm
R4	Crossing street	6 m	2	2.7m x 2.2m	30 cm
R5	Crossing street	6 m	16	0.7m x 1.06m	20 cm
R6	Crossing street	6 m	3	1.0m x 1.5m	30 cm

R7	Crossing street	6m	14	1.4m x 1.7m	30cm
R8	Crossing street	Crossing street	11	1.4m W x 1.6m H	30cm

Source: Final project detailed design

4.5.5 Drainage system layout

Drainage network of field, tertiary and main drainage system is provided to dispose of surplus irrigation water and storm water from the fields. Field drains which are parallel to the field canals are envisaged to be constructed by the beneficiaries. Tertiary drains collect drainage from the field canals and dispose them to the nearest natural drains. In some stretches they are parallel to the farm roads. The tertiary drains are aligned along contour on the higher side of the farm road while the main drains are aligned downhill. The main drains are important for drainage of the area towards the Muvumba river.

4.5.6 Irrigation and drainage system in paddy rice farms

Unit area drainage discharge was estimated at 0.045 m³/s/ha, depending on the calculation of runoff discharge analysis, in addition there is irrigation water which is continuously drained from irrigation canal and run off from the watershed and also has to be connected to the drainage network up to Muvumba river. Discharges and trench sizing in each of the catchments connected to the paddy field has to be drained in water ways as of the simulation of rainfalls corresponding to 5 return periods.

Table 4-5: Irrigation Plot Canals in Paddy Field

Items	Units	SD-1	SD-2	SD-3	SD-4	SD-5
Design discharge	Q (m ³ /sec)	50.07	2.88	2.16	1.44	0.72
Width of canal bed	B (m)	1.3	1.1	1	0.8	0.6
Water depth	D (m)	1.233	1.074	0.931	0.786	0.585
Bank slope	1:N	1.5	1.5	1.5	1.5	1.5
Cross-sectional area of flow	A (m ²)	3.883	2.912	2.231	1.555	0.864
Wetted perimeter	P (m)	5.746	4.972	4.357	3.634	2.709
Hydraulics mean depth	R (m)	0.676	0.586	0.512	0.428	0.319
Coefficient of roughness	N	0.25	0.025	0.025	0.025	0.025
Canal bed slope	1 (%)	0.10	0.127	0.143	0.167	0.200
Mean velocity	V (m/s)	0.974	0.990	0.968	0.927	0.835
Velocity head	Hv (m)	0.048	0.050	0.048	0.044	0.036
Free board	Fb (m)	0.217	0.226	0.219	0.214	0.165
Depth of canal	H (m)	1.45	1.30	1.15	1.0	0.75

Source: Final Detailed Design

4.5.7. Irrigation water requirement

The irrigation project will require a peak demand of 7.26 m³/sec from the storage of Muvumba Multipurpose Dam, assuming 24 hours designed for main irrigation canal. The annual water abstracted will be up to 115 million cubic metres (MCM) when the scheme is cultivated at 100%. The average water consumption per hectare in a dry year will be approximately 729 mm per annum.

For the calculation of the irrigation water demand, climate data and rainfall and evapotranspiration relevant to the project area and over a long time series is required. Moreover, for design purposes rainfall with 80% probability should be used, which requires continuous monthly rainfall records over many years. Table 4-6 presents the Average rainfall, 80% dependable monthly (and annual) rainfall and evapotranspiration data.

4.5.8 Sourcing of construction materials

The consultant has conducted geological and geotechnical site investigation work along the left and right-side canals to identify the geotechnical characteristics of the ground. According to the material investigation, it was observed that the investigated materials (laterite, stone/gravel and sand) have enough geological reserve compared to the volume of materials required. The available quantity of construction materials against the required ones is illustrated in Table 4-7. Because this ESIA did not cover the sites for sourcing construction materials, site specific ESIA(s) for these sites (including those listed below) will be prepared by the contractor before construction works commence. Fig.4-9 indicates the location of construction materials identified during geological and geotechnical site investigation

Table 4-6: Average rainfall, 80% probability rainfall and Evapo-transpiration data

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Average rainfall (mm)	52.0	70.8	97.5	140.6	79.3	20.3	12.5	25.6	53.7	86.3	114.5	67.6	821.1
80% dependable rainfall (mm)	23.7	37.4	56.9	85.0	34.2	2.1	0	4.8	38.0	60.9	71.1	40.2	452.2
Effective rainfall (considering 80% dependable rainfall), mm	22.8	35.1	51.7	73.4	32.3	2.1	0	4.8	35.7	54.9	63.0	37.6	413.5
Evapo-transpiration mm/day	3.74	4.00	3.99	3.92	3.87	4.13	4.21	4.43	4.45	4.04	3.75	3.73	48.26

Table 4-7: Estimated Quantity of Available Construction Material as against required quantity

Proposed Borrow Area ID	X-Coordinate (m)	Y-Coordinate (m)	Area (m ²)	Estimated Depth of reserve (m)	Estimated Volume of Reserve (m ³)	Required volume (m ³)	Ratio (Available Volume/ Required Volume)
Laterite							
Borrow Area 1 (BP1)	4857843.4	532969.9	25,000	3	75,000	185,000	1.5
Borrow Area 2 (BP2)	4855923.68	538871.71	35,000	3	105,000		
Borrow Area 3 (BP3)	4849013.48	538487.70	33,000	3	99,000		
Borrow Area 4 (BP4)	4857066.46	528992.04	33,000	3	99,000		
Total for Laterite Soil					378,000		
Stone/Gravel							
Borrow Area 1 (BP1)	4849862.46	537328.30	52,100	3	156,300	115,000	5.6
Borrow Area 2 (BP2)	4849444.72	16568.07	66,700	3	200,100		
Borrow Area 3 (BP3)	4861656.35	539320.08	38,900	3	116,700		
Borrow Area 4 (BP4)	4852347.43	535621.71	56,798	3	170,394		
Total for Stone/Gravel					643,494		
Natural Sand							
Borrow Area 1 (BP1)	4855515.57	520153.88	28,900	3	86,700	60,000	7.35
Borrow Area 2 (BP2)	4852615.03	518435.97	33,600	3	100,800		
Borrow Area 3 (BP3)	4866612.46	543380.79	36,600	3	109,800		
Borrow Area 4 (BP4)	4843890.15	547963.45	48,000	3	144,000		
Total for Natural Sand					441,300		

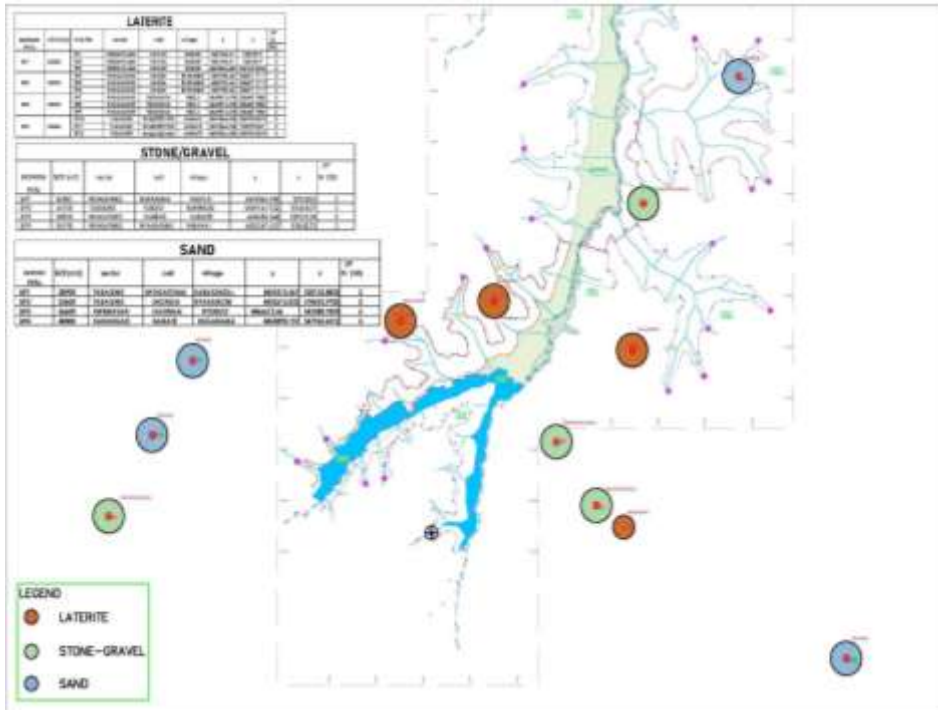


Figure 4-10: Locations of construction materials

4.7 Design of roads in the irrigation system

Belt roads are planned on the inner sides of the scheme i.e. just adjacent to the Primary canal as service road which facilitates during the construction, operation and maintenance of the project. This road is 6 m wide and is planned to serve during construction of the scheme as well as during operation of the scheme. These roads will be used for movement of agricultural produce and also tractors. The existing roads are categorized as farm roads and district roads and inside the command area. These are presented in Fig. 4-10 and 4-11.

Type of road	Number (designation) of road stretch	Road length (m)	Type of road	Number (designation) of road stretch	Road length (m)
District	1	3,787	Farm	1	1052
	2	1,916		2	1852
	3	365		3	301
	4	508		4	902
	5	392		5	622
	6	523		6	1457
	7	398		7	770
	8	322		8	747
	9	238		9	620
	10	147		10	793
	11	18,553		11	1987
	12	795		12	614
	13	883		13	1014
	14	1,003		14	531
	15	472		15	1810
	16	451		16	666
	17	13,613		17	1337
	18	1,097		18	1199
	19	1,623		19	830
	20	1,375		20	695
	21	1,041		21	1302
	22	964		22	1525
	23	1,071		Total	22626
	Total	51,536			
Grand total 74,162 km					

Figure 4-11: Summary of existing roads

The existing District roads are in normal condition but the farm roads need to be rehabilitated.

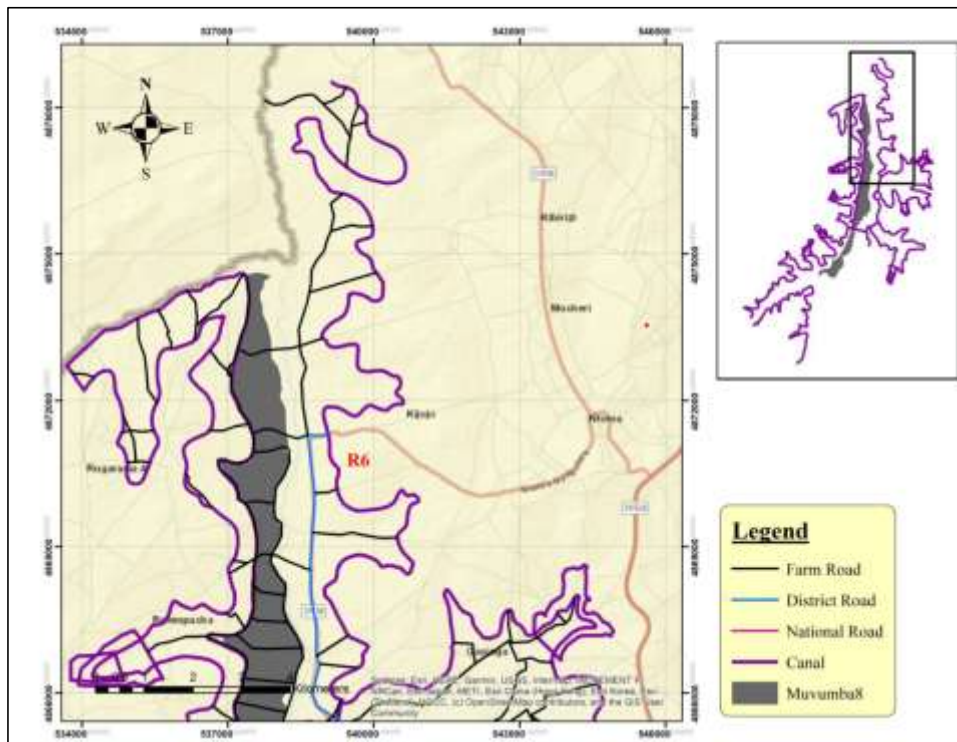


Figure 4-12: Existing roads in the scheme (District Roads and Farm roads)

For the new roads the grading and laying a murram compacted for 6 meter wide road of for the all stretches all along the irrigation canal is designed with a compaction to 95% Maximum Dry Density (MDD) for a length of 200 km in layers of 150mm by mechanical means approved by the Engineer in charge. There will be new roads - 14 numbers of total length 43 Kms, within the farms (i.e. farm roads). Layout of roads in one of the areas inside the command area is shown in Fig. 4-13

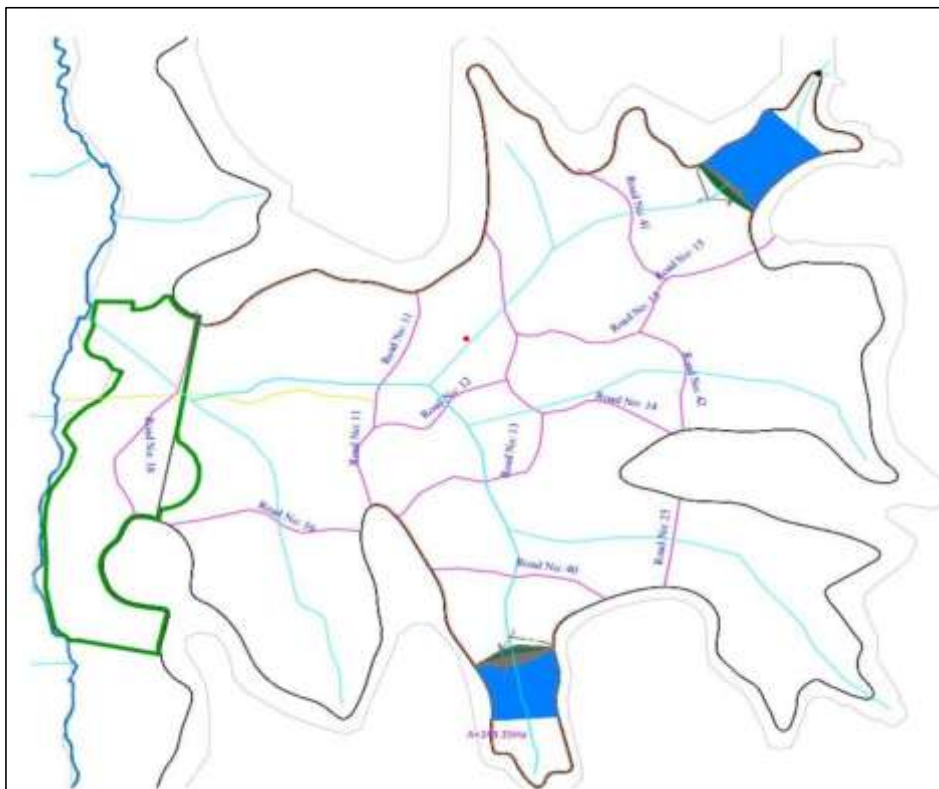


Figure 4-13: General layout of proposed farm roads in one of the areas in the command area

4.8 Post-Harvest Infrastructure

Postharvest loss can be defined as the degradation in both quantity and quality of a food production from harvest to consumption. Quality losses include those that affect the nutrient caloric composition, the acceptability, and the edibility of a given product. These losses are generally more common in developed countries. Quantity losses refer to those that result in the loss of the amount of a product.

Loss of quantity is more common in developing countries. Farmers and food sellers have been concerned about losses since agriculture began. Yet the problem of how much food is lost after harvest to processing, spoilage, insects and rodents, or to other factors takes on greater importance as world food demand grows. Cutting postharvest losses could, presumably, add a sizable quantity to the global food supply, thus reducing the need to intensify production in the future. 10 post-harvest infrastructures have been planned under this project to reduce Post harvest loss.

Agricultural crops losses are a measurable reduction in foodstuffs and may affect either quantity or quality. They arise from the fact that freshly harvested agricultural produce is a living thing that breathes and undergoes changes during postharvest handling. Loss should not be confused with

damage, which is the visible sign of deterioration, for example, chewed grain and can only be partial. Damage restricts the use of a product, whereas loss makes its use impossible. Losses of quantity (weight or volume) and quality (altered physical condition or characteristics) can occur at any stage in the postharvest chain.

The household metal structure is one of the key post-harvest technologies in the fight against hunger and for food security. It is a simple structure that allows grains to be kept for long periods and prevents attack from pests such as rodents, insects and birds. If the grains have been properly dried and the household metal structure is kept under cover, there are no problems of moisture condensation inside it. So it is the best procedure to reduce the losses during the harvesting process and it should be adopted.

The design of drying ground adopted and shelter for harvesting are commonly constructed at MINAGRI sites by Post-Harvest and Agribusiness Support Project (PASP). Existing drying ground and shelter in nearby area for post-harvesting is shown in Fig.5-14. Similar facility is proposed in the irrigation scheme, under component 1, 10 post harvest infrastructures will be constructed



Figure 4-14: Existing drying ground and shelter in nearby area for post-harvesting (similar facility proposed in Muvumba)

Fig.4-14, 4-15 and 4-16 depict the Plan, front elevation and right elevation of the post-harvest building

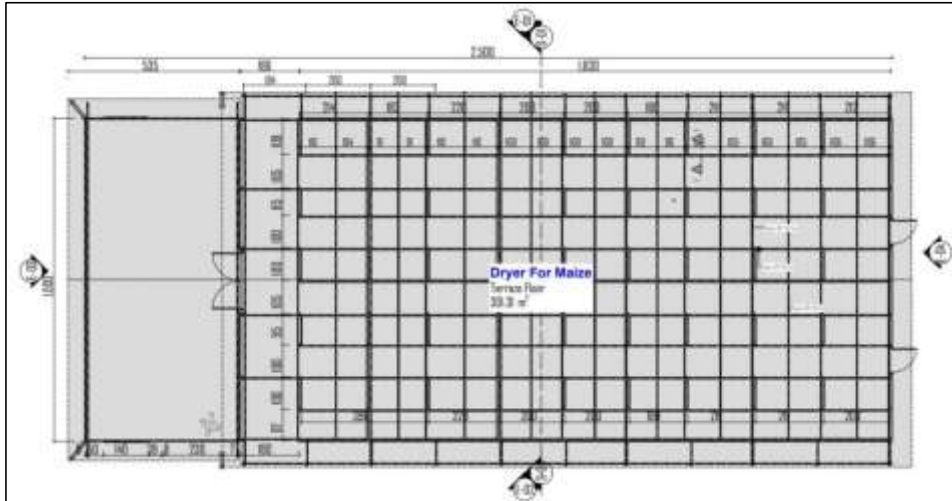


Figure 4-15: Plan of post-harvest storage building

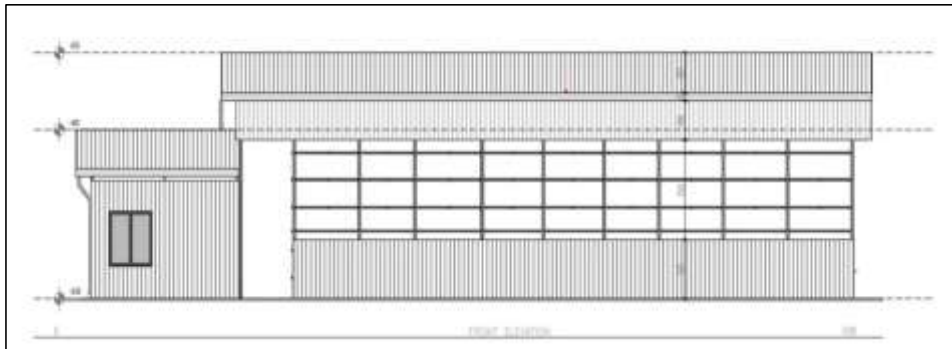


Figure 4-16: Front elevation of building

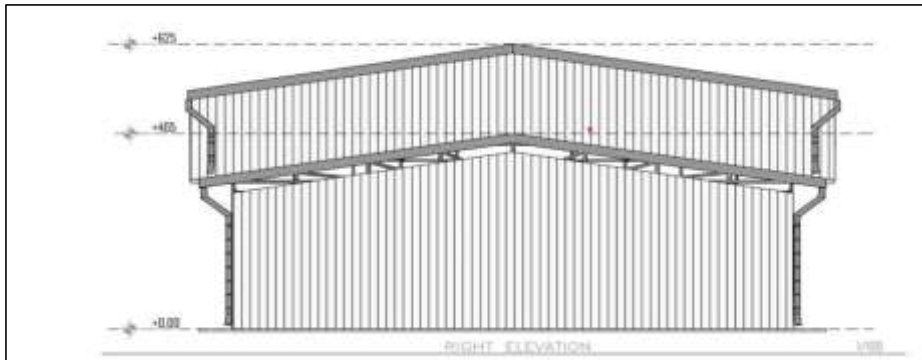


Figure 4-17: Right elevation of building

4.9. Livestock water supply layout and design requirements

4.9.1. Livestock water demand

Muvumba river serves as the main source of water for the entire valley of Muvumba. The water requirement for cattle is closely tied to whether the animals are lactating, the moisture content of their feed ration and environmental factors such as air temperature and relative humidity. During this design the following parameters have been studied:

- Number of cattle and critical locations
- Existing infrastructures or facilities for livestock watering
- The water consumption per head per day of each type of animal

The location of a watering source is critical. Watering sources can influence grazing, compaction, and manure/nutrient deposition patterns. The watering source should be placed in an area where it is protected from pollutants which can be harmful or fatal to livestock. Water requirement for various types of cattle are listed in Table 4-8.

Table 4-8: Water requirement for various types of cattle

Cattle Type	Demand (l/head/day)
Cow-Improved (for milk)	82
Goat	8
Sheep	8
Swine	15
Chicken	0.5

Source: Development of Rwanda national water resources Master plan, Rwanda Natural Resources Authority (RNRA) 2014

For more than one animal to drink at a time, the water supply needs to be adequate. The water supply rate, volume of water, and allotted space need to be greater than or equal to the demand in order to allow non-dominant animals an opportunity to drink as much water as they need. The average water considered while designing the water consumption per cattle per day is 80 litres; this number is considered as high but while designing the water demand, the water conveyance is always considering the peak. If more than one animal can drink at once, the supply rate must be equal to the combined drinking capacity of the animals. If the flow rate cannot keep up with demand, then storage or additional volume in the form of increased tank size or pumping equipment should be provided to offset the difference.

Dairy animals vary greatly in their daily stock water requirements depending on (1) breed, (2) stage of lactation and milk production, (3) water quality, and (4) ambient temperature. However, water should be available to dairy cattle at all times. If this is not possible a 'rule of thumb', is applied to determine the quantity of water required by the animals. Therefore, the daily water intake by milking cows is estimated as follows:

- ♣ Dry matter intake per day in kg x 6
- ♣ Plus 1 liter of water per every liter of milk produced daily
- ♣ Plus, additional allowances for extremes of weather

Given the total number of cattle in the district command area and, assuming a total dry matter feed intake (TDMI) of 12 kg per cow per day, water requirement is calculated as
 12 Kg TDMI x 6 = 72 litres of water/cow per day.

Assuming that the cow is producing 10 litres of milk, which is equal to 10 litres of water, the total water requirement of a cow in the command area will be 72 + 10 = 82 litres of water per cow per day.

The main source of water for cattle will be Muvumba Dam which its construction is ongoing in the upstream of the command area, and water will be channeled from Muvumba dam together with irrigation water into the canal to farms in the command area and thus various water intake through pumping or any other water offtake sites for water for cattle is provided.

The number of livestock was determined herein to remain unchanged until 2040 in accordance with the "Consultancy services for development of Rwanda National Water Resources Master Plan (2014, RNRA)." However, it was planned herein that the proportion of milk cow (cow-improved) would be expanding considering the qualitative improvement of livestock farming industry in line with governmental policies. Drinking water requirement for livestock in the year 2040 is presented in Table 4-9.

Table 4-9: Drinking water requirement for livestock in m3/year (Target year: 2040)

Sector	Cattle	Goats	Sheep	Pigs	Rabbit	Chicken
Rukomo	353,502	42,328	3,848	5,79	496	2,636
Karama	145,468	38,568	5,304	2,28	328	2,068
Rwempasha	2,421,132	14,6	8,256	4,17	392.5	2,044
Nyagatare	1,869,682	27,328	3,84	1,8	247	4,61
Tabagwe	816,064	43,624	6,656	1,005	356	3,792
Sub-total	1315,034	166,448	27,904	15,045	1427	15,15
Total (lit/day)	107832,788					
Q (l/sec)	1,247.6					

Source: RNWR Master Plan, 2014

4.9.2. Livestock water supply layout

The selected option is to keep the livestock in the irrigation command areas, all farms which are under command area boundary will be supplied water for livestock by providing a hydrant and trough is constructed and connected to this hydrant in each farm based to number of livestock.

The owner of each farm covered by the irrigation system will decide if he/she is going to plant the whole land with the crops or he/she will keep 10, 20 or 30% of the total land for livestock. In this case the land provided for livestock will accommodate all related livestock infrastructures especially shelter and troughs for feeding and watering the cows. This is also supported by Government policies wherein the movement of animals are discouraged in order to limit the disease transmission from one group to another due to search of food and water.

The unit of 40 ha has been designed for one trough and in phase-1 there will be 75 water troughs. Layout showing troughs p in the irrigation command area is shown in Fig.4-18.

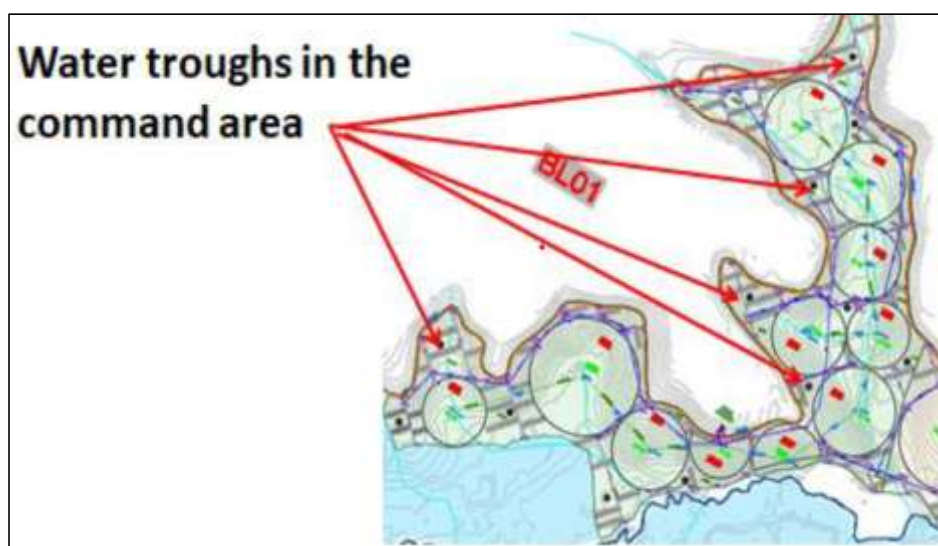


Figure 4-18: Layout showing troughs in the sprinkler area in the irrigation command area

4.9.2.1 Factors considered in selecting or sizing a water trough

Following points are common to almost all watering troughs:

- The capacity of the trough, or series of troughs, should be suitable for the herd to be watered
- The physical size should be suitable for the type of animal and the number to be watered at any given time.
- The construction should be sufficiently robust to take abuse from the animals, and to withstand the rigours of weather.

- The water supply should be capable of meeting peak demands.
- The trough should be easy to clean and to maintain.
- There should be some way for birds and small animals to escape if they happen to fall in.

The trough should be easy to access so that animals are not required to travel too far to reach it, and the surrounding terrain should not inhibit movement.

4.9.2.2. Design of a water trough

The required size of a water trough depends on whether the trough is intended to provide storage in addition to being a drinking vessel, on the total number of livestock being served, on the rate at which the trough can be filled, and on how many animals the trough is intended to serve at any given time.

Circular troughs provide the most storage for the amount of material used in their construction, but rectangular troughs provide the greatest amount of drinking space in relation to their capacity. To enable cattle to water from both sides, rectangular troughs should be at least 0.7 m wide. An appropriate height for a water trough is between 0.5 and 0.7 m.

If circular troughs are used, six of 3 m diameter troughs would be sufficient. Note that if six numbers of 3 m diameter troughs with a depth of 0.7 m are used, the troughs themselves would store about 30,000 L of water. Typical drawings are provided in Fig.4-19.

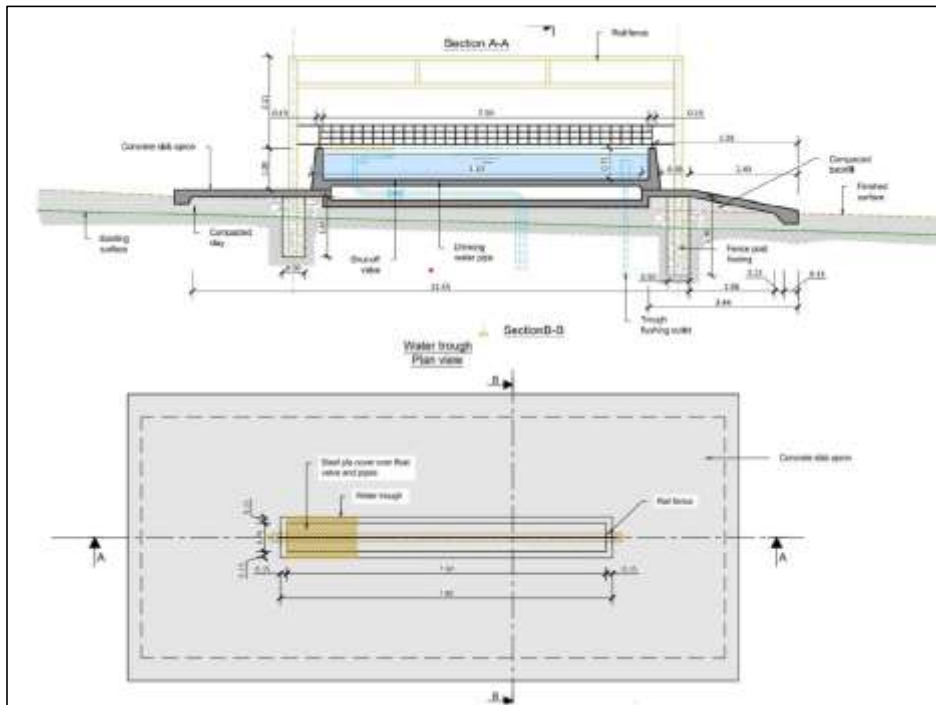


Figure 4-19: Water troughs (various views)

4.10 Project Management

The Muvumba Additional Financing Irrigation Sub-Project will be implemented by the Rwanda Water Resources Board (RWB) in close collaboration with the Rwanda Agriculture Board (RAB), which brings extensive experience in the design and implementation of irrigation initiatives. To formalize the collaboration, a Memorandum of Understanding (MoU) will be signed between RWB and RAB, clearly outlining the roles and responsibilities of each institution in the sub-project's implementation.

A dedicated Project Implementation Team (PIT) separate from the existing PIU managing the dam project has been proposed for this irrigation component. This team will include a Project Manager, a Social Safeguards Specialist, and an Environmental Specialist, and will be supported by the Single Project Implementation Unit (SPIU) within RWB, drawing from the institutional experience of the dam sub-project. The irrigation scheme will be managed by the district irrigation water User Committee in collaboration with water User Association which will be based on the irrigation scheme.

RAB will continue to provide technical expertise related to irrigation systems and livestock practices during the operation phase. In line with existing irrigation schemes, the Water Users Associations (WUAs) will remain under the management and supervision of RAB to ensure sustainability and farmer engagement.

4.10 Project activities

4.10.1 During pre-construction phase

4.10.1.1 Land acquisition

This phase will involve acquisition of land for main canal construction and center pivots and affected persons will be compensated prior to the land take with sufficient notice to relocate. As the project activities will engage the putting in place of working spaces including site offices, machinery and equipment handling site, sanitary facilities and site protection facilities. Depending on the length of the main canal, the study proposes a six temporal camp sites for offices and storage of equipment can be considered. However, these lands will not be permanently acquired as they will be temporally used and this will be a sole responsibility of the contractor to lease the land from the owners. The contractor shall prepare the ESIA for temporary campsites, including rehabilitation plans to restore the land. Handover of these sites shall take place only after successful site rehabilitation.

Fair Leasing Arrangements for Temporary Campsites

Because land is leased for temporary campsites use, the contractor shall ensure that leasing arrangements are fair, transparent, and consistent. RWB will have full responsibility to ensure the lease negotiations are free of coercion and fair arrangements are provided to the persons.¹⁹

The lease agreement shall include:

1. **Environmental and Social Impact Assessments (ESIAs):** A site-specific ESIA shall be prepared in advance, addressing potential environmental and social impacts associated with the campsites.
2. **Rehabilitation Plans:** Detailed rehabilitation plans shall be developed as a part of ESIs and shall outline measures for full restoration of the land to its pre-lease condition or to an improved state, as agreed. These ESIs and rehabilitation plans will be annexes to the leasing contracts
3. **Financial and Performance Safeguards:** The agreement shall specify financial arrangements (e.g., rental fees, and rehabilitation guarantee) to guarantee implementation of the rehabilitation plan.

¹⁹ If a purchase, lease, or other type of land transfer includes land on which people other than the owner live or have use, whether formally or as customary or informal occupants at the time of the transaction, OS5 will apply.

4. **Handover Conditions:** Handover of the leased site shall only occur after joint inspection and confirmation that all rehabilitation measures have been satisfactorily implemented, and the land owner signs off.
5. **Remedies for Non-Compliance:** In the event that rehabilitation obligations are not fully or partially met, the agreement shall include provisions for the contractor to undertake the works at the cost of the defaulting party e.g themselves or a sub contractor. RWB is responsible to ensure the Contractor's Contract clearly stipulates obligations related to the leasing arrangements and liabilities therein including provision of environmental security.

These provisions shall ensure that temporary land use for campsites is managed responsibly, with clear obligations for rehabilitation and full restoration of the affected sites.

4.10.2 During construction phase

4.10.2.1 Establishment of temporal Site installations

Initial activities during this phase will involve putting in place of the pre-fabricated camp site, mobilization of machinery and equipment handling site, sanitary facilities and site protection facilities. The project will start with 2 camp sites-one on the left and one on the right side of the main channel. Each site will be composed of site office, storage yard and sanitary facilities.

As there will be no labor camp on the project site, the project will proceed with employing labor from the site proximity communities. Various plant and equipment to be used during the execution of civil works will include: Graders, Vibrators /Rollers, Water Trucks, Bulldozers, Front End Loader, Vehicles, Containers, Concrete Mixers, Concrete Pavers, Excavators, Water Pumps, Mechanical Tool Boxes, Civil Plate Compactors, Tipper Trucks, etc. The number of each article/ equipment or machinery is to be determined by the contractor for construction.

A. Components of temporal site installations

The design of site installations has planned to include site offices for contractor, the supervision Consultant, Project Implementing Team, meeting room for 20 persons, some bathrooms, workshops, stores, space for any kind of store, parking space, water and electricity supply installations, electric facilities, and deposits. In general, temporal site installations for this project will be mainly composed of the following elements:

- Site offices
- Storage yards
- Workshops
- sanitation facilities
- Environmental facilities: Temporary water supply and sewage treatment facilities
- Temporary electric facilities.

B. Temporary water supply facilities

Water required at a construction site is divided into living water (drinking water, etc.) including that needed for the office facilities and construction water (aggregate washing, concrete mix, etc.). Therefore, water will be supplied in two ways: Living water will be purchased via Water and Sanitation Cooperation (WASAC) Nyagatare branch, whereas construction water (including water spray for reducing dust emission during construction) will be pumped from Muvumba river, stored in a water tank and then supplied. The capacities of the water supply facilities are shown in Table 4-10 below.

Table 4-10: Specifications of the Temporary Water Supply Facilities

Item description		Construction water	Domestic water
Supplied locations	Location	Primary canal and cross drainage structures, siphons	Contractor's temporary sites
	Method	Intake from the Muvumba Muvumba river and stored in water tanks	

C. Waste treatment facility

Wastewater will be produced from the contractor's site and will cause adverse impacts on the water quality when directly released to the open environment.

Mitigation measures:

- Establishment of proper toilets connected to septic tanks at the contractor's site and pumping stations i.e Installation of wastewater treatment facilities to treat sewages and fecal sludge produced by personnel.
- Site specific ESIA and rehabilitation plans prepared by the contractor will be required to guide C-ESMP.

D. Temporary electrical facilities

Temporary electrical facilities consist of temporary lighting. Major targets of power supply are temporal sites and construction lightings, and pumping stations. The design indicates about 230-440V alternating current (AC) for construction and lighting of the contractor's site.

4.10.2.2 Siting of borrow pits and quarries

Prior to construction phase, there will be a review on the construction material sources proposed by the consultant during geotechnical investigations. The siting of those material sources will also be initiated by seeking permit and license from Rwanda Mining, gas and petroleum Board (RMB). Site specific ESIA's will be undertaken for these facilities. This is because this ESIA does not cover the sites for quarry, borrow pits and sand-gravels materials as the final lists are not available as at the time of this ESIA.

4.10.2.3 Earth works: Site Preparation and Leveling

Initial site preparation will involve the removal of substantial vegetation cover, scarification of topsoil, and earthworks to establish the required levels and drainage falls. Although the project area is generally level, some earthworks will be required to achieve suitable working conditions. These activities will predominantly involve the use of machinery such as bulldozers and graders.

Site preparation works will entail the following:

- Clearing and grubbing to removal of existing vegetation
- Topsoil stripping for removal and stockpiling of the upper fertile soil layer for later rehabilitation.
- Levelling and grading for cutting and filling operations to create a stable and uniform working surface.
- Excavation works for drainage channels, and waste management facilities such as soak pits, septic tanks, and toilets).
- Compaction to stabilize of the ground

All works shall be planned and executed in line with mitigation measures highlighted in this ESIA to minimize land disturbance and facilitate eventual site rehabilitation.

4.10.2.4 Cement Works: Construction of canals and livestock water use infrastructures

The project civil works will engage the construction of open canal system in lined concrete material of sand and cement as well as troughs construction made of sands and cements and a significant amount of earth moving will be required.

4.10.2.5 Traffic movement of construction materials

Transportation of construction materials / waste to and from the sites will involve the movement of heavy vehicles on access roads to the project sites as well as within the sites. Construction activities such as clearing, excavation, earth moving and mixing of concrete will involve the movement and operation of heavy plant and equipment around the sites.

4.10.2.6 Rehabilitation and upgrading of Access roads

The rehabilitation and upgrading of the existing access roads have been included in the Muvumba irrigation scheme project not only to operate and maintain the project structures but also to facilitate the movement of the agricultural products. Apart from the need to upgrade this road by providing all weather gravel surfacing, additional major requirement to ensure sustainable maintenance is to provide effective roadside open drainage ditches. Without good drainage, allowing quick run-off of storm water well graveled road will lose gravel and will become impassable even with short but intensive rains. Hence the construction of drainage culverts is proposed at the drain crossings.

4.10.2.7 Dismantling of equipment and fixtures and Site Restoration

All temporary site installations, road materials and equipment including electrical installations, furniture partitions and pipe-work among others will be dismantled and removed from the site on decommissioning of the temporal sites, and other project components. Once all the wastes resulting from demolition and dismantling works are removed from the sites, the sites will be restored through replenishment of the topsoil and re-vegetation using indigenous plant species or developed according to the development trend of the time.

4.10.2.8 Construction materials and Energy

Sand, stones and gravel that will be used for construction of various irrigation structures were identified during geotechnical investigation but source locations will be finalized later and subjected to site specific ESIA's. During construction phase, Electric energy needed at contractor's site will be tapped from existing distribution line available in the vicinity of the project site.

4.11.2.9 Waste generated During construction

During construction phase, human waste will be generated from workers and staffs at the construction sites and temporal site installations. Movable toilets facilities will be installed to facilitate disposal of human wastes and improve sanitation at construction sites. The locations of toilets will be areas that will not cause underground pollution or poor sanitation to workers and the surroundings. As part of land lease agreement, the contractor shall prepare site specific ESIA's which will include rehabilitation plans prior to site installation and its associated facilities.

In addition, large amounts of construction solid waste will be generated during construction phase. These will include construction material debris, metal cuttings, rejected materials, surplus spoil, excavated materials, paper bags, empty cartons, empty paint and solvent containers among others. During construction, the contractor must hire a Licensed waste collection company to assist in both general and hazardous wastes collection and disposal. The disposal should be the existing approved landfill of Nyagatare District. Prior to collection by the hired company, these shall be stored in the waste/dust bins that will be located in the selected places or a designated spoil area on site.

4.10.3 During Operation phase

During the operational phase, the key activities will include:

- Water management: operation of intake structures, canals, and pumping systems; scheduling and distribution of water to farms in line with crop requirements.

- System maintenance: regular inspection and servicing of canals, pipelines, pumps, gates, and control structures; desilting of canals and reservoirs to maintain design capacity; and repair of leaks, erosion damage, and embankment failures.
- Health and safety measures: continuous implementation of measures to control waterborne diseases through effective drainage management, and ensuring safe access to canals and reservoirs by providing fencing, signage, and cross-drainage bridges.
- Drainage system upkeep: regular removal of silt and vegetation, repair of side slopes, maintenance of road banks, and servicing of outfalls and other hydraulic structures

The importance of regular maintenance of the entire drainage system is emphasized in the detailed design, including removal of silt, removal of vegetation, repair of side slopes, maintenance of road banks and, and maintenance of outfall and other structures.

The Water User association will be responsible for small maintenance like desilting of canals and reservoir as well as water allocation while maintenance requiring technical expertise shall be done by district through district irrigation steering committee. Field ditches and drains would require maintenance by the users of each basic irrigation unit - weed removal and maintenance of slopes and profile. Furrows would require continuous maintenance by the individual sub-plot users. The maintenance of irrigation canals will be the responsibility of District Irrigation Water User Association under this irrigation scheme, in collaboration with the district and RAB for their technical support.

4.10.3.1. Materials and Energy used

The operation of center pivot will need electric energy to operate. This electricity will be tapped from existing distribution line available in the vicinity of the project site.

4.10.3.2 Waste Generated

Clearing canals will be made for the purpose of removing sediments. As these are very rich in nutrients, they will be used by farmers in their plots. During operation, solid wastes will be generated from pumping stations during their operation. A proper waste collection point will be located to dispose such wastes temporarily and approved waste collectors will be used to dispose them in the district landfill for their treatment. To avoid pollution of canals, the pumping stations will be sited off the canal.

4.11.4 Decommissioning phase

The lifespan of the irrigation scheme depends on different facilities. In case of pivot machines, their lifespan can be 25 years, maintenance at every 3 years for access road, 15 years for pumps replacement. Civil works for canals can last for even up to 40 years with maintenance in between. The decommissioning phase for this irrigation scheme will mainly involve the maintenance or upgrade of different irrigation facilities depending on lifespan mentioned above.

For upgrading access roads within the command area, a layer of laterite will be added to fill potholes as well as rehabilitating the related cross drainage structures and box culverts. For earthen canals, it requires regular removal of sediments while civil works will be implemented for concrete canals. Pivot machines will be replaced upon defects depending on the lifespan mentioned above. The focus on decommissioning in this project therefore largely focuses on the temporal construction on the project site which will be cleared, and site restored by the contractor during the construction period.

The main sources of energy that will be required for decommissioning of the project will include electricity and diesel. Electricity will be used for welding, metal cutting/grinding and provision of light. Diesel will run heavy trucks, machinery such as bulldozers and concrete mixers. The proponent should intend to promote efficient use of materials and energy through proper planning to reduce economic and environmental costs of excavating new materials.

5. ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

5.1. Background

Baseline data plays a crucial role in the Theory of Change (ToC) by providing a reference point to measure progress and impact over time. It represents the initial conditions before any intervention begins, allowing organizations to identify gaps, set realistic goals, and track changes effectively. By understanding the starting point or initial conditions, stakeholders can define measurable indicators and assess whether expected outcomes are being achieved. Additionally, baseline data helps in testing assumptions within the ToC framework, ensuring that strategies are based on real-world evidence rather than speculation. It also aids in decision-making, enabling adjustments to interventions if results deviate from the anticipated pathway of change. In essence, strong baseline data enhances transparency, accountability, and the overall effectiveness of any change initiative.

The irrigation project will be implemented in Nyagatare District as presented on the map of project sites. This chapter highlights the biophysical situation (hydrology, flora, fauna, sensitive ecosystems, soils) and socioeconomic baseline of the sub-project site. It focuses on sensitive ecological and agronomic areas that may be affected by construction activities, land acquisition, labour influx, agrochemicals application, and vector attraction. Therefore, these baseline data should be used to track the project impacts during and after the scenario.

5.2. Biophysical Environment

5.2.1. Physical environment

This section discusses the physical environment of irrigation project area, with particular focus on the location, climate (i.e., temperature, rainfall), hydrology, water quality, air quality, land use and management, topography, status of existing hydraulic structures and soil of the project area, as well as the socio economics.

5.2.1.1. Location of Muvumba command area

The command area of the irrigation project covers the valley of Muvumba river starting from the Muvumba Multipurpose Dam. The proposed command area covers parts of Karama, Tabagwe, Rwempasha, Nyagatare, and Rukomo sectors of Nyagatare District in the Eastern Province and in all covering 3,073ha, stretches 76 km from the dam intake to the downstream of Muvumba river. On the left side, the command area stretches up to the Umuyanja stream on the Uganda border and along the right side from the Muvumba Multipurpose Dam to Rukumo (one leg) and on after crossing the Muvumba river [from left to right through the Main Siphon (Siphon – 1)] and continues towards Kagitumba. **Fig. 5-1** shows the location of the command area within the five target sectors.

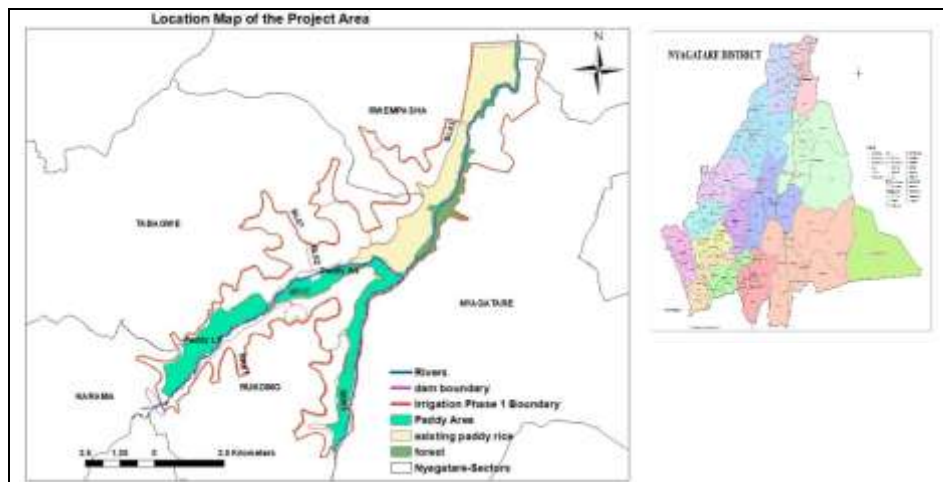


Figure 5-1: Location of the project command area

5.2.1.2. Relief

This project is located in granite low valley whose average altitude is 1513.5m from Mean Sea level (MSL). This kind of topography is potential to undertake modern and mechanized agriculture. The terrain is also characterized by flat to gently sloping topography.

The landscape of the project area is characterized as a gentle flat. The project area is a part of the Mutara plateau. This is a vast plain with reduced relief where the altitudes vary between 1300 m and 1500 m. The river valleys have gentle slopes only interrupted by some valleys with steep slopes where the heights reach 1550 to 1600 m like in the East of Nyagatare.

5.2.1.3. Topography

Muvumba marshland is characterised by steep and undulated topography, situated at an elevation ranging from 1273 m to 2422 m. The topographic map of the catchment was produced using Digital Elevation Model (DEM) obtained from Rwanda Water Board (RWB) database, which is at 10m resolution with the Geosurvey points of 2019.

The whole District is located in a low granite valley, whose altitude is 1513 m from mean sea level (DDP 2013 -2018). The hilly sides have gentle slopes which end in Muvumba and Akagera Rivers' wetlands. The lowest place is Umuvumba valley and the highest parts are tops of Busana and Mirama hills. The catchment area in Uganda side, upstream of the project area, is constituted by a mountainous zone with a tropical rainforest (Olsen et al 2001) and a buffer zone where a mountainous zone transits to a savannah (Breugel et al. 2011).

Generally, the Eastern Savanna Agro-climatic Zone is characterized by a gently sloping landscape with hills that are intersected by large valleys (Verdoodt and van Ranst, 2003). Similarly, the command area of Muvumba River Dam is gently and contiguously flat along the river, especially on the right-side irrigation canal. Around 45.2% of the command area is located below 5 % slope and about 50.0% of the irrigable land is located between 5~10 % slope class. Topographic map of the command area is shown in Fig.5-2.

The end stretches of the command area on the right-side canal is a wide flat valley (0~5% slope class) bordering the existing Musheli Drip irrigation scheme. In general, the topography of the command area is suitable for irrigated agriculture, although the steeper slopes on hillside will require terracing for field-crop production. The surrounding catchment areas of the project command area are characterized by gently rolling hills on both sides of the irrigation canal. The elevation of the command area varies from 1,329 m to 1,390 m according to the canal level. Also, the command area is bisected by the Muvumba river.

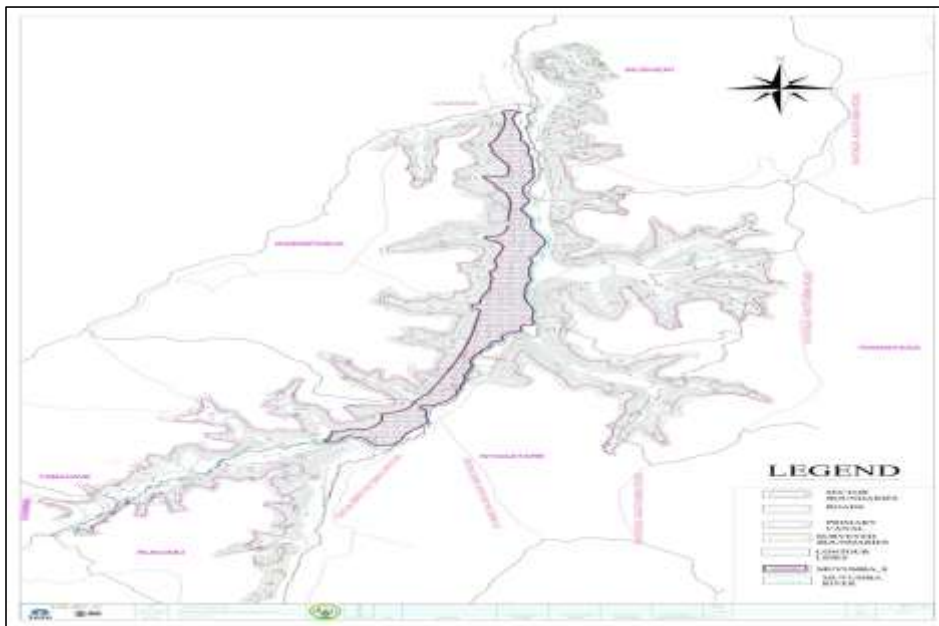


Figure 5-2: Topographic map of Muvumba catchment

5.2.1.4. Climatic conditions

The climate within the area experiences small quantities of rain which are unevenly distributed throughout the year. The Irrigation project site shares the climate with that of Nyagatare District which is characterized as hot region of Rwanda due to its relatively high temperatures; having two main seasons: one long dry season that varies between 3 and 5 months with an annual average temperature varying between 25.3 °C & 27.7 °C as shown in Table 5.1.

On average (from 1999-2019), the driest month is July as shown in Table 5.1 with an annual rainfall is quite less (827 mm/year) and unpredictable to satisfy the needs for agriculture and livestock, with 9 mm |0.4 inch of rain²⁰. The highest amount of rainfall occurs during April with a mean value of 131 mm | 5.2 inch.

The closest available climate station in the area is Nyagatare station (Latitude:01° 17' Longitude: 30°18', Altitude 1,377 metres above sea level) having satellite merged data for rainfall from 1981 to 2021. Summary of monthly average rainfall for Nyagatare from this satellite merged data series is presented in Table 5.3.

Table 5-1: Summary of satellite merged monthly rainfall data for Nyagatare

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average (mm)	37.9	50.0	111.9	99.9	123.7	25.2	7.5	25.6	69.7	103.3	100.2	68.2	823.0

Rainfall data from Gabiro station is analyzed considering the recorded data from Rwanda Meteorological Agency (Meteo Rwanda) in the period from 1931 to 1989. In this, 5 years have been excluded (i.e. 1931, 1952, 1954, 1979 and 1989) which don't have data for 4-11 months in each of these years. Summary is shown in Table 5-2.

Table 5-2: Summary of monthly rainfall data for Gabiro station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average (mm)	52.0	70.8	97.5	140.6	79.3	20.3	12.5	25.6	53.7	86.3	114.5	67.6	821.1

It is observed that average annual rainfall in Gabiro is slightly less than that of Nyagatare i.e. Gabiro station is slightly drier as compared to Nyagatare. Hence the output of the analysis done using Gabiro data is safe in terms of irrigation system sizing (i.e. slightly conservative) as compared to running the analysis using Nyagatare data.

²⁰<https://en.climate-data.org/africa/rwanda/east-province/nyagatare-56217/#climate-graph>

Considering all aspects, Gabiro station data, both rainfall and other climate data is utilized and further analysis carried out. These are part of Agronomy and value chain study where we have utilized this rainfall data in ascertaining the water availability for irrigation.

The monthly distribution of the rains varies from one year to another. In the command area (in the year of 2004- 2024), annual rain falls are both very weak (909 mm/annum) and still very unpredictable to satisfy the needs in agriculture and livestock that requires irrigation system construction as seen in Table 5.4.

Table 5-3: Data: 1991 - 2021 Min. Temperature °C (°F), Max. Temperature °C (°F), Precipitation / Rainfall mm (in), Humidity, Rainy days. Data: 1999 - 2019: avg. Sun hours

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	21.2 °C (70.2) °F	22 °C (71.6) °F	21.3 °C (70.3) °F	20.4 °C (68.7) °F	20.5 °C (69) °F	21.1 °C (70) °F	21.6 °C (71) °F	21.3 °C (70.7) °F	21 °C (69.8) °F	20.6 °C (69) °F	19.9 °C (67.7) °F	20.2 °C (68.4) °F
Min. Temperature °C (°F)	15.6 °C (60.1) °F	16.3 °C (61.3) °F	16 °C (60.7) °F	15.6 °C (60.5) °F	15.8 °C (60.4) °F	15.7 °C (60.2) °F	15.7 °C (60.3) °F	16 °C (60.8) °F	15.5 °C (59.9) °F	15.4 °C (59.8) °F	14.9 °C (58.8) °F	15 °C (59) °F
Max. Temperature °C (°F)	26.6 °C (79.9) °F	27.6 °C (81.7) °F	26.7 °C (80) °F	25.5 °C (77.8) °F	25.5 °C (77.8) °F	26.3 °C (79.4) °F	27.2 °C (81) °F	27 °C (80.7) °F	26.7 °C (80) °F	26 °C (78.7) °F	25.1 °C (77.3) °F	25.4 °C (77.8) °F
Precipitation / Rainfall mm (in)	55 (2)	57 (2)	104 (4)	131 (5)	87 (3)	22 (0)	9 (0)	40 (1)	72 (2)	115 (4)	125 (4)	87 (3)
Humidity(%)	66%	61%	70%	77%	71%	57%	48%	56%	64%	71%	76%	73%
Rainy days (d)	8	8	13	16	11	3	1	5	10	15	16	12
avg. Sun hours (hours)	9.8	10.0	9.3	8.2	8.4	9.5	10.1	9.8	9.6	9.3	9.1	9.4

The month that sees the most relative humidity is April (47.65 %). The month with the lowest amount of relative humidity is July (47.65 %). The month with the highest amount of rainfall is April (21.37 days), whereas the one with the lowest precipitation level is July (1.70). The rainfall analysis revealed that Ngoma receives the highest precipitation as well as some portions of Mulindi and Muvumba sub-catchments²¹.

Table 5-4: Monthly Rainfall (mm) for command area for the period of 2004-2024

M	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AV
MA	54	65	115	123	95	10	6	40	80	123	114	84	909
M: Month; MA: Monthly Average rainfall, AV: Average Annual Rainfall													

²¹ Meteorological Department, Government of Rwanda (Rwanda Urban Development Program & Preliminary Designs for Infrastructure, 2015 by Voyants Solutions PVT. LTD.& HICE Consult.

In the project command area, the month with highest rain fall in 2024 is April and October with 123mm and the lowest rainfall in July with 6 mm. Crops are likely to be vulnerable in the months of January, February, June, July and August.

5.2.1.5 Agro-Climatic Zones

The upstream part of the command has the characteristics of the Eastern Plateau and Buberuka Highlands Agro-climatic Zones): It covers parts of Rukomo, Karama, Tabagwe and part of Nyagatare Sectors. The Downstream of the command area is within the Eastern Savanna Agro-climatic Zone and covers part of Tabagwe, and Rwempasha, Sectors.

The downstream area has bigger flat lands but much drier and therefore unsuitable for rain-fed crop production without irrigation. The Muvumba valleys occupy a central part in the command area, with a series of rice perimeters that were developed across time using irrigation waters from the Muvumba and Warufu rivers.

5.2.1.6. Hydrology

A. Hydrologic network in the irrigation catchment

The hydrographic network is very limited in the district. Few of the rivers found there such as Nyiragahaya, Kayihenda, Karuruma, Nayagasharara and Kaborogota are erratic and intermittent. The weak river network constitutes a serious problem to respond to the needs of water for people and animals. Fig. 5-3 shows the project location map showing command area, catchments and stream network.

Muvumba river enters from Uganda and drains with a much gentler sloping landscape before joining the Akagera river at the border point between Uganda, Tanzania and Rwanda (outside of the project area), and thus, it is a transboundary river. The Muvumba river is the only permanent water body of the region and its waters are required for water supply, irrigation, and livestock water use. During field work, it was observed that another main river is Karungeri river, which serves as a tributary of Muvumba, which flows completely within Rwanda and discharges to Muvumba close to Nyagatare town.

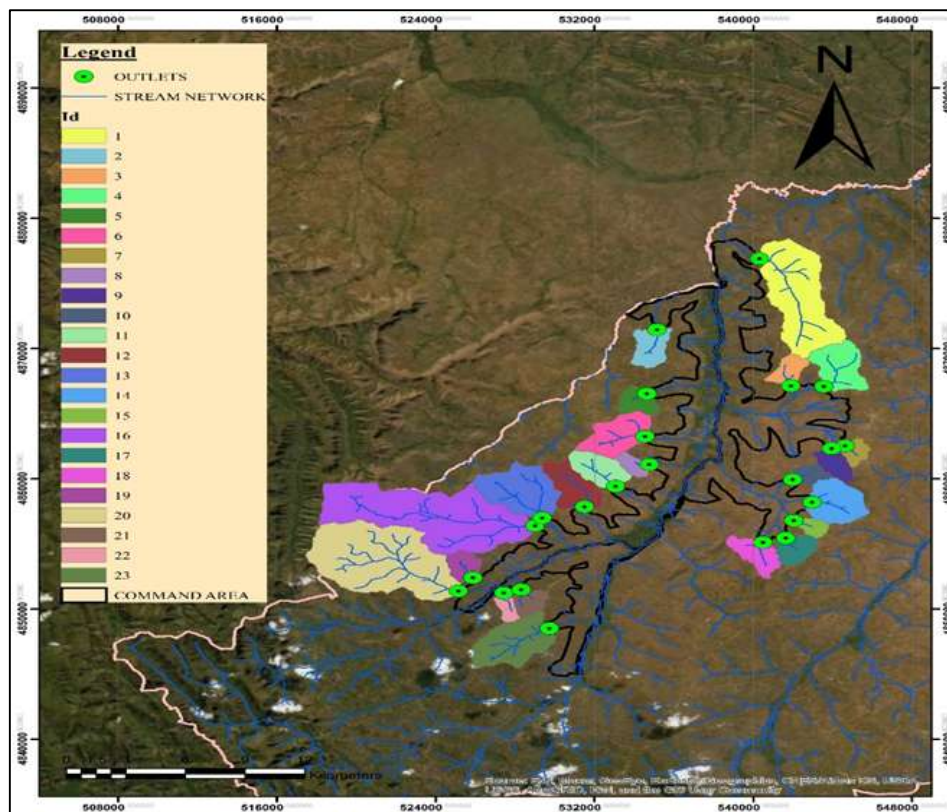


Figure 5-3: Hydrologic Network in the project area

Muvumba river and its wetland are the main ecosystem that will be affected during irrigation canal installation. The main drainage system of the command area is Muvumba and Warufu rivers which flow from north to south and drain to the Muvumba river at the end of the command area. Some parts of the command area at the valley bottom fall in marsh lands.

B. Water Resources and Hydrograph

The hydrographic network is very limited in the District of Nyagatare. Apart from the River Muvumba that cut across the District, the Akagera and Umuyanja Rivers passing the District constituting its limits with Tanzania and Uganda, respectively, there is no other consistent river that can be exploited by the population in Nyagatare.

Few of the streams found in the project area, such as Nyiragahaya, Kayihenda, Karuruma, Nayagasharara and Kaborogota are erratic and intermittent. The weak river network constitutes a serious handicap to responding to the needs of water for people and animals. The Muvumba river is a source of irrigation for Muvumba P8 Marshland which is also under proposal of rehabilitation by the Rwanda Agricultural and Animal Resources Development Board (RAB) under commercialization and de-risking agricultural and transformation (CDAT) project.

C. Water quality in the project area

Overall, water quality analysis is essential for sustainable agriculture, enabling farmers to optimize crop production, protect soil and water resources, and ensure the health and safety of both crops and livestock.

Rice in Muvumba agricultural practices rely on irrigation to supplement natural rainfall. Poor-quality irrigation water can adversely affect soil structure, crop growth, and yield. Water quality analysis helps farmers determine the suitability of water for irrigation, preventing damage to rice and soil of Muvumba marshland. Water from Muvumba river will be used to fill Muvumba multipurpose dam, and part of dam water will be used in the irrigation scheme. The quality of irrigation water directly influences the quality of the soil and the crops grown on this soil. Poor irrigation water quality has a negative effect on crop productivity, crop product quality, and public health of consumers and the farmers who come in direct contact with the irrigation water.

It is imperative that its water quality be assessed before its use to determine its suitability. In addition, the water will return to Muvumba river after use in the irrigation scheme. Water from the irrigation scheme may carry agrochemicals back to the river after irrigation and there is a concern of water pollution. For this reason, baseline data on different parameters should be captured for future monitoring to track the impact of the project throughout the project lifecycle.

To ensure representative water sampling, the water samples were collected by consultant team from the Upstream (1°21'12.63"S; 30°13'58.90"E) and Downstream (1°14'23.65"S; 30°20'39.71"E) of Muvumba River on July 23, 2025 and the samples were sent to Institute of Ines Ruhengeri, where samples were analyzed by third party to avoid conflict of interest. The upstream sampling point represent water quality at the dam where the water for irrigation will be abstracted from. The downstream is essentially the water that is exiting the wetland covered by the project area. After analysis, the results obtained in Annex 4A & 4B were summarized in Table 5-5. FAO standards were also used to compare with the obtained results with those of FAO permissible water quality for irrigation²². The parameters analyzed were pH, electric conductivity (EC), Total suspended solids (TSS), Total dissolved solids (TDS), nitrate (NO₃-N), Fluoride (F) and Chloride (Cl) ions, coliform, salinity, dissolved oxygen, trace metals of lead (Pb), Zinc (Zn), Cadmium (Cd), Manganese (Mn), and Arsenic (As).

²² <https://www.fao.org/3/t0234e/T0234E00.htm>

According to the results obtained, all parameters measured were in the range or below the maximum permissible limit for irrigation water set by FAO and RS 564:2023 Rwanda standards for ambient water quality, except Cd which slightly exceeded the set limit by FAO as shown in the Table 5-5. Generally, at the Upstream sampling point, most parameters showed slightly higher levels than Downstream, and this could be due to activities at the construction site of Muvumba Multipurpose dam located at the Upstream.

Table 5-5: Water quality data of Muvumba River at selected sampling sites

Parameters	Units	1 st sample Upstream	2 nd sample Downstream	Measured Average	RBS Standards ¹	FAO standard ²
Total Coliforms	CFU/10 0 ml	1.70×10 ⁵	1.68×10 ⁵	1.69×10 ⁵	4×10 ²	n.a
Fecal Coliform	CFU/10 0ml	2.35×10 ⁴	2.29×10 ⁴	2.32×10 ⁴	4×10 ²	n.a
pH	Units	6.8	7.0	6.9	6-8.5	5-9
EC	µS/cm	220	222.6	221.3	1000 ^a	700
TDS	mg/L	133	128	130.5	n.a	450-2000
TSS	mg/L	950	930	940	2100	250
BOD5	mg/L	4.8	5.2	5	na	na
COD	mg/L	11	12	11.5	na	na
Salinity	%	0.113	0.115	0.114	n.a	n.a
NO₃-N	mg/L	6.3	6.9	6.6	10	10
PO₄-P	mg/L	1.0	1.2	1.1	0.7	n.a
SO₄²⁻	mg/L	77	79	78	250	n.a
Cl⁻	mg/L	29	29.8	29.4	600	n.a
F⁻	mg/L	0.06	0.08	0.07	600	1.0
DO	mg/L	7.0	7.02	7.01	5	n.a
As	µg/L	ND	ND	ND	50	1000
Hg	µg /L	ND	ND	ND	2	n.a
Mn²⁺	µg/L	3.0	2.8	2.92	1000	2000
Pb²⁺	µg/L	9.1	8.94	9.02	50	5000
Zn²⁺	µg/L	40.5	40.26	40.38	2000	2000
Cd²⁺	µg/L	13.4	13.0	13.2	50	10
Total hardness	mg/L	44	42	43	na	na
Magnesium (Mg)	mg/L	10.9	10.0	10.45	na	na

n.a: not available; ND: not detected; ¹ Rwanda tandards for ambient water quality; ²FAO Standards for Irrigation water

D. Suitability of Muvumba river water quality for irrigation

Based on both FAO irrigation water quality guidelines and Rwanda Standards (RS), the Muvumba River water exhibits generally favorable conditions for use in irrigation across the five sectors of Nyagatare District, with certain cautionary parameters requiring attention. The water's **pH of 6.9** falls neatly within the FAO-recommended range of 6.5–8.4 and Rwanda's acceptable limit of 6.0–8.5, indicating it is well balanced for nutrient availability and optimal plant growth. **Electrical conductivity (EC) at 221.3 $\mu\text{S}/\text{cm}$** shows low salinity potential, well below the critical FAO threshold of 700 $\mu\text{S}/\text{cm}$, and thus poses no risk of salt buildup in soil or adverse effects on crop yield. Likewise, the **Total Dissolved Solids (TDS) of 130.5 mg/L** reflect excellent water clarity, with minimal mineral content that could otherwise stress sensitive plants or clog irrigation equipment. Nitrate levels ($\text{NO}_3\text{-N}$ at 6.6 mg/L) are well below the FAO limit of 30 mg/L and contribute useful nitrogen for crop uptake without causing toxicity, further supporting its agricultural viability.

However, challenges emerge with a few parameters. **Phosphate ($\text{PO}_4\text{-P}$) concentrations at 1.1 mg/L** exceed Rwanda's national standard of 0.7 mg/L, introducing risks of eutrophication, especially in slow-moving irrigation canals or storage ponds, where algal growth could interfere with system functionality and nutrient cycles. Additionally, **Cadmium levels averaging 13.2 $\mu\text{g}/\text{L}$** slightly surpass FAO irrigation safety thresholds ($< 10\mu\text{g}/\text{L}$), and is below Rwanda's permissible environmental limits ($\leq 50\mu\text{g}/\text{L}$), posing a low risk of long-term accumulation in soils and uptake by leafy vegetables and root crops.

From a design and systems management perspective, the presence of **Total Suspended Solids (TSS) at 940 mg/L**, although below RBS limits (2100 mg/L), could clog drip or sprinkler irrigation systems if not filtered or settled prior to use. This highlights the need for sediment traps, gravel filters, and regular flushing protocols in your irrigation infrastructure. Encouragingly, **fluoride (0.07 mg/L)**, **chloride (29.4 mg/L)**, and **sulfate (78 mg/L)** levels all remain within safe limits, ensuring water will not lead to leaf scorching, toxicity, or root disturbance under standard irrigation practices.

Corrosion Risk: With a pH of 6.9 and relatively low electrical conductivity (EC 221.3 $\mu\text{S}/\text{cm}$), the water poses minimal corrosion threat to irrigation infrastructure. Slightly acidic conditions (close to neutral) might cause minor wear over time in metallic pipes, but it's generally safe for reinforced PVC, polyethylene, and galvanized systems. The absence of chloride-induced corrosion is also supported by low Cl^- levels (29.4 mg/L), well below thresholds that typically trigger corrosion risks. In addition, FAO set limit values for evaluating water aggressivity as shown in Table 5-6.

Table 5-6: Limit values for evaluating the aggressivity of water to concrete

Test	Intensity of attack			
	None to slight	Mild	Strong	Very Strong
pH	>6.5	6.5 – 5.5	5.5 – 4.5	<4.5
Lime-dissolving carbonic acid (CO ₂), mg/l	<15	15–30	30–60	>60
Ammonium (NH ₄), mg/l	<15	15–30	30–60	>60
Magnesium (Mg), mg/l	<100	100–300	300–1500	>1500
Sulphate in water (SO ₄), mg/l	<200	200–600	600–3000	>3000

Source: Data adapted from Ayers & Westcot, (1994)

Most corrosion and encrustation problems are associated with water quality. Surface water supplies can be **corrosive to concrete** as shown in Table 5-6. Three types of corrosion are globally recognized (TYPE I, II & III). TYPE I is related to leaching corrosion, TYPE II: Ion exchange corrosion and TYPE III is related to corrosion by expansion.

This corrosion may affect the life of an irrigation canal lining but the most frequent corrosion occurs when groundwater is pumped through a closed concrete pipeline.

Salinity Impact: The water's EC and total dissolved solids (TDS 130.5 mg/L) fall well within FAO's safe range for irrigation (<700 μ S/cm and 450–2000 mg/L respectively), indicating very low salinity stress. This favors most crops, including those sensitive to salt, by preventing osmotic imbalances and salt-induced dehydration. Low salinity also supports long-term soil fertility, minimizing the need for leaching strategies.

Soil Infiltration: The relatively clean chemical profile, low TDS, neutral pH, and non-clogging salinity, supports efficient infiltration. However, elevated total suspended solids (TSS 940 mg/L) could restrict percolation in fine-textured soils or cause surface sealing if not pre-filtered. Mitigation with settling basins or sand traps will be essential to preserve infiltration rates and prevent crusting in furrow or basin systems.

The resulting data serves as a reference point for ongoing environmental monitoring throughout the project lifecycle. By establishing these initial benchmarks, stakeholders can track changes over time and detect any degradation in water quality linked to construction activities, natural processes, or anthropogenic sources. This proactive approach is vital for ensuring that the dam continues to provide clean, safe, and sustainable water resources to its intended beneficiaries.

E. Environmental flows (E-Flow)

The Muvumba multipurpose dam has facilities to release environmental flows as shown in Fig. 5-4. The indicated information regarding environmental flow releases is gathered from the Hydrology Study of the Muvumba Multipurpose Dam and hydropower plant installation project that will be constructed upstream.



Figure 5-4: Baseline on environmental flow

The Muvumba Multipurpose Dam, located between Kabuga (upstream) and Bushara (downstream), is equipped with facilities to release environmental flows to maintain downstream ecological integrity. Environmental flow releases are guided by the Hydrology Study of the Muvumba Multipurpose Dam and Hydropower Plant Installation Project, which is situated upstream of Bushara. The monthly calculated data on E-flow indicates that environmental releases range from 2.678 m³/s in July to 5.158 m³/s in September, aligning closely with natural flow conditions observed at Kabuga. At Bushara, the recorded flows are slightly higher than those at Kabuga.

This increase is not only due to controlled releases from the dam, but also results from additional inflow contributed by tributaries, which joins the Muvumba River before the Bushara gauging station. These combined flows ensure that ecological requirements are met downstream, especially during critical dry months such as July and August as shown in Table 5-7

Table 5-7: Working out available environmental flows

Month	Domestic water supply	Livestock water supply	Environmental flows	Hydropower demand	Irrigation	Total	Available Flow (%)*	Remarks
	m ³ /sec	m ³ /sec	m ³ /sec	m ³ /sec	m ³ /sec	m ³ /sec		
January	0.276	0.021	1.188	1.93	1.771	5.186	60%	Water, after flowing through the turbines will be discharged back to Muvumba river downstream of the dam. Hence for all practical purposes this also is considered as part of environmental flows (accordingly, percentage of flows in the Muvumba river is worked out)
February	0.303	0.023	1.304	3.55	5	10.18	48%	
March	0.276	0.021	1.188	2.54	3.431	7.456	50%	
April	0.286	0.022	1.228	1.71	0.843	4.089	72%	
May	0.276	0.021	1.188	2.06	1.23	4.775	68%	
June	0.286	0.022	1.228	2.55	3.679	7.765	49%	
July	0.276	0.021	1.188	1.49	4.211	7.186	37%	
August	0.276	0.021	1.188	2.09	4.289	7.864	42%	
September	0.286	0.022	1.228	3.93	4.242	9.708	53%	
October	0.276	0.021	1.188	2.2	3.091	6.776	50%	
November	0.286	0.022	1.228	2.02	2.641	6.197	52%	
December	0.276	0.021	1.188	2.25	2.256	5.991	57%	
AVERAGE							53%	
*Percentage of flow available for Environmental purpose [i.e. (Env + Hydro)/ 225Total]								

According to hydrology report of Muvumba dam project, the environmental release demand is 100% satisfied i.e. there is no water constraint downstream throughout the year.

F. Riparian Notification Downstream of Muvumba River

Muvumba River constitutes a shared international water body with a riparian country, namely the Republic of Uganda. Rwanda Water Resources Board has an obligation to formally notify riparian Province/Region susceptible to be affected by the project implementation, through the existing Nile Basin Cooperation Framework.

In the context of complying with international best practices on the use of shared water resources, and more so the shared Muvumba water basin, a memorandum of understanding was made and signed on July 29, 2011 between the Ministry of Natural Resources of the Republic of Rwanda (currently MoE) and the Ministry of Environment of the Republic of Uganda for the cooperation on shared environmental issues to be implemented by both parties. Following this MoU on May 31, 2016, the Ministry of the Natural Resources of the Republic of Rwanda notified Ministry of Environment of the Republic of Uganda on the ongoing study of Muvumba Multipurpose Dam in the shared Muvumba Catchment. After this notification, a bilateral technical meeting took place on 29th-30th March 2017 at Nyagatare District to discuss the collaborative mechanisms on the management and development of the Muvumba river and its related resources. The meeting emphasized on the ongoing water resource management and development initiatives on the Rwandan side of the Muvumba catchment. On the side of Rwanda, the meeting was represented by the Director General of Rwanda Water and Forestry Authority (currently RWB) and commissioner of Water Resources Planning and Regulation on the side of Uganda.

The Director of the water resources regulation at Rwanda Water and Forestry Authority (Currently RWB) on the side of Rwanda presented the ongoing initiatives in line with the Muvumba river. These include among others the establishment of Catchment Management Plan, Catchment rehabilitation measures have been developed such as terracing and agroforestry, natural forest restoration, riverbank protection, restoration of wetlands, etc. The Muvumba multipurpose dam which was under development at that time was also presented.

On the side of Uganda, the team leader for Victoria water resource management zone outlined different interventions including the establishment of catchment management plans including Muziba, major water related structures such as the hydro dam which was under construction on the side of Muvumba and one which was in the pipeline.

Based on the ongoing and planned interventions by both countries, the team extensively discussed how to define mechanisms and areas for collaboration with the objective of sustainably utilizing the shared water resources and to optimize socio-economic and environmental benefits by both partner states. Several areas for collaboration were identified including among others:

- ❖ Identify areas of convergence based on ongoing initiatives in either country
- ❖ Monitoring of water and related resources at strategic points including consideration for joint monitoring.
- ❖ Develop and implement strategy for engaging stakeholders especially the community in catchment
- ❖ Information sharing by both countries as and when required including bench marking on best

practices.

Following the field observations, where the team noted poor quality of water i.e. largely the high concentration of sediments and bacteria that are attributed to inappropriate agriculture practices and untreated waste discharge from the upstream area of the Muvumba river, the team recommended the joint effort to restore the catchment and need to find mechanism for providing incentives for catchment management as they are key in maintaining the quality and quantity of water.

5.2.1.7. Soil and geology conditions of the command area

In general, Rwanda has a complex geological history which presents itself in varied topographic profiles from the mountainous Northwest to the grassland of Akagera in the East. The oldest rocks of Rwanda are the Paleoproterozoic migmatites, gneisses and mica schist overlain by the Mesoproterozoic Kibaran Belt. The folded and metamorphosed sediments of the Kibaran Belt are primarily schists and quartzites introduced by granites and cover most of Rwanda,

According to the geotechnical and geological investigations done by TCE-IBC JV consultants as a part of detailed design of irrigation project to ascertain the suitability of soils against seepage and the bearing capacity of the foundation materials in response to the loads imposed by structures and to identify the adverse conditions that may impose problems during or after the construction of the project, it was revealed that the left and right sides of the project area on which the left and right canals will be passing through were identified to be composed of soil deposits that include residual deposits and alluvial deposits. In general, regardless of their origin most of the deposited materials were decomposed to clay and silt size and sand size soils while a few of them were found to be gravel sizes.

The ground water condition along the proposed canals shows that groundwater was encountered at around 2 m depths at some locations, whereas most investigation pits do not show groundwater at least up to 3 to 4 m depth. Regardless of their grain sizes, all types of soils encountered along the left and right canal route were found to be semi-pervious at compacted state condition. This implies that the in-situ condition permeability could be previous. The canals stretching on both sides are semi-pervious in compacted state that implies that the permeability is still higher for in-situ condition and the alignment through which the canal passes contains non-plastic silts or medium/low plastic boundary soils, canal section improvement like lining has been recommended. The low plasticity and low optimum moisture content indicate that the soil formation could be subjected to erodibility conditions. This could be a threat for the case of an unlined canal system.

Information provided in this section are sourced from the Soil survey investigations and Land suitability studies done by TCE-IBC JV consultants as a part of detailed design of irrigation project (November 2022). The soil survey investigation done by TCE-IBC JV consultants as a part of detailed design of irrigation project was conducted by the consultant and different physico-chemical soils parameters were analyzed and interpreted with the purpose of estimating the actual soil nutrient status, leading to estimating fertilizer rates to be applied to selected crops. Soil

physical parameters analyzed are Soil pH, organic carbon, Available phosphorus, Exchangeable Aluminum while chemical parameters include the soil bulk density, soil texture, soil infiltration rate, hydraulic conductivity. With these investigations on 36 soil profiles, it was found that dominant soil units in the command area are: Ferralsols, Cambisols, Vertisols, Gleysols, Alisols, Nitisols. Luvisols, Fluvisols and Acrisols.

Hydraulic conductivity: Based on the result of hydraulic conductivity of the soil samples collected from the command area, it was observed that structure of the soil is not very open gravels nor fissured clay rather a combination of clay and silt or clay, silt and sand. Indeed, it was also observed that the soils of the selected marshlands where the investigation was conducted, are dominated by fulvic minerals mixed with clays. Therefore, it can be concluded that crops can be fed by the upward movement of water when the water table increases due to irrigation or river water.

Soil infiltration rate: Results obtained in Muvumba command area showed an infiltration rate of soil ranging between 15- 50 mm/ h for a small portion of land (P4, P13 and P15) while a big portion of land has soil infiltration rate higher than 50 mm/h. These results prove that the big portion of the investigated command area is dominated by a texture with sand.

Soil pH: The results conducted on soils samples collected from Muvumba proposed irrigation command area shows that the soil pH values for 119 soil samples collected from 0-30 and 30-60 cm depth have pH values which are low acidic ranging between 5.5 to 6.8, while 29 soil samples have pH values ranging between 5.4 to 5.2 classified as moderate acidic and 32 soil samples have pH values ranging between 5.1 to 4.3 classified as very acidic according to Horneck, et al., (2011). According to Brady and Weil (2002), most cultivated crops require neutral to slightly acidic (pH ranging between 5.5 and 7.0) soils for better development. In summary, according to the results mentioned above, the soil pH of 60% of the command area are generally good for agriculture production while 40 % of the investigated area requires liming amendment.

Soil Organic carbon, total Nitrogen, basic cations and Micronutrients

The result of soils test from the Muvumba command area showed a low organic carbon (less than 5%) and according to FAO, 2014, most of the productive agricultural soils have between 5 and 8 % organic matter (FAO, 2005). Hence the land will need to get additional organic amendment to improve crop productivity as low organic carbon levels generally constitute a serious limitation for agriculture production.

In tropical soils, total nitrogen values superior to 0.25% are considered as high enough for agriculture production (Landon, 1991). It can be observed from the results that the proposed irrigation command area has total nitrogen which is moderate to less suitable for agriculture production. According to the results on total and available phosphorus, it was observed that only 28% of the command area has sufficient available phosphorus suitable for agriculture production while 72% of the command area has low available phosphorus content required for crop production. Hence, Muvumba site will need phosphorus fertilizers if yield crop has to be increased.

The evaluation of exchangeable Calcium and Magnesium shows that some are high in these minerals while others are in moderate levels. In addition, 61% of Muvumba command area has adequate exchangeable potassium while 39% of the command area needs additional potassium to ensure a productive land. The Sodium content was also evaluated to examine salinity level of the soils from the proposed irrigation area and it was found that The Muvumba command area is 97% free from salinity meaning that the land can accommodate crops.

The amount of micronutrient found in all soil samples collected in the command area were all high in Copper, Iron and Zinc, however they were found to fall below the permissible limits range (100 - 270 mg/kg) for Cu, (200-1100 mg/kg) for Zinc except for Iron where 48% of the command area is higher than the permissible range (80- 55000 mg/kg) while 62 % fall in the permissible range allowed in Agriculture land (He et al., 2015).

Soil texture: results of particle size distribution of soils in the irrigation command area, as well as respective textural classes. According to the laboratory tests, for 180 soil samples collected from 0 to 30 cm and 30 to 60 cm , 61 soil samples have sandy loam texture, 44 soils samples have sandy clay loam texture, 34 soil samples have clay loam texture, 17 soil samples have loam texture, 14 soil samples have clay soil texture, 3 soil samples have silt loam texture, 3 soil samples have silt clay loam texture, 2 soils samples have loam sand texture while 1 soil samples has silt clay texture and 1 last soil samples has sandy clay texture. According to these results, most soils in the command area are sandy loam, sandy clay loam and clay loam with 77% of the total command area while the rest occupy 23% of the irrigation command area. Soil Map showing the dominant soil units in the irrigation command area is depicted in Fig.5-5.

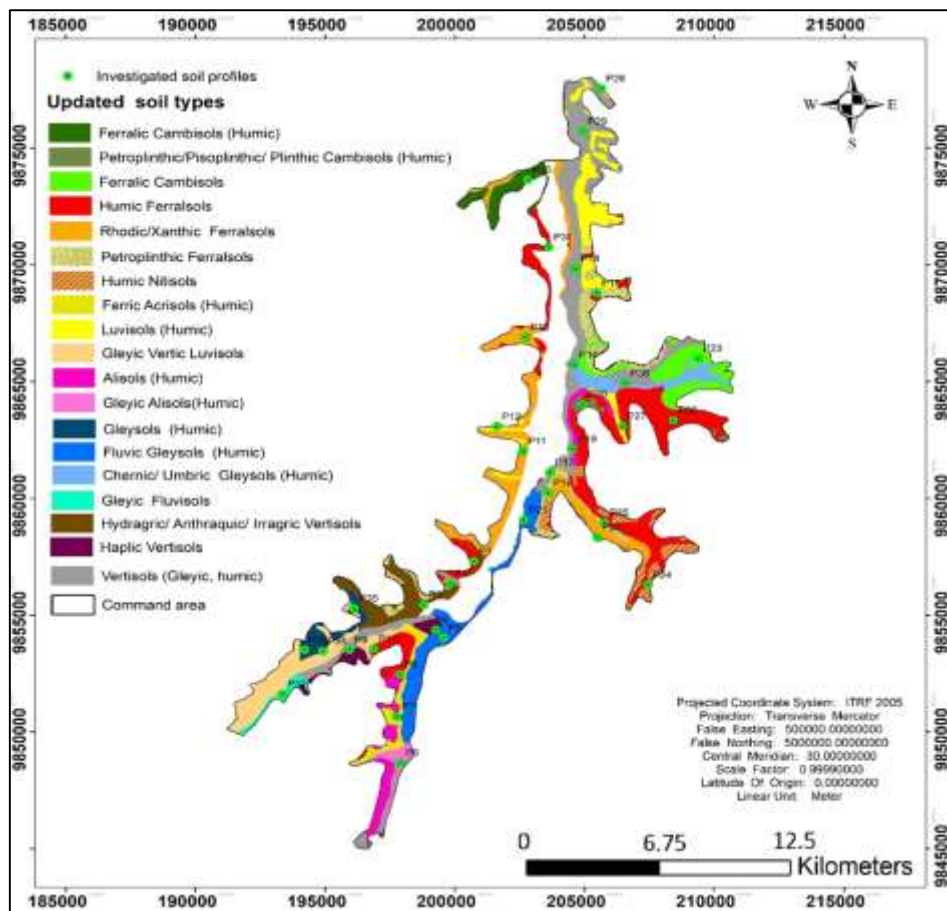


Figure 5-5: Soil Map showing the dominants soil units in the irrigation command area

5.2.1.8. Land Use and Settlement

1. Overview of Agriculture in the command area

The upstream part of the command has the characteristics of the Eastern Plateau and Buberuka Highlands Agro-climatic Zones): It covers parts of Rukomo, Karama and Tabagwe Sectors as shown in the Fig. 5-6 Agriculture is characterized by traditional crops under a rain-fed production system for both seasons-A & B (banana, maize, beans, sorghum and cassava).

The Downstream of the command area is within the Eastern Savanna Agro-climatic Zone and covers part of Tabagwe, Nyagatare and Rwempasha Sectors. The area has bigger flat lands but much drier and therefore unsuitable for rain-fed crop production without irrigation. Agriculture farms are mixed up with cattle grazing areas in variable patterns. Seasonal crops also include maize, beans, banana, sorghum and cassava in rotation between A and B growing seasons.

The Muvumba valleys occupy a central part in the command area, with a series of rice perimeters that were developed across time using irrigation waters from the Muvumba river. (Muvumba P8). The buffer zones of these rice perimeters are increasingly used to produce vegetable crops (tomato, onions, beetroots, watermelons, egg plants, etc.), with farmers pumping water from irrigation canal canals. (Source: Agronomy and value chain study by the consultant, Nov 2022).

The existing crops that are mostly cultivated in the command area are mainly i) Cereals (maize, rice, sorghum); ii) Legumes and pulses (mainly climbing beans and soya); iii) Fruits and vegetables.

2. Fodder crops

The land-use in livestock farms in Nyagatare is allocated as follows: 70% for livestock and 30% for agriculture. Within the 70% allocated for livestock, the farmer can allocate a given percentage to produce fodder crops to feed his cattle.

The promotion of fodder crops has considerably changed the livestock situation in Nyagatare, as death of cattle is no longer happening during the dry season. The main fodder crops developed are: *Chloris gayana* (Umukenke), *Brachiaria* (Ivubwe), *Panicum* (Umutete) and *Pennisetum*. The yield is 8T/Ha, with 4 harvests per year under irrigation. RAB has a fodder crops multiplication site in different sectors of Nyagatare and has trained a network of farmers who multiply the planting material and sell/distribute them to other farmers. RAB has also acquired equipment to make fodder bales and farmers can hire the service at 30,000 RwF per day. The machine can prepare up to 500 bales per day, with an average weight of 18-22 Kg per bale.

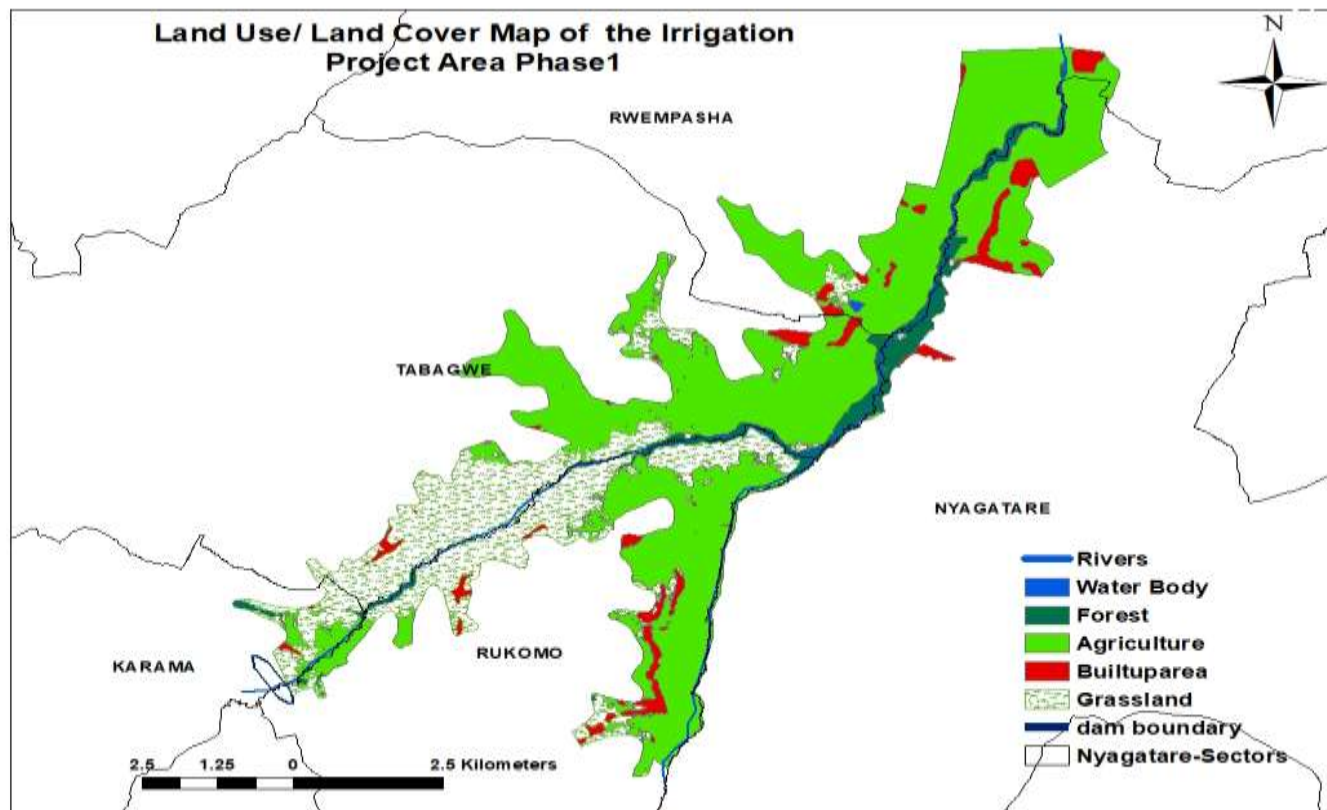


Figure 5-6: Land use in the project command area

3. Vulnerability to climate change

Of the sectors of Nyagatare District, Tabagwe, Rwempasha, Rukomo, Karama, and Nyagatare are shaped by persistent challenges such as limited access to safe drinking water (REMA, 2018), low household water storage capacity (CCOAIB, 2021), and sparse irrigation coverage (AfDB, 2023). Farmers in these sectors increasingly perceive variability in temperature and rainfall patterns (REMA, 2018), while knowledge of climate-resilient farming methods remains uneven (CCOAIB, 2021). Only a modest proportion of households utilize irrigation systems, further intensifying their exposure to seasonal droughts (InfoNile, 2022). In response, the Muvumba Multipurpose Water Resources Development Project proposes targeted interventions, including irrigation infrastructure, hydropower installations, and livestock watering schemes, designed to strengthen local adaptive capacity, stabilize water availability, and foster sustainable farming practices (AfDB, 2023; RWB, 2024).

Overall, to assess Nyagatare District's vulnerability to climate change, secondary data available in the assessment of national climate change vulnerability report conducted by REMA in 2018 were used²³. In this report, thirty-seven (37) national vulnerability indicators have been analyzed to determine the direction of change between the baseline data (2015) and the updated data (2018). The results showed that Nyagatare District had a medium vulnerability ranking, with a vulnerability index ranging from 0.486 to 0.526. Fig. 5-7 compares districts in the level of climate change Vulnerability.

²³ https://climatechange.gov.rw/fileadmin/user_upload/Rwanda_Climate_Change_Vulnerability_Report_2019_.pdf
<https://mapafrica.afdb.org/en/projects/46002-P-RW-EA0-015>
<https://ccoaiib.rw/documents/FINAL-REPORT-OF-THE-CLIMATE-RESILIENT-AND-AGROECOLOGICAL-PRACTICES-IN-KIREHE-NYAGATARE-NYARUGURU-AND-NYAMAGABE-DISTRICTS.pdf>
<https://infonile.org/en/2022/04/smart-irrigation-saves-water-improves-farming-practices-in-rwandas-remote-drought-stricken-region/>

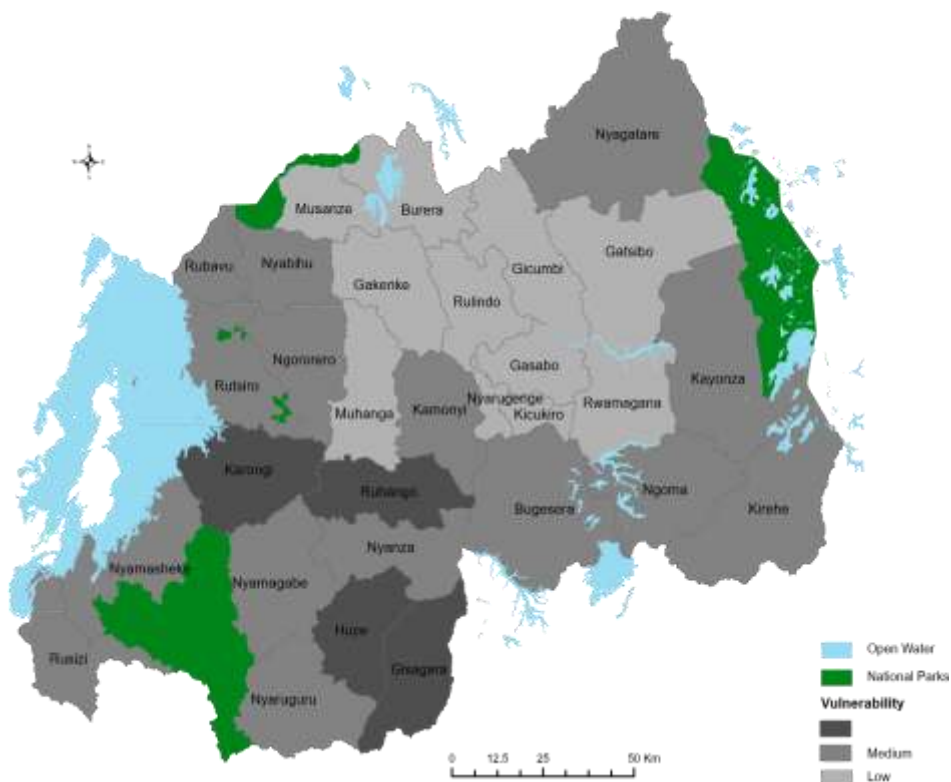


Figure 5-7: Map of Provinces comparing level of climate change Vulnerability

Nyagatare district is exposed to high and frequent episodes of drought. In general, the vulnerability index to climate change 0.52 and is ranked medium. The vulnerability to drought has justified the mobilization of public investments for the development of irrigated agriculture in Nyagatare district. Many irrigation projects are operational in Nyagatare district, while other are in the pipeline, including the present assignment i.e. Irrigation Project.

4. Settlements

There are many scattered houses within the command area, including small villages. The design considered the existence of settlements, and the RAP undertaken together with this ESIA identified which will be relocated as a result of the infrastructure installation. The existing road network within the command area will be used by the farmers for easy transportation of their products to the markets. In the project areas, housing units are mainly covered by iron sheets and

few are made of local tiles. The walls of the housing units are mostly built with sun dried bricks and few are made of wood/mud.

The binding material is mostly mud and with others made in cement. The floor is covered with cement pavement with few tiles. The openings such as doors and windows are mainly made of trees and wood while few are made of metallic openings.

5.2.1.9. Status of Existing Hydraulic structures

1. Status of existing livestock water supply

In some livestock farms in the proposed irrigation command area, in Tabagwe, Rwempasha and Nyagatare sectors, there are existing project interventions. These have recently been supplied with livestock water through the Livestock Infrastructure Support Project (LISP) as indicated in Fig. 5-8&9, a project funded by the African Development Bank (AfDB) and implemented by MINAGRI.

It appears that most of the lands in the command area are currently privately owned, with most of these under livestock farming grazing on open fields. Livestock farms are not planted with improved forage crops and are covered by indigenous grasses and shrubs mixed up with savanna tree species (TCE-IBC JV).



Figure 5-8: Livestock water supply infrastructures developed by the Project

The Government of Rwanda zoned a land dedicated for cattle rearing and currently the Nyagatare District has 5,182 farms with a total area of 68,284 ha. Among the 14 Sectors of Nyagatare District, five (5) sectors namely Karama, Rwempasha, Tabagwe, Nyagatare and Rukomo, where this ESIA noted that the Muvumba river passes through and totalizing 2,945 farms have been selected as service areas for livestock water.

Nyagatare District is the nation's largest livestock farming area, accounting for 20% of the total number of livestock. Indigenous cattle were predominant (67.03%) followed by cross-breeds (28.37%) and exotics (4.6%) while all farmers kept small ruminants. Natural breeding predominated (74.9%) and most farms (60.6%) had animal houses most of which were (52.8%) temporary (Mazimpaka et al., 2017).

In Nyagatare District, especially in the command area, water availability is identified as the major limiting factor for both crop and livestock production. Recently, in some livestock farms randomly

distributed in the proposed irrigation command area, for example in Tabagwe, Rwempasha and Nyagatare Sectors, livestock water was supplied through existing project interventions such as the Livestock Infrastructure Support Project (LISP), a project funded by the African Development Bank (AfDB) and implemented by MINAGRI.

The project was designed to supply livestock water to a total number of 968 farms distributed over an area of 6,467 ha, with a total water need of 581 m³/day. Unfortunately, this project is not working properly due to inadequate water supply; the water which was supposed to be for livestock was/is not even sufficient for domestic use (WASAC Service in Nyagatare).



Figure 5-9: Status of existing water trough installed by the Project

Additionally, along the belt canal of Muvumba P8 rice scheme on the left bank of Muvumba river, there are several livestock water troughs (Ibibumbiro) that have been installed by the Rural Sector Support Project (RSSP-3, a World Bank funded program implemented by MINAGRI) during the development of the scheme. The water used in these cattle water use points is pumped by local farmers from the belt canal on the Muvumba-P8 rice scheme.

2. Status of existing irrigation structures

Nyagatare District is highly vulnerable to climate variability, particularly recurrent droughts that severely impact agricultural productivity and water availability. In the sectors of Rwempasha, Tabagwe, Rukomo, Karama, and Nyagatare, hillside farming systems remain predominantly rain-fed, leaving communities exposed to seasonal shocks and food insecurity. Although the district hosts existing irrigation infrastructure within the Muvumba wetland, significant challenges persist,

especially in water management and long-term sustainability. For example, the existing paddy rice located in Muvumba P8 has been under surface irrigation by Rural Sector Support Project II (RSSP II), and is supplied by Muvumba river at the upstream of the wetland on the Muvumba Diversion Weir shown in Fig. 5-10.

The Muvumba River is a vital water source for Nyagatare District, forming part of the transboundary Muvumba catchment shared between Rwanda and Uganda. Historically, the river has supported multiple functions, including irrigation, domestic water supply, and livestock watering. However, recent assessments have not identified any irrigation infrastructure in the hillside. Additionally, the assessment findings indicate that several irrigation structures linked to the river have deteriorated over time, resulting in reduced water availability in some part of Muvumba wetland, particularly affecting rice farmers who depend on consistent surface irrigation in the region.

For instance, as of the most recent available data, the Muvumba P8 irrigation block located in Muvumba wetland is situated near the proposed irrigation project, and is being upgraded by RAB via commercialization and de-risking agricultural transformation (CDAT) project. However, specific figures for the currently irrigated area of P8 are not well detailed in the latest reports. That said, recent updates from January 2025 indicate that 682 hectares of rice fields in the Muvumba Wetland (which includes P8) are under irrigation, though this area has been severely affected by water shortages and infrastructure failures, leaving 23 hectares uncultivated²⁴.



Figure 5-10: Muvumba Diversion weir, source of water for Muvumba P8

Additionally, this study on Muvumba Perimeter 8 highlights how irrigation influences land value and agricultural productivity, demonstrating its importance for local communities. While authorities

²⁴ Nyagatare Rice Farmers Grapple with Devastating Water Shortages, Huge Losses – KT PRESS

have recognized the need for rehabilitation efforts, the broader Rwanda Irrigation Master Plan offers strategic direction for marshland and hillside irrigation. However, ensuring environmental and social safeguards remains crucial for long-term resilience and sustainability. The Muvumba Valley, covering 1,700 hectares across Tabagwe and Rwempasha sectors, was operationalized in 2013 to boost agricultural productivity. However, the current crisis highlights the need for robust infrastructure to withstand climatic and environmental challenges.

5.2.1.10. Disaster Risks

A. Seismic Hazards

Parts of Rwanda are in a seismic zone and so the population faces exposure to some level of earthquakes. However, the project area is not in a seismically active zone.

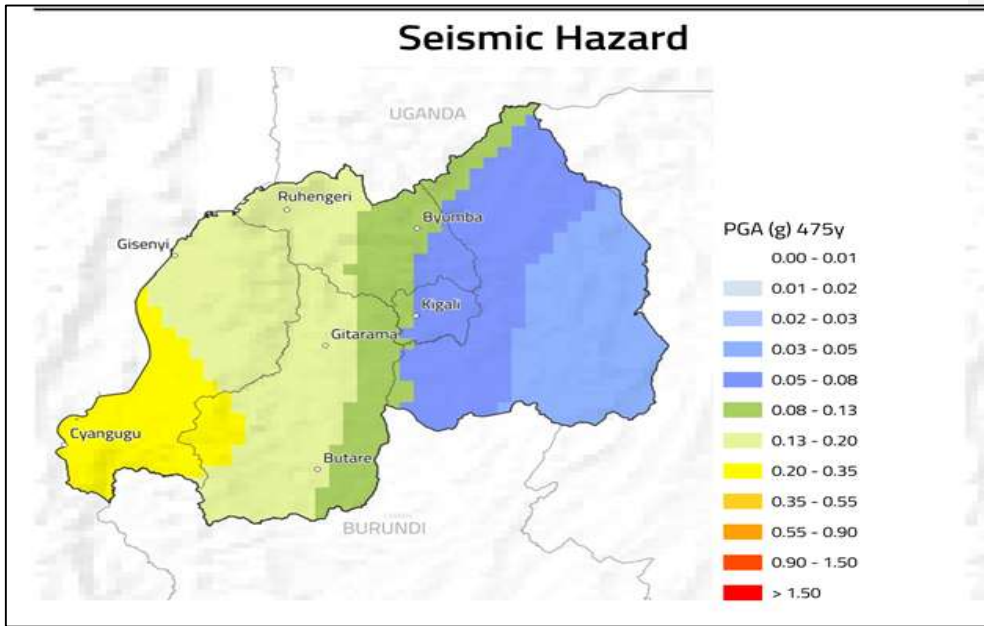


Figure 5-11: Seismic hazard Map of Rwanda

Viewed from the Global Seismic Hazard Map²⁵, the seismic hazard map depicts the geographic distribution of the Peak Ground Acceleration (PGA) with a 10% probability of being exceeded in 50 years, computed for reference rock conditions (shear wave velocity, Vs30, of 760-800 m/s).

²⁵ [OpenQuake Map Viewer - Global Seismic Hazard Map](#)

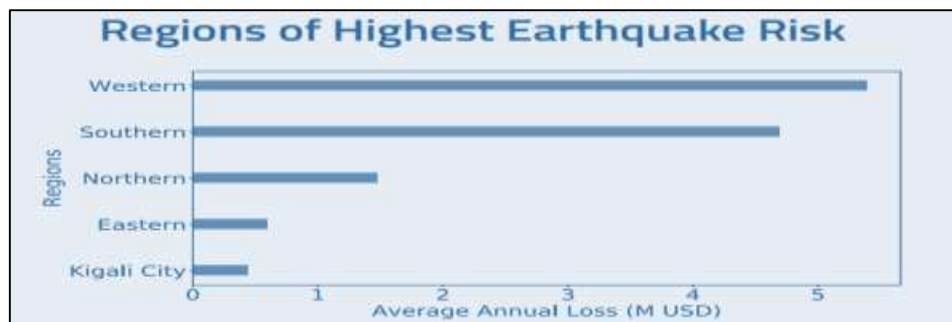


Figure 5-12: Earthquake risk of Rwanda's Region

Rwanda's seismic hazard profile shows a clear regional gradient, with Western Province experiencing the highest risk due to its position along the East African Rift. In contrast, Eastern Province, including Nyagatare, remains a low seismic hazard zone. Recent 2025 data confirms this distinction: Western Rwanda recorded 11 moderate earthquakes (Mag ≥ 4), including shallow tremors near Rubavu, while Nyagatare experienced only 4 minor events, none exceeding magnitude 4.7. According to USGS (2008), MIDIMAR (2013), and updated GEM OpenQuake hazard mapping, there's no significant upward trend in Eastern seismic activity. This supports a streamlined mitigation strategy in this ESIA, emphasizing basic structural resilience while prioritizing other environmental risks.

B. Mudslides

No mudslide hazard has been formally recorded in Tabagwe, Rukomo, Rwempasha, Nyagatare or Karama sectors of Nyagatare District over the past five years. This absence is largely due to the district's gently rolling terrain, which lacks the steep slopes typically associated with mudslide events. Available data and assessments from 2020 to 2025 focus on flood damage, erosion, and infrastructure loss, particularly in Karama and Rukomo, but do not isolate mudslides as a distinct hazard category. While slope instability and sedimentation are evident, they are generally attributed to seasonal flooding and poor land use, underscoring a need for a catchment management strategy.

5.2.1.11 Air Quality and Noise Baseline

Air quality measurements were conducted by consultant team *in situ* at 20 strategically selected sampling points across the project area to capture ambient atmospheric conditions and potential environmental impacts as shown in Fig. 5-13 and the results obtained at different sampling sites are presented in Table 5-8. Sampling was done daily (once) on July 26, 2025. Before all measurements, the meters were well calibrated according to the guiding manual provided by the supplier. Particulate matter concentrations (PM₁₀ and PM_{2.5}) were measured using the handheld

portable Counter Particle NK 800 portable meter, ensuring high-sensitivity detection in real-time. In parallel, gaseous pollutants, including ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2), were assessed using a portable multi-gas detector (Model S316) equipped with a pump suction system for targeted air intake. To complement these readings, ambient noise levels were recorded at each site using a portable digital sound level meter (SW 6024 Model), capturing fluctuations associated with nearby infrastructure or activities. All parameters were measured systematically at each location before noon (from 10:00-12:00am) and afternoon (2:00-3:00 pm), ambient average temperature of 28 °C, and the recorded daily values were averaged and presented in Table 5-8.

5.2.1.11a Air quality

By comparing the obtained results with RSB and WHO air quality permissible limits, the air quality measurements. Across the 20 sampling points, particulate matter levels remain relatively low and consistent. The average PM_{10} concentration of $17.05 \mu g/m^3$ is well below both RSB ($50 \mu g/m^3$) and WHO ($45 \mu g/m^3$) thresholds. $PM_{2.5}$ averages $16.01 \mu g/m^3$, which complies with RSB's $25 \mu g/m^3$ limit but slightly exceeds WHO's updated guideline of $15 \mu g/m^3$.

Spatially, elevated PM_{10} readings ($20 \mu g/m^3$) are observed at Muvumba Dam construction (PS1) and roadside near residential area, suggesting localized emissions from traffic and ongoing construction activity. Residential and school zones tend to show lower particulate levels.

The gaseous pollutants, NO_2 , SO_2 , CO, and O_3 are uniformly low across all sites. NO_2 and SO_2 average just $0.16 \mu g/m^3$ and $0.14 \mu g/m^3$ respectively, far below both RSB and WHO limits. CO and O_3 levels are negligible, with averages of $0.05 \mu g/m^3$ and $0.01 \mu g/m^3$, indicating minimal combustion-related or photochemical pollution. These trends suggest that the surveyed sectors, likely rural or peri-urban, are not significantly impacted by industrial or vehicular emissions during the sampling period.



Figure 5-13: Filed Measurement for Air Quality in project Area

5.2.1.11b Noise Baseline

As indicated by Table 5-8, Noise levels, averaging 44.59 dBA, fall within acceptable daytime limits for residential and institutional zones under both RSB and WHO guidelines. While most sites remain below 50 dBA, slightly higher readings near commercial hubs and roadside areas reflect typical ambient conditions in mixed-use environments. However, during the field assessment, the results observed nearby the Muvumba Multipurpose dam construction (Bushara Centre 1) showed elevated noise levels (57.4 dBA) followed by areas resided by grouped populations (as shown in Table 5-8). This trend could be stemmed from the ongoing construction activities for the Muvumba Multipurpose Dam, which involve heavy machinery, excavation, and material transportation. These operations generated significant noise levels affecting the surrounding environment. Though no site exceeds critical thresholds, a periodic monitoring near these sensitive receptors is advisable to ensure long-term compliance.

Table 5-8: Measured Air Quality and Noise Levels in Project Area

Sampling Points	Coordinates		Sector	Sensitive Receptors	PM ₁₀	PM _{2.5}	NO ₂	SO ₂	CO	O ₃	Noise
	Lat.	Long.									
SP1	1°20'57.73"S	30°13'38.08"E	Karama	Bushara Centre 1	20.00	16.00	0.2	0.0	0.0	0.0	57.4
SP2	1°21'18.20"S	30°14'19.32"E	Rukomo	Kayenzi Village	16.00	13.00	0.2	0.0	0.0	0.0	40.2
SP3	1°19'40.04"S	30°16'41.68"E	Rukomo	Benishyaka Village	18.00	16.00	0.2	0.0	0.0	0.0	42.2
SP4	1°20'58.36"S	30°13'2.60"E	Karama	Bushara Centre 2	15.00	15.00	0.0	0.0	0.0	0.0	44.1
SP5	1°20'17.52"S	30°13'16.11"E	Karama	Urugwiro Village	18.00	26.00	0.0	0.0	0.0	0.0	51.1
SP6	1°20'14.36"S	30°13'51.59"E	Tabagwe	Akajevuba Village	18.00	16.00	0.2	0.0	0.0	0.0	50.5
SP7	1°19'55.14"S	30°14'40.83"E	Tabagwe	Ibare Village	16.00	15.00	0.1	0.0	0.0	0.0	50.1
SP8	1°19'21.96"S	30°14'18.18"E	Tabagwe	Kaduha Village	17.00	17.00	0.0	0.0	0.0	0.0	40.2
SP9	1°20'37.64"S	30°14'57.00"E	Rukomo	Nyakagarama Village	15.00	16.00	0.2	0.0	0.0	0.0	35.2
SP10	1°20'50.51"S	30°14'36.60"E	Rukomo	Kayenzi Village	19.00	15.00	0.2	0.0	0.0	0.1	45.0
SP11	1°18'48.02"S	30°15'10.27"E	Tabagwe	Kabirizi Village	17.00	16.00	0.0	0.0	0.0	0.0	39.6
SP12	1°20'21.42"S	30°16'5.97"E	Rukomo	Rurenge Market	16.00	15.00	0.3	0.0	0.0	0.0	54.8
SP13	1°17'27.28"S	30°18'17.50"E	Tabagwe	Nshuri Village	17.00	15.00	0.1	0.0	0.0	0.0	38.6
SP14	1°16'29.87"S	30°18'40.78"E	Rwempasha	Rutare 1 Village	16.00	15.00	0.0	0.0	0.0	0.0	51.5
SP15	1°15'59.45"S	30°18'29.26"E	Rwempasha	Rutare 2 Village	18.00	16.00	0.2	0.0	0.0	0.0	50.1
SP16	1°15'2.48"S	30°17'33.33"E	Rwempasha	Cyenjojo II Village	15.00	15.00	0.1	0.0	0.0	0.0	40.2
SP17	1°14'47.30"S	30°17'24.20"E	Rwempasha	Cyenjojo II Village	17.00	16.00	0.2	0.0	0.0	0.0	35.2
SP18	1°14'25.78"S	30°17'1.81"E	Rwempasha	Bweya Village	18.00	16.00	0.1	0.0	0.0	0.0	45.0
SP19	1°14'48.66"S	30°16'54.53"E	Rwempasha	Mashaka Village	17.00	15.00	0.2	0.0	0.0	0.0	39.6
SP20	1°15'38.71"S	30°20'25.89"E	Nyagatare	Nsheke P. School	18.00	16.00	0.3	0.0	0.0	0.0	41.2
Average measured values					17.05	16	0.14	0	0	0.005	44.59
RSB Standards Permissible Limits					50	25	200	125	10⁴	100	55–65
WHO Permissible Limit					45	15	25	40	4³	100	50

All measurement units are in µg/m³, except for noise in dBA

5.2.2. Biological environment

5.2.2.1. Flora

A. Methodology

To assess plant diversity across the project area, a field survey of systematic sampling strategy was implemented (in July 2025) using 5 linear transects, each approximately 10 kilometers long and spaced 2 kilometers apart to ensure spatial coverage. Along each transect, five vegetation plots of 200 m² were established making a total of 25 plots to document trees and shrubs, with repeated species within a transect recorded only once to avoid redundancy. Additionally, ten microplots of 1 m² per transect were surveyed to capture herbaceous and grass species composition, providing a comprehensive snapshot of both woody and ground-level vegetation across the landscape. The species recorded were summarized in the Table 5-9 below.

Table 5-9: Plant diversity identified in the project area

Habitat	Family	Botanical name	IUCN Status**	Life form	Plant density (No./ha)*
Native and Wild Plant Species					
Savannah Woodlands	Moraceae	<i>Ficus sycomorus</i>	Least Concern	Tree	1.5(75)
Dry Savannah	Combretaceae	<i>Combretum molle</i>	Least Concern	Tree	2(100)
Riverine Forests	Fabaceae	<i>Albizia zygia</i>	Least Concern	Tree	3 (150)
Rocky Hillsides	Euphorbiaceae	<i>Euphorbia candelabrum</i>	Least Concern	Shrub	4.2((210)
Rocky Hillsides	Euphorbiaceae	<i>Euphorbia tirucalli</i> (L.)	Least Concern	Tree	1.3 (65)
Savannah Grasslands	Poaceae	<i>Hyparrhenia rufa</i>	Not Evaluated	Grass	1.1[11000]
Lowland forests (Kirkii)	Ebenaceae	<i>Euclea racemosa</i> subsp. <i>Schimperi</i>	Not Evaluated	Tree	2 (100)
Lowland forests (Kirkii)	Fabaceae	<i>Vachellia sieberiana</i> var. <i>woodii</i>	Least Concern	Tree	2 (100)
Lowland forests (Kirkii)	Fabaceae	<i>Vachellia gerrardii</i>	Least Concern	Tree	0.5(25)
Lowland forests (Kirkii)	Celastraceae	<i>Elaeodendron schlechterianum</i>	Not Evaluated	Tree	1 (50)
Lowland forests (Kirkii)	Fabaceae	<i>Erythrina abyssinica</i>	Least Concern	Tree	1 (50)
Lowland forests (Kirkii)	Euphorbiaceae	<i>Sapium ellipticum</i> (<i>Shirakiopsis elliptica</i>)	Least Concern	Tree	1 (50)
Herbaceous and Medicinal Species					
Roadsides/Farmlands	Asteraceae	<i>Bidens pilosa</i>	Least Concern	Herb	0.2[2520]
Moist Disturbed Areas	Commelinaceae	<i>Commelina benghalensis</i>	Least Concern	Herb	0.345[3450]
Cultivated Fields	Asteraceae	<i>Ageratum conyzoides</i>	Least Concern	Herb	0.111[1110]
Savannah Grasslands	Poaceae	<i>Imperata cylindrical</i>	Least Concern	Grass	1.202[12020]

Homesteads	Lamiaceae	<i>Ocimum basilicum</i>	Not Evaluated	Herb	2.03[20300]
Agroforestry Zones	Fabaceae	<i>Calliandra calothyrsus</i>	Not Evaluated	Shrub	1(50)
Agricultural Crops					
Irrigated Wetlands	Poaceae	<i>Oryza sativa</i> (Rice)	Least Concern	Grass	1.26[12600]
Upland Farms	Poaceae	<i>Zea mays</i> (Maize)	Least Concern	Grass	0.42[4200]
Mixed Cropping Zones	Fabaceae	<i>Phaseolus vulgaris</i> (Beans)	Least Concern	Herb	2.1345[21345]
Semi-arid Uplands	Euphorbiaceae	<i>Manihot esculenta</i> (Cassava)	Least Concern	Shrub	2.4(120)
Sandy Soils	Fabaceae	<i>Arachis hypogaea</i> (Groundnut)	Least Concern	Herb	36.54[36400]
Dryland Farming	Poaceae	<i>Sorghum bicolor</i>	Least Concern	Grass	4.123[41230]
Homestead Gardens	Musaceae	<i>Musa spp.</i> (Banana)	Least Concern	Herb	1.23[12300]
Irrigated Gardens	Solanaceae	<i>Solanum melongena</i> (Eggplant)	Least Concern	Herb	0.782[7880]
Smallholder Plots	Solanaceae	<i>Capsicum spp.</i> (Chili)	Least Concern	Herb	2.341[2341]
Planted and Agroforestry Plants					
Irrigated wetlands, valleys	Poaceae	<i>Saccharum officinarum</i>	Not Evaluated	Grass	21.32[213200]
Riverbanks, erosion-prone zones	Poaceae	<i>Bambusa vulgaris</i>	Not Evaluated	Grass	0.31[3100]
Homesteads, windbreaks	Proteaceae	<i>Grevillea robusta</i>	Not Evaluated	Tree	12(600)
Home gardens, agroforestry	Lauraceae	<i>Persea Americana</i>	Least Concern	Tree	5(250)
Afforestation areas, roadside	Myrtaceae	<i>Eucalyptus globulus</i>	Least Concern	Tree	1.2(75)
Homesteads, fodder plots	Fabaceae	<i>Calliandra calothyrsus</i>	Not Evaluated	Shrub	2.1(105)
Agroforestry plots, contour lines	Fabaceae	<i>Leucaena leucocephala</i>	Least Concern	Tree	0.3(15)
Mixed farms, degraded lands	Meliaceae	<i>Azadirachta indica</i>	Least Concern	Tree	0.11(6)
Silvopastoral zones	Moraceae	<i>Ficus thonningii</i>	Least Concern	Tree	0.51(26)
Fruit gardens, homesteads	Rutaceae	<i>Citrus sinensis</i>	Not Evaluated	Tree	1.15(58)
Agroforestry belts	Fabaceae	<i>Gliricidia sepium</i>	Not Evaluated	Tree	2.19105)
Riverbanks, buffer zones	Salicaceae	<i>Salix babylonica</i>	Not Evaluated	Tree	0.6(30)
*Number of tree, shrub species per 200 m² plot and figures in round brackets denote stems ha⁻¹ (i.e.: number of trees in 200 m² multiplied by 50); herbaceous and grass species populations were estimated in a 1 m² plot, and figures in square brackets stand for plants ha⁻¹ (i.e.: number of grasses species in 1m² multiplied by 10,000) **IUCN. 2025. The IUCN Red List of Threatened Species. Version 2025-1. https://www.iucnredlist.org. Accessed on [June 12, 2025].					

B. Vegetation Cover in the Project Area

During the field survey conducted, different species in 17 families were identified in project area as shown in the Table 5-9 above, both native and invasive plant species, perennial and seasonal crops are interacting in project area (Fig. 5-14), from where the intakes will be connected nearby the ongoing dam construction to the rest of command area, vegetation cover will be slightly disturbed due to removal of existing agroforestry trees and were estimated to be 12,345 trees as a result of project activities such as, construction of planned intakes, excavating of irrigation canals networks, cross drainage construction, fixation of connecting Siphon and so on. The site proposed for the construction of right-side intake is situated at a hilly slope with an inclination between 40-45°. The area is a mixed land, one part cultivated and covered by banana plantation; another is covered by a dominated plantation of *Eucalyptus* associated with *Acacia siberiana*, *Ficus toniingi* *Grevillea* and *Markhamia lutea*.



Figure 5-14: Existing crops in the project area

The site selected for the construction of left side intake is situated within a moderate slope with an inclination between 25 to 30°. During the field visit, the seasonal crops mainly maize, beans, sorghum were harvested and currently covered by *Manihot esculenta* as well as banana plantation are still in the yard. Moreover, some plants associated with crops have been recorded such as: *Persea americana*, *Cedrella odorata*, *Vernonia amygdalina*, *Euphorbia tirucalli* and *Markhamia lutea*. Some these agroforestry trees will be affected by the project, especially construction of canals. The data obtained from RAP estimate a total of 12, 345 trees will be cut down due to right of way as shown in the Table 5-10.

Table 5-10: Project affected trees

Type of trees affected	Number/Piece
Fruits trees	
Avocado	1,664

Papaya	256
Mango trees	640
S/total 1	2,560
Commercial trees	
Grevilia trees	7948
Eucalyptus	663
Acacia Kirkii	780
Caliandra	394
S/total 2	9,785
Total	12,345

The Rwempasha-Nsheke siphon will cross the Muvumba cultivated wetland and connect to the Nsheke drainage canal.



Figure 5-15: Existing agroforestry trees (*Grevillea Robusta*) in the project area

The Nsheke farm siphon crosses the valley and connects to the drainage canal at the opposite hilly side. The Kabare-Gasinga siphon will cross the valley and connect to the drainage canal starting in a farm with a luxurious banana plantation. Eight portions of drainage canals crossing hillsides to irrigate fields by gravity have been surveyed. These include canal line routes crossing Kamati, Nyagasharara, Gasinga, Rurenge, Nyabitekeri, Rwempasha, Nsheke and Cyanyayiha. such as *Dracaena afromontana*, *Vernonia amygdalina* and herbs such as *Elymus repens* and *Pennisetum purpureum*.

Generally, different crops will be affected by preparation of drainage canals and their installation such as *Musa nana*, *Manihot esculenta*, *Saccharum officinarum*, trees such as *Euphorbia tirucalli*, *Eucalyptus*, *Erythrina abyssinica*, *Grevillea robusta*, *Acacia* sp shrubs. Moreover, the project will also affect seasonal crops and a small number of perennial crops that are interacting within the project command area. The following list of agricultural plantspecies in Table 5-9 highlights the identified crops within the project area.

5.2.2.2. Fauna

A. Methodology

To assess the baseline data on fauna across the Rwempasha, Karama, Rukomo, Nyagatare, and Tabagwe sectors of Nyagatare District, a stratified sampling technique was employed to ensure ecological representation across varying habitat types, topography, and land use patterns. The study area was divided into distinct strata using GIS-based land cover mapping and participatory validation, categorizing zones/habitats (stratum) such as wetlands, savannah, farmland edges, and forest patches. Prior to fieldwork, a comprehensive literature review was conducted to identify the optimal timing for fauna detection, based on species-specific activity cycles and seasonal variations.

At each selected sampling point within a stratum, fauna observations were carried out using direct visual methods: human eye observation was used for nearby species, while binoculars facilitated detection of distant or elusive fauna. Additionally, domestic species were surveyed through family member inquiry in affected households (PAHs). Each sampling effort lasted a minimum of 10 minutes to allow sufficient time for fauna to emerge or respond to environmental cues. Observations were conducted at varied times of day, morning, midday, and dusk, to capture the full spectrum of faunal activity and diversity. The combination of spatial stratification, timed observation, and variable temporal effort enhanced the reliability of data and allowed for a nuanced understanding of species richness, distribution, and habitat utilization. A detailed status for all animal species in the project area is illustrated in Table 5-11.

Table 5-11: Fauna diversity in the project area

Habitat	Family	Scientific Name	Common Name	IUCN Status
Wild Species				
Savannah edges	Numididae	<i>Numida meleagris</i>	Helmeted guineafowl	Least Concern
Savannah edges	Columbidae	<i>Streptopelia senegalensis</i>	Laughing dove	Least Concern
Woodland patches	Cercopithecidae	<i>Papio Anubis</i>	Olive baboon	Least Concern
Savannah edges	Leporidae	<i>Lepus microtis</i>	African savanna hare	Least Concern
Woodland patches	Agamidae	<i>Agama agama</i>	Common agama lizard	Least Concern
Savannah edges	Scincidae	<i>Trachylepis maculilabris</i>	African skink	Least Concern
Farmland edges	Apidae	<i>Apis mellifera</i>	Honeybee	Not Evaluated
Savannah edges	Acrididae	<i>Zonocerus variegatus</i>	Variegated grasshopper	Least Concern
Farmland edges	Coccinellidae	<i>Coccinella septempunctata</i>	Seven-spotted lady beetle	Least Concern

Woodland patches	Formicidae	<i>Camponotus spp.</i>	Carpenter ants	Not Evaluated
Woodland patches	Vespertilionidae	<i>Pipistrellus nanus</i>	Dwarf pipistrelle bat	Least Concern
Homesteads	Muridae	<i>Rattus rattus</i>	Black rat	Least Concern
Aquatic	Cichlidae	<i>Oreochromis niloticus</i>	Nile Tilapia	Least Concern
Aquatic	Clariidae	<i>Clarias gariepinus</i>	African Catfish	Least Concern
Domestic				
Farmland	Bovidae	<i>Bos Taurus</i>	Domestic cattle	Not Evaluated
Homesteads	Suidae	<i>Sus scrofa domesticus</i>	Domestic pig	Not Evaluated
Homesteads	Caprinae	<i>Capra aegagrus hircus</i>	Domestic goat	Not Evaluated
Homesteads	Galliformes	<i>Gallus gallus domesticus</i>	Chicken	Not Evaluated
Homesteads	Anatidae	<i>Anas platyrhynchos domesticus</i>	Domestic duck	Not Evaluated
Homesteads	Leporidae	<i>Oryctolagus cuniculus</i>	Domestic rabbit	Not Evaluated

B: Fauna Species Identified in Broader Area (Outside of the 3073ha)

During site reconnaissance, it was observed that a gallery forest exists near the project area but beyond the 3073ha project command area (see Fig. 5-18 below). The shortest distance between the forest and the extended canal is estimated as 0.65km with a human settlement, Nsheke Primary, farms and a National Road (Nyagatare-Ryabega road separating the two. Construction works will not therefore impact on the forest.

The gallery forest runs along Muvumba river and accommodates a huge diversity of bird's community including *Ardea cinerea*, ducks, Black-head weavers and so forth as well as mammals such as baboons. Generally, 19 species were found in the gallery forest as supported by previous study²⁶ on Rwanda wetland biodiversity status in August 2021 conducted by REMA, ARCOS network and IUCN. Still the study found that of the various functional wetland ecosystems assessed in the whole of Rwanda, Muvumba wetland complex presents lowest species richness.

Baboons are the predominant mammals found mostly in the gallery forest.

In the Muvumba River, only two fish species were surveyed in the river following. They indicated that two fish species of *Oreochromis niloticus* (Nile Tilapia) and *Clarias gariepinus* (African Catfish) belonging to the family of Cichlidae and Clariidae respectively. There are many termite mounds on the outskirts of the marshlands.

²⁶ http://arcosnetwork.org/uploads/2021/10/Rwanda_Wetland_Biodiversity_Status-1.pdf

Domestic species commonly identified near the project area include cattle, goats, chickens, and dogs. These animals are vital to local livelihoods, providing food, income, and cultural value. Project safeguards should protect their access to water and pasture, minimize disease risks, and promote coexistence with wild fauna for harmonious resource use.

5.3. Socio Economic Baseline

This section describes findings pertaining to social and economic status of households likely to be affected by the project, mainly in the five sectors (Nyagatare, Karama, Rukomo, Rwempasha and Tabagwe) of Nyagatare District. Statistical data presented in this section were directly extracted or adapted from the Fifth Rwanda Population and Housing Census (RPHC5, 2022). This includes the households of people using the project area and from the communities surrounding the project area. It focuses on the socio-economic environment components such as demographic characteristics, livelihoods of the populations (including health), functioning of households (distribution of charges and tasks, sharing of responsibilities, distribution of income), economic activities and Basic infrastructure and services. The socio-economic data presented in this section are sourced from the RAP survey done during its preparation.

5.3.1 Demographic characteristics of the project area

There is an increase of population growth in Nyagatare District between 2012 to 2022 population census. Nyagatare District is the second most populated district of Rwanda with a total population of 628,202 inhabitants of which 306,399 are male (48.8 %) and 321,803 are female (51.23%) grouped into 160,435 households as shown in Table 5-12. The district average density is 242 inhabitants per Km², but this density remains under the national density which is 321 inhabitants per Km².

Table 5-12: Distribution (count) of the resident population of District of Nyagatare, by affected sectors and by sex and households (NISR, 2022)

District	Counts			Percentage (%)			Counts	%	%
	Total	Male	Female	Total	Male	Female	House-holds	Rural ¹	Other/Urban ²
Nyagatare	628,202	306,399	321,803	100.0	48.8	51.23	160435	84.4	15.6

Sector	Counts			Percentage (%)			Counts	%	%
	Total	Male	Female	Total	Male	Female	House-holds	Rural ¹	Other/Urban ²
Nyagatare	81,915	40775	41,140	100.0	49.7	50.3	20,739	87.2	2.8
Karama	32,949	15,627	17,322	100.0	47.4	52.57	8262	97.0	3.0
Rukomo	43,650	20,892	22,758	100.0	47.9	52.14	10916	93.9	6.1
Rwempasha	38,592	19,234	19,358	100.0	49.8	50.16	9136	53.8	46.2
Tabagwe	53,528	25,832	27,696	100.0	48.3	51.74	12594	83.0	17.0
Total	250,634	122,360	128,274	100.0	48.8	51.20	61,647	82.98	15.02

¹Umudugudu (Planned rural settlement)

²Integrated Model Village, Old settlement, Dispersed/ Isolated housing, Modern planned urban housing Spontaneous /squatter housing other type of housing

In terms of project affected households, 1657 households and one public institution (Nsheke Primary School) will be affected within the project-affected area. The data reveals that the largest share of the project affected population across all sectors falls within the 4–17year age group, accounting for 37.0% of the total population. The 18–35-year age group, representing 29.3% of the population, forms the core of the potential agricultural workforce.

Individuals aged 36–64 years constitute 22.2% of the population and typically serve as household heads and main income earners. Children under 3 years comprise 6.2% of the total. The elderly population (65+ years) makes up 5.4% of the total,

The socio-demographic analysis of Project-Affected Households (PAHs) reveals a total of 1657 households and one public institution across the five sectors: Karama, Nyagatare, Rukomo, Rwempasha, and Tabagwe. Of this total, 24% (398) are female, while 76% (1,259) are male, indicating a gender imbalance likely influenced by factors such as labor roles and household representation. These imbalances can be important for tailoring gender-sensitive project interventions, such as targeting female participation in water users' associations or capacity-building programs under Component 2 of the irrigation project.

5.3.2 Vulnerable Groups

The socioeconomic landscape of Rwempasha, Rukomo, Karama, Nyagatare and Tabagwe sectors reflects a mosaic of opportunities and vulnerabilities shaped by demographic dynamics, livelihoods, and infrastructure access as shown in Tables 5-13 and 5-14. These sectors, predominantly rural, host a significant proportion of vulnerable groups, which must be centrally considered in project planning and safeguards. Children under 18 years comprise nearly 47.3% (111,576) of total population in the five sectors (250,634) as well as 2.95 % of children aged five (5) and above with disability, underscoring high dependency ratios and the need for investments in child-centered services such as education and nutrition.

Table 5-13: Distribution of Persons aged 5 years and above with disabilities (NISR, 2022)

Sector	Disabled Male (Count)	Disabled Female (Count)	Total Disabled (Count)	Population aged 5yrs above (Count)
Nyagatare	1,040	1,217	2,257	70,276
Karama	533	628	1,161	28,215
Rukomo	658	803	1,461	37,542
Rwempasha	505	606	1,111	32,941
Tabagwe	693	731	1,424	45,342
TOTAL	3,429	3,985	7,414	214,316
% of total population in five sectors	1.36	1.58	2.95	85.5

Youth (16–30 years), who represent about 27.57% of the total population in the five sectors, face high rates of underemployment, with many engaged in seasonal agriculture or informal trade. Women-headed households—accounting for 27.1% of total households—face heightened vulnerability due to limited access to land and productive assets. The elderly (3.02% elderly females and 2.37% elderly males) often live without adequate social protection, while instances of child-headed households, though rare, are were not recorded and indicate deeper layers of social fragility, especially in remote communities.

Table 5-14: Distribution of elderly persons, children and youth

Sector	Elderly (Count)		Youth (Count)	Children (Count)	
	Male	Female	All sexes	Male	Female
Nyagatare	1,686	1,994	24,298	18,913	18,915
Karama	998	1,299	9,015	7,562	7,591
Rukomo	931	1,411	11,727	10,329	10,137
Rwempasha	1,021	1,167	10,044	9,562	9,212
Tabagwe	1,328	1,701	14,035	13,253	13,102
Total	5,964	7,572	69,119	59,619	58,957
% of total population in five sectors	2.37	3.02	27.57	23.78	23.52

The vulnerability profile of Project-Affected Households (PAHs) reveals the diversity and severity of social vulnerability factors across the five affected sectors: Karama, Nyagatare, Rukomo, Rwempasha, and Tabagwe. Out of 1657 PAHs, a total of 713 vulnerable Households heads were identified based on multiple criteria, including female-headed status, old age, disability, orphan care, widowhood, chronic illness, and income poverty. Elderly-headed PAHs (65+ years) are the most common form of vulnerability, making up 31% % of all vulnerable PAHs.

PAHs with chronic illness account for 7% % of all vulnerable households, with Nyagatare Sector showing a particularly high share at 23.86 %. This may point to increased health burdens in the area, likely related to its semi-urban environment and access to diagnosis services. PAHs with disabilities are also notable, comprising 7% of vulnerable PAHs overall. Female-headed Households make up 18% and 28% of the total vulnerables being widows.

5.3.3 Economic activities and Employment

Economically, the five sectors are anchored in subsistence agriculture and livestock rearing, which together employ over 74% of the working population. Households primarily cultivate maize, beans, and cassava, while cattle and goats remain vital to both livelihoods and cultural identity. However, climate variability and land degradation have disrupted productivity in recent years. A small but growing informal sector, estimated at 18.5%, provides livelihoods through petty trade, motorcycle taxis (*moto*), and artisanal crafts, especially among youth. Formal employment

opportunities remain limited (7.3%), largely confined to civil service roles and a few NGO-supported initiatives.

Employment in Nyagatare District is predominantly informal and agriculture-based, reflecting the rural character of sectors like Rwempasha and Karama. According to the 2022 census, 57.8% of the working-age population (16 years and above) in Nyagatare is economically active, placing the district among those with relatively high labor force participation rates in Rwanda. However, the majority of this labor force over 74%, is engaged in subsistence agriculture, with limited access to mechanization or value chains. Livestock farming, especially cattle rearing, remains a key economic activity and source of household income.

The informal sector absorbs approximately 18.5% of the employed population, with youth and women disproportionately represented in low-paying, insecure jobs such as petty trade, domestic work, and informal transport (*moto* services). Formal employment is limited to 7.3%, mostly in public administration, education, and health services. Youth unemployment and underemployment are pressing concerns, particularly in Rukomo and Tabagwe, where limited vocational training and job creation initiatives constrain economic mobility.

Amongst the identified PAHs, the occupation structure of the 1657 Project-Affected Households (PAHs) provides key insights into livelihood patterns in the project area: Agriculture remains the core economic activity, with 54% (901 households) involved, 37% (615 households) practicing agriculture and livestock. Only 4% (61 households) are employed in government positions, and 0.5% (8 households) in private salaried jobs. 1% in trading (23 households), 1% in Skilled handcrafts (15 households), 15 households (1%) are unemployed and Transport (0.5% with 8 households) are minor livelihood sources, often practiced in a semi-informal setting. These sectors may present growth opportunities, especially in Tabagwe, Rukomo, and Nyagatare, where skills and small-scale enterprise already exist.

The income distribution of Project-Affected business owners Households (320 PAHs) across the five sectors—Karama, Nyagatare, Rukomo, Rwempasha, and Tabagwe—indicates that the vast majority of households live on low to very low monthly incomes, with a clear concentration in the lowest income brackets.

Across the full population, 10% of households earn more than 200,000 RWF, but not exceeding 500,000 RWF per month, and an additional 42% (135 PAHs) fall within the 50,001 to 200,000 RWF range. Combined, this means nearly 5 in every 10 households (48%) subsist on less than 50,000 RWF monthly. These figures reflect serious income poverty, especially considering that these incomes must support rural livelihoods often reliant on subsistence agriculture.

5.3.4 Land tenure

Land tenure is a critical pillar in the region's socioeconomic fabric. Approximately 81.6% of households in Nyagatare own land, with 67.2% possessing formal titles. Nonetheless, tenure insecurity persists, particularly for women, despite legal provisions promoting gender equality in land ownership. Land fragmentation and competing land uses, agriculture, grazing, settlement,

have intensified, heightening the risk of conflict, especially in densely populated areas like Rukomo and Tabagwe. Out of 1,657 Project-Affected Households (PAHs) identified in the survey are landowners, Tabagwe Sector has the largest number of landowners (684), followed by Rukomo (389) and Nyagatare (286), while Rwempasha (134) and Karama (164) have comparatively fewer.

5.3.5 Poverty

Poverty remains a pervasive concern, with 34.5% of the district population living below the national poverty line. Sectors such as Rwempasha and Karama experience multidimensional poverty, reflected in poor housing conditions, inadequate sanitation, and limited access to electricity or clean water. The *Ubudehe* categorization continues to be a key targeting mechanism, with a substantial proportion of households falling into Categories 1 and 2, markers of extreme and moderate vulnerability.

5.3.6 Access to Infrastructures and Services

Access to infrastructure and basic services varies significantly across the five sectors:

5.3.6.1 Education

Education indicators in Nyagatare show progress in access but persistent gaps in quality and retention. The district boasts a primary school net enrollment rate of 94.1%, reflecting strong uptake of basic education. However, transition to secondary education remains a challenge - hampered by distance, affordability, and inadequate infrastructure. Many students, especially in Karama and Rwempasha, drop out due to long distances to schools, lack of boarding facilities, and household poverty. The secondary school net enrollment rate is significantly lower, with disparities more pronounced among girls and children from vulnerable households. Adult literacy in Nyagatare stands at 72.3%, slightly below the national average, with rural sectors lagging behind urban centers. Efforts to expand access to Technical and Vocational Education and Training (TVET) have begun to take root, but coverage remains limited. The district has a few TVET centers, yet their capacity and alignment with local labor market needs are still evolving. Investments in teacher training, school infrastructure, and inclusive education are critical to improving learning outcomes and reducing dropout rates.

Regarding the surveyed 1657 PAHs, school attendance is a critical indicator of PAHs welfare and long-term socio-economic development. The data collection task assessed whether the PAHs attended school at the time of data collection. The socio-economic data collection results show that 63% completed only primary school and 33% never attended school, while very few reached secondary (4%) or university (less than 1%). Men dominate across all levels (76% male vs. 24% female). For other members in the households, 47% of household members have completed primary education, providing a broad base of basic literacy and numeracy. However, only 30% have progressed to secondary education, and a very small proportion, 3%, have attained

university education, highlighting limited access to higher learning opportunities. A further 10% of household members have never attended school, reflecting persistent educational gaps within the community. In addition, 9% are children who have not yet started formal schooling, which indicates ongoing educational transition within households.

Overall, the survey under this ESIA identified only one school located within the vicinity of the proposed project sites, namely Nsheke Primary School located in Nsheke Cell, Nyagatare Sector. School infrastructures of toilet facilities and fence will be directly impacted by construction activities (see consultation meeting in Annex 15). This school is situated within close range of labor-intensive zones and access routes. Given the potential exposure of adolescents to Gender-Based Violence (GBV) risks during project implementation, the ESIA strongly recommended that targeted and continuous sensitization efforts be conducted in this school. This should include age-appropriate awareness sessions, engagement with school leadership, and integration of GBV safeguards into community outreach plans.

5.3.6.2 Access to Energy

While national efforts to expand rural electrification have borne fruit, the overall connection rate in Nyagatare is still at 42.7%, with many households in Karama and Tabagwe relying on off-grid solutions such as solar kits. The majority of affected households rely on traditional energy sources, with limited penetration of electricity or solar systems. A breakdown of lighting sources was also studied. Lighting sources among Project-Affected Households (PAHs) reflect significant energy disparities across the five sectors.

While access to electricity and solar energy dominates, the data reveals varying degrees of energy infrastructure and affordability influencing lighting choices.

Solar energy is the most common lighting source overall, used by 49.7% of households highlighting its affordability and increasing adoption as the main source of household lighting. This high reliance on solar systems points to the growing role of off-grid solutions in meeting rural energy needs, particularly where grid electricity is limited or unaffordable.

Electricity from the grid is used by 35.9% (595 PAHs) of total households is significant but still lags behind, reflecting gaps in grid connectivity across the community. Battery-powered lighting plays a modest role across sectors. Kerosene lamps and candles are now rare lighting sources. Kerosene accounts for only 0.8% overall while candles are used in 1.5% of households. Their low usage suggests positive progress in eliminating unsafe and inefficient lighting sources.

The dominant cooking fuels among affected households were also recorded. A heavy reliance on biomass such as firewood and charcoal may indicate environmental and health risks. Overall, firewood is the dominant source of cooking energy, used by 90.6% of all affected households. Charcoal, although cleaner than raw biomass, is used by 7.2% of households. Gas use, overall, remains very low (2.0%),

5.3.6.3 Access to Water

Water access also remains uneven in the overall district; only 58.3% of households use improved water sources, with reliance on boreholes, springs, and seasonal streams common in remote zones.

For PAHs identified in the project area, access to safe and reliable water was examined by identifying the **main water sources** used by households and estimating the **average distance to water points**. These indicators are essential for understanding potential risks to health and productivity. The majority of households rely on tube wells or boreholes (41%) and public standpipes (40%), showing that groundwater and shared public access points are the dominant water sources. Additionally, public piped to yard/plot, serving up to 7% of all project affected household. The surface water sources dependants across all sectors (wells, rain water, protected springs), accounts for 2.0 % of total households, with only 1% PAH who depend on unprotected springs and piped into dwelling.

5.3.6.4 Health Services and Disease Burden among Households

Health and education services have improved in coverage but still face limitations in quality and staffing. Most sectors have at least one health center, yet gaps in essential drugs, medical personnel, and ambulance services persist. The five sectors: Rukomo, Nyagatare, Rwempasha, Karama, and Tabagwe are served by local health centers, with Nyagatare town hosting the district hospital and private clinics. Rukomo and Rwempasha have dedicated sector-level facilities, while Karama relies on Kabuga Health Centre. Tabagwe accesses nearby services in Nyagatare. This setup ensures basic coverage and referral access across the cluster.

The data indicates that a majority of Project-Affected Households (56.4% PAHs) live within a 1–2-kilometer radius of the nearest health facility, suggesting generally good geographic access. However, a significant share (25.3%) is located 2.1–5 km away, and another 15.2% live within less than 1 km, which indicates disparities in access. While only a small fraction (3.0% combined) lives at distances greater than 5 km, these households face increased vulnerability in emergencies due to travel constraints.

Understanding the health profile of Project-Affected Households (PAHs) is crucial for planning effective social and health interventions. The dataset reveals a range of 660 health challenges or cases across sectors, with both communicable and non-communicable diseases reported.

The most frequently reported illness across all sectors, 22% PAHs reported on malaria cases. Blood pressure-related illnesses also follow same trend, reported by 22% of PAHs respondents overall. Tuberculosis (TB), though less widespread, still comprises 7% of all cases. Diarrhea (9%) and respiratory infections (6%) reflect poor water quality and exposure to indoor air pollution. Skin diseases (8%) are also noteworthy, and underscores the need for improved health data classification during future assessments.

Regarding HIV prevalency, recent data from the Rwanda Biomedical Centre²⁷ and Kigali Times²⁸ show that Eastern Province, which includes Nyagatare District, had 289,015 people tested in 2023, with 2,675 confirmed infections, suggesting a positivity rate of approximately 0.9%. While this is lower than historical peaks, it still warrants attention, particularly in sectors like Karama, Tabagwe, Rwempasha, Rukomo, and Nyagatare town, where construction activities may attract mobile workers and increase GBV and HIV transmission risks.

5.3.6.5 Common Means of Transport

Road infrastructure poses additional challenges, feeder roads linking communities to main markets are often unpaved and susceptible to erosion, impeding transport during the rainy season. The mode of transport used by households in the project area provides insight into infrastructure accessibility, economic capacity, and service availability. Across all sectors, walking is the overwhelmingly dominant mode of transport, used by 81.6% of respondents. This reflects the rural character of the area, limited access to public transportation, and likely low household income levels. The use of bicycles (8.3%) and motorcycles (9.7%) across all sectors suggests some modest levels of transport asset ownership or community-based informal transport systems. However, public vehicle use is virtually nonexistent (0.5%), with only 10 households out of 2,078 reporting it. This indicates a critical gap in formal public transportation systems and potentially poor road connectivity.

5.3.7 Urbanization

Among the five sectors, Rukomo and Tabagwe exhibit the most visible signs of urban transition. Rukomo benefits from its location along key feeder roads and its role as a service center for surrounding rural communities. It has seen increased construction of semi-permanent housing, small-scale commercial centers, and public facilities such as schools and health posts. Tabagwe, bordering Uganda, is also experiencing densification due to cross-border trade and the expansion of rural electrification and water supply programs.

Karama and Rwempasha, by contrast, remain predominantly rural, with dispersed settlements and limited urban infrastructure. However, the government's *Imidugudu* (grouped settlement) policy is gradually reshaping settlement patterns, encouraging clustered housing to facilitate service delivery and land use efficiency. These sectors are also targeted for future densification under the district's spatial development framework, particularly in areas with access to water points, schools, and health centers.

5.4. Sensitive receptors

The project area spans ecologically and socially diverse sectors including Rwempasha, Karama, Tabagwe, Nyagatare, and Rukomo, where sensitive receptors play a critical role in shaping the environmental and social safeguards strategy. These receptors mainly include buildups

²⁷https://rbc.gov.rw/fileadmin/user_upload/report23/HIV%20Annual%20report%202022%20-2023.pdf

²⁸ <https://www.kigalitimes.rw/2025/01/07/hiv-in-rwanda-insights-and-challenges-from-recent-statistics/>

(residential communities, public institution of Nsheke primary school), and Muvumba river. In other sensitive receptors found in the project area include agroforest trees of about 17 families were identified in the project area with high dense grevillea trees (600trees/ha) in agroforestry area (Table 5-9).

Although not in the project area of 3073ha, the field assessment conducted under this ESIA indicated that the Muvumba gallery forest, located at 0.65km from the nearest main canal (extended canal) is made of mainly *vachellia kirkii*, which naturally grows along the Muvumba river near Nyagatare City and provides habitat for several birds, amphibians, and small mammals of which some were found in the project area (Fig.5-17). The species naturally grow in water-logged areas. It is found in the Muvumba wetland along the Muvumba River in the Tabagwe and Rwempasha sectors of Nyagatare district, north-eastern Rwanda.

The gallery forest with a density of 1305 *V. kirkii* trees per ha tolerate seasonal flooding and maintain a humid mi-croclimate year-round enabling several undergrowth species to survive (Mugunga et al., 2021). This riparian vegetation provides a habitat for several birds, amphibians, and small mammals. The vegetation also serves to support the associated wetland ecosystem, especially by protecting the Muvumba River.

These species had the most localized distribution, clustered into a thin, riverine forest adjacent to the Muvumba River where the species' individuals occurred in an almost pure, monospecific stand as shown in Fig.5-16. Six other tree species namely, *Euclea schimperi*, *V. sieberiana* var *woodii*, *V. gerrardii* (Benth.), *Elaeodendron Schlechteianum*, *Erythrina abyssinica*, and *Sapium ellipticum*. were identified in the forest, but their den-sities were lower than *V. kirkii* in the same niche. Even when their numbers were combined, *V. kirkii* outnumbered them by over three-fold.



Figure 5-16: Plant diversity in the project area (*Vachellia kirkii*)

The gallery forest hosts a remarkably diverse array of fauna, spanning several ecological families. Amphibians such as true toads (Bufonidae) and reed frogs (Hyperoliidae) thrive in its moist undergrowth, while reptiles like the African side-necked turtles (Pelomedusidae) inhabit its freshwater zones. The forest also supports a rich avian population, including cranes (Gruidae), herons and egrets (Ardeidae), and waterfowl from the Anatidae family. Insects play a vital role in the ecosystem, with mosquitoes (Culicidae) and dragonflies (Libellulidae) contributing to both the food web and environmental balance. This blend of terrestrial and aquatic species highlights the gallery forest's role as a biodiversity hotspot, offering critical habitats for a wide range of fauna.

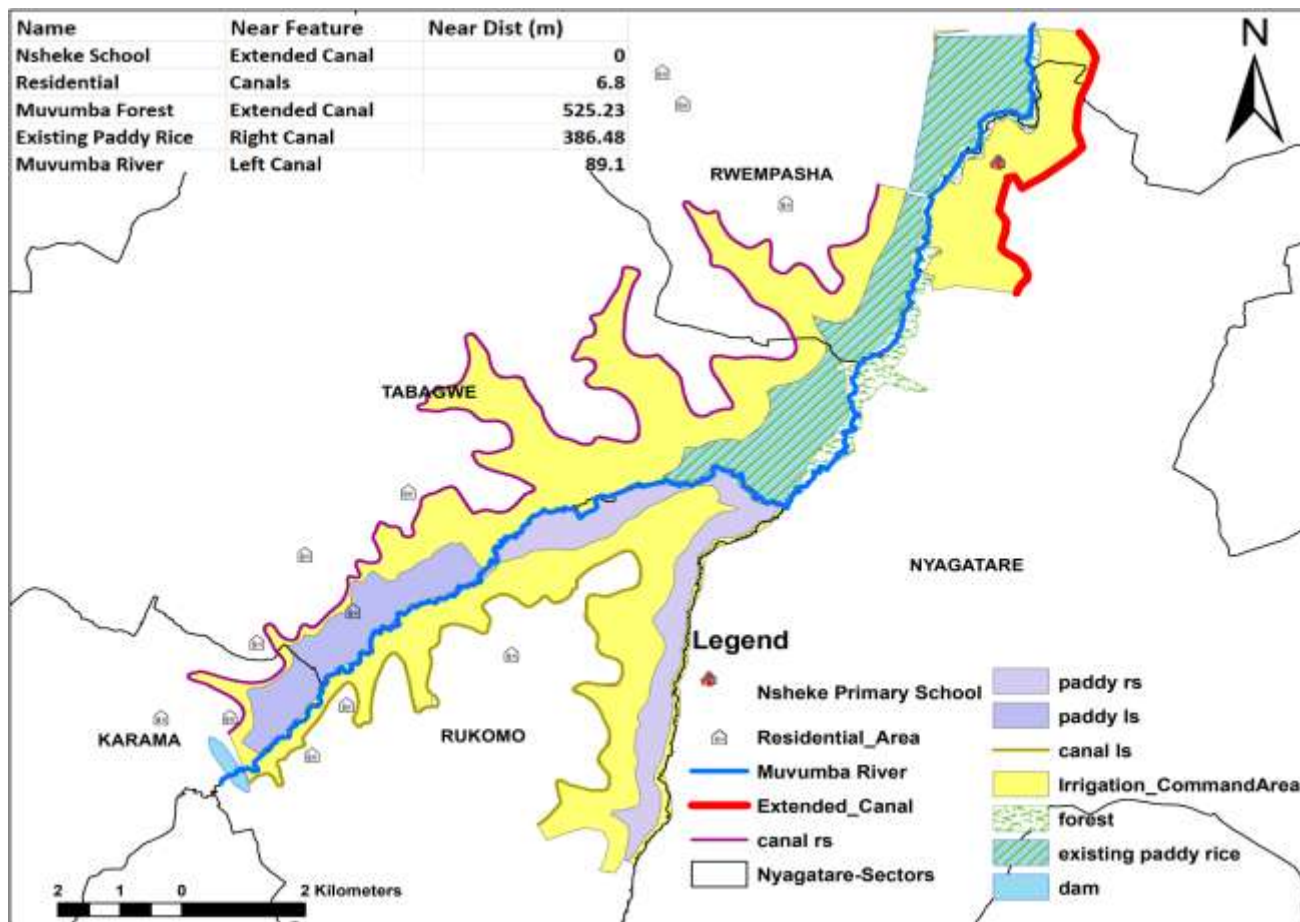


Figure 5-17: Sensitive receptors within and near the project area



Figure 5-18: Nearest point of Irrigation Canal to the Gallery Forest

As indicated earlier, the Grey Crowned Cranes *Balearica regulorum* were spotted in the Muvumba wetland/rice paddies located outside project command area of 3073ha, during the field assessment conducted in July 2025 as shown in Fig. 5-18. The *Balearica regulorum* is listed as Endangered and it is on IUCN redlist. It was observed that the breeding sites for the species are could be located in the Muvumba Gallery Forest, and thus, this site will not be disturbed by the construction activities. This is because the gallery forest will not be negatively affected by the project as they are not found in the project command area, where irrigation pivot and sprinkler infrastructures and canals will be established. However, due to irrigation activities, it is predicted that the cranes might be attracted by new habitat that will be created after installation of irrigation canals as seen in the case above in July 2025. Therefore, this project will implement protective measures including, community awareness on the importance of diversity and the vulnerability of these special species.

The sighted the grey crowned crane in one of the fields within the rice fields—presumably attracted by the rice fields/paddies and likely having migrated from the National parks especially Akagera (over 100kilometres away). The crane is a protected species in line with the Ministerial order No 007/2008 establishing the list of protected animals and plant species in Rwanda and appears on the IUCN List of endangered species.

One-quarter of the Rwandan Grey Crowned Crane population depends on marsh ares and, its abundant and diverse aquatic plant life. Plants here serve as food sources and play a vital role in stabilizing the marsh ecosystem by preventing erosion of the fertile volcanic soil and maintaining water quality. The crane often plucks insects, small reptiles and plant material from the marsh/wetland.

The theory of migration is supported by results based on The Integrated Biodiversity Assessment Tool (IBAT) which provides fast, easy and integrated access to critical biodiversity information. The IBAT facilitates access to biodiversity information for business decisions, based on Protected Areas, Key Biodiversity Areas, and the IUCN Red List. IBAT results shows no natural habitats for protected species within 1 km as well as within 5km of the project site. The nearest natural habitats and protected species are within 50km of the project site.



Figure 5-19: Grey Crowned Crane in Muvumba Wetland/Rice irrigation paddies outside the 3073ha

Additionally, the gallery forest shelters several species, including the Olive Baboon (*Papio anubis*), known for its complex social behavior and seed dispersal role. Protecting them supports ecosystem integrity, biodiversity conservation, and human-wildlife balance. Project safeguards ensure their habitat remains intact, minimizing ecological disruption and fostering long-term resilience in Muvumba's landscape.

Despite being outside the command area, with the expectation that the irrigation area may also attract the grey crowned crane in the future into the project area, the ESIA proposes that prior to operation, RWB/RAB to prepare a sensitization plan that will include need for sensitization of the targeted Muvumba irrigation water user committees and cooperatives on the importance of the grey crowned crane. Further the contractor teams will be sensitized that any hunting in the gallery forest or project area is strictly prohibited.



Figure 5-20: Baboons' species mostly found in the Muvumba galley forest

6. ENVIRONMENTAL AND SOCIAL IMPACT ANALYSIS AND MANAGEMENT

6.1. Introduction

This chapter outlines the potential negative and positive impacts that will be associated with the implementation of the proposed project. An impact is any change to the existing condition of the environment caused by human activity or external influence. Impacts therefore may be positive (beneficial) or negative (adverse). They may also be direct or indirect, long-term or short-term, and extensive or local in effect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific (localized) or widespread, reversible or irreversible.

Different types of impacts shall occur from the project activities. Which may be positive or negative and can be categorized as being either direct (primary), indirect (secondary) or cumulative. Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (for example, dust generation excavation activities). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable. Indirect impacts are induced changes that may occur because of the activity (for example the use of water from a natural source at the activity will reduce the capacity for supply to other users). These types of impacts include all the potential impacts that either do not manifest immediately when the activity is undertaken, or which occur at a different place because of the activity

Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (for example, removal of vegetation may cause soil erosion, leading to excessive sediments in receiving stream, leading to reduced sunlight penetrating the water and thus reducing dissolved oxygen in the water and adversely affecting aquatic life and water quality). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts (Evan, 1982) Those kinds of impacts are predictable for this project, as the irrigation activities will be preceded by dam and intakes construction, temporary facilities, excavation works for channel preparation etc.

This section entails assessment of impacts of the irrigation project. The proposed project has potential to cause positive as well as adverse impacts on the biophysical and socio-economic environment. The magnitude of potential impacts will vary between the phases of project implementation

The analysis of impacts will be related to activities carried out during:

- i. Pre-construction Phase
- ii. Construction phase;
- iii. Operational phase;
- iv. Decommissioning phase

6.2. Impact identification and analysis

Assessment of impacts depend on the nature and magnitude of the activity being undertaken, as well as the type of environmental control measures that are envisaged as part of the project proposal. Several aspects and potential impacts were identified for each phase (Pre-construction, Construction and Operation and decommissioning) of the development, with impacts evaluated in terms of their nature, occurrence, possibility and severity potential. Some impact mitigations have already been addressed in the proactive design and other mitigations can only be guaranteed through active, responsible management, helped by following the guidelines in the project Environmental Management Plan.

The impacts of the project during each of its life cycle stages (preparation/planning, construction, operation and decommissioning) can be categorized into: impacts on the biophysical environment; health and safety impacts and socio-economic impacts. All the potentially significant environmental and social from the project are grouped into the following receptors:

- ❖ Air Environment: Impact on ambient air quality.
- ❖ Noise Environment: Impact on ambient noise.
- ❖ Water Environment: Impacts on surface and ground water quality.
- ❖ Land Environment: Impacts on land use and on soil fertility.
- ❖ Impacts on trees/vegetation, forest and wildlife (Ecological impacts)
- ❖ Socio-Economic Impacts:
- ❖ Impacts on other infrastructure.
- ❖ Impacts on employment.
- ❖ Impacts on public health and safety,
- ❖ Impacts on aesthetics.
- ❖ Living conditions.

6.2.1. Sources of Impacts

The possible impacts associated with this project mainly emanate from site activities, products, By-products and outputs. These are related to for instance:

- ❖ Land acquisition and resettlement
- ❖ Contractor/staff activities at the site: earth works, creation of quarries, etc.
- ❖ Pollution from earthworks etc.
- ❖ Visual impacts from the project structure
- ❖ Impact resulting from site clearance (grasses and trees)
- ❖ Habitat loss from tree cutting and site clearance, noise pollution that affects birds etc

6.2.3. Impact Analysis

To assess the affected environmental and social aspects, Leopold Impact Matrix as shown in Table 6-1 was used and this offers a structured yet flexible framework for qualitatively assessing the environmental and social repercussions of irrigation projects. By charting interactions between proposed activities and affected components, the matrix enables specialists to pinpoint critical areas where interventions may alter ecological systems, community dynamics, and resource flows. This tool's strength lies not in numerical precision but in its capacity to foster reflective analysis, bringing clarity to complex relationships that govern the sustainability of water-based infrastructure.

Table 6-1: Impact analysis matrix:

Nature or Status of the Impact: The type of effect the activity would have on the environment		
Status	Description	
Positive	a benefit to the holistic environment	
Negative	a cost to the holistic environment	
Neutral	no cost or benefit	
Duration (D) of the Impact: The lifetime of the impact		
Score	Duration	Description
1	Short term	less than 5 years
2	Medium term	5 – 10 years
4	Long term	Beyond 10 years
5	Permanent	Cannot be remedied
Extent or Scale(E) of the Impact: The distance from source that impacts may be experienced		
Score	Extent	Description
1	Site specific	Within the site boundary (less than 500m)
2	Local	Affects immediate surrounding areas (within a radius of 500m-5Km)
		Extends substantially beyond the site boundary
3	Regional	Extends substantially beyond the site boundary
4	National	Affects country
5	International	crosses international borders
Reversibility(R) of the impacts: to what degree its influence on the relevant environment can be negated		
Score	Extent	Description
1	Completely reversible	Reverse with minimal rehabilitation & negligible residual effects
2	Reversible	Requires mitigation and rehabilitation to ensure reversibility
3	Irreversible	Cannot be rehabilitated completely/rehabilitation not viable
Intensity or Magnitude(I) of the impact: Severity of the negative and magnitude of positive impacts		
Score	Severity	Description
1	Low	Little effect-negligible disturbance/benefit
2	Low to Moderate	Effects observable-environmental impacts reversible with time
3	Moderate	Effects observable-Impacts reversible with rehabilitation
4	Moderate to high	Extensive effects-irreversible alteration to the environment
5	High	Extensive permanent effects with irreversible alteration
The probability(P) of the impact: describes the likelihood of the impact actually occurring		
Score	Rating	Description

1	Unlikely	Less than 15% probability of an impact occurring
2	Possible	Between 15-40% sure of an impact occurring
3	Probable	Between 40-60% sure of an impact occurring
4	Highly probable	Between 60-85% sure of an impact occurring
5	Definite	Over 85% sure that the impact will occur
The consequence (C)		I+E+D+R
The significance (S)		Consequence(C)*Probability (P)

6.2.3.1. Determination of Significance

Based on the criteria described above, the significance of an impact can be determined. The various ratings are then accorded to these criteria shown in Table 6-3. These ratings shown in Table 6-2 are formerly used to calculate a significance (S) rating and are formulated by adding the sum of ratings given to the extent (E), duration (D), Reversibility (R) and intensity (I) and then multiplying the sum with the probability (P) of an impact as shown in equation 6.2.

Table 6-2: Impact significance rating

Score out of 100	Significance	Equation
1 to 20	Very low	Significance (S) = (E+D+R+I) X P(6.1)
21 to 40	Low	
40 to 70	Medium	
Over 70	High	

Table 6-3: Criteria used for determining impact significance

Impact scale	Descriptors
High	Irreversible, wide spread, covering local, regional and global indirect influence area. Will lead to high mortality of important endangered species on site and off site. Exceeds limits set by environmental standards both national and international. Major contribution to known global environmental problem with tangible effects. Causing widespread nuisance both onsite and offsite. Leading to the release of hazardous wastes which lethal effects in the environment. Permanent loss of livelihoods for entire community. Leaves permanent and irreparable scars on the landscape.
Medium	Noticeable effects on the environment which are reversible over the long term Localized degradation of resources restricting potential for further usage. Limited effects on locally or globally endangered species with no long-term effects on their reproduction and migratory behaviors. Increased pollution of water bodies in the short term but drops with time. Noise and air pollution above maximum levels accepted in the environment. Disruption of livelihoods in the short term but no long-term effects. Leads to a repairable scar on the landscape but reparable over time.
Low	Noticeable effect on the environment, but returning naturally to original state in the medium term. Minimum degradation of resources but does not does not constrain future use Disruption of the behavior of threatened/endangered species but returns to normal in the short term.

	Release of periodic particulate matter that is circulated in the short term Intermittent noise nuisance Changes in water and air quality levels not above maximum acceptable limits.
Very Low	No noticeable or limited local effect on the biophysical environment that rapidly returns to its original state. Unlikely to lead to any changes in ambient air and water quality. Unlikely to affect resources in any noticeable way. No anticipated effect on livelihoods Will not change the landscape in any way.

6.3. Positive environmental and social impacts

On the other hand, despite the negative impact, this project is expected to impact positively the social aspects of the community and improve environmental conditions. The quantified positive impacts are detailed in the following sections.

6.3.1. During construction phase

6.3.1.1 Creation of job opportunity/Employment

Construction works of irrigation structures require skilled, semi-skilled, and unskilled workers, thereby creating temporary job opportunities for numerous people. To improve the livelihoods of the local community, priority will be given to local hiring, and at least 450 unskilled workers will be employed. Importantly, a minimum of 30% of the hired workers will be female, ensuring gender inclusion and empowerment. In addition, as a result of the increased population during construction, other job opportunities such as the supply of commodities, provision of accommodations, food outlets, and restaurants will emerge, further supporting several jobless people in the area.

Enhancement measure:

- Recruit semi-skilled and unskilled workforce from local people, giving priority to women, youth and other disadvantaged groups as well as interested PAPs;
- Give on job training for the workers and graduate trainees including apprenticeships;
- Pay fair salary and cover health insurance;
- Promote labor intensive work.

6.3.1.2 Gender impacts

Women could work as daily laborers during the construction phase. Female-headed households in particular could benefit from the construction work through employment opportunities that would be created. They also gain working skills that can be applied in other similar activities. It also helps to develop confidence and self-sufficiency among women who are involved in the construction work. The other benefit of the project for the women during the construction phase is that it would help them to start small businesses such as opening tea houses, meal houses and small shops etc.

Enhancement measures:

- To exploit these advantages, the clause in the construction contract document should be included to encourage use of local manpower during the construction phase of the project, giving priority to women.
- Encouraging women to use local Savings and Credit Cooperative Organization (SACCOs) to enables them begin small businesses during the dam construction by providing initial (capital) money for the startup of small businesses. Offer training tailored to women's needs, including technical skills and leadership development.

6.3.1.3 Possibility of skill transfer

Construction of different infrastructures require technical knowhow for technicians and involved workforce. Scales of such planned activities will involve considerable technical, management and planning skills that will be gained by the Rwandese people who will be employed by the project and this will likely contribute to their capacity building in management, engineering, environmental, health and safety sectors. Working with international groups as supervisors or contractors can result in the transfer of skills and build additional local capacity where deliberate efforts are initiated for skills transfer.

Enhancement measures:

- Providing on the job training including apprenticeships
- Give priority of job opportunity for the local people
- Offer priority of job opportunity for women
- Have inbuilt initiatives for skills transfer and requirements for contractor to demonstrate this achievement.

6.3.1.4 Increased public revenues

The implementation of the irrigation project will increase revenue and taxes for both the central (Rwanda Revenue Authority) and local authorities. Revenues will be collected by both the national and local authorities from the procurement of construction materials and finishes, employees' salaries, VAT on materials and services, among others. The increased revenue of project's employees generated by their salaries will lead to the possibility of savings in local banks and micro-finances and hence, which may give in return an access to credit. With this credit, they will be able to invest in other activities such as construction of houses, commerce, agriculture development or livestock activities etc.

6.3.1.5 Promotion of local businesses and economy

During the construction phase of the irrigation project in Nyagatare District, the influx of workers, engineers, and support staff will stimulate local economic activity. Restaurants, shops, transport services, and accommodation providers are likely to experience increased demand, boosting daily revenue and creating temporary employment opportunities. This surge in foot traffic and service

consumption not only energizes existing businesses but may also encourage new micro-enterprises to emerge, especially in sectors like food vending, mobile money services, and construction supply. The economic ripple effect during this phase lays the groundwork for sustained local development even after the project is completed.

6.3.2. During Operation Phase

6.3.2.1 Increased crop production and productivity

A total of 3,073 hectares will be irrigated, and developing irrigation farming on such a large scale will significantly increase crop production and yields. This will help address the recurring shortage of food crops in the country and also contribute to foreign exchange earnings through the export of surplus produce.

Enhancement measures:

- Provision of extension services to ensure locals Select high yield crop varieties and locally acceptable as well as marketable crops;
- Control crop pests and weeds;
- Address post-harvest losses;
- Establish agro industries to add value on the farm products to ensure higher incomes

6.3.2.2 Create temporary and permanent job opportunities

It is expected that the infrastructure will boost agricultural production during operation, and members of the Water Users Association will benefit from employment opportunities. Additionally, the increased yield will necessitate more workers across the agricultural value chain. In total, about 450 jobs will be created, providing significant employment opportunities for local people as well as attracting workers from other areas in search of both temporary and permanent jobs.

Enhancement measures:

- Provide job opportunities for the local people, giving priority for women.
- Give on job training for the workers
- Pay fair salary and cover health insurance
- Reduce machineries and use more manual labor

6.3.2.3 Efficient use of land resource

During the study of baseline environmental and socio-economic conditions of the project area, it was revealed that the current use of the proposed land is mainly agriculture and grazing. There is much need for improvement. Converting this land into an irrigated farm would provide better production, enhance productivity and efficient use of the land resource for the betterment of the local people as well as for the country. This is important as land is a finite resource.

Enhancement measures:

- Allocate each land for appropriate use based on soil suitability, water and topography;
- Incorporate production of livestock food as part of irrigation farm;
- Reclaim eroded areas at the upstream and prevent soil erosion

6.3.2.4 Increased soil fertility and management

Implementing a modern irrigation with appropriate environmental management will improve soil fertility in the command area. This will be achieved primarily through the addition of organic matter with limited and carefully managed (right quantity) use of inorganic/chemical fertilizers where necessary. Evidence from existing good practices in some irrigation farms of the country show that previously infertile and sodic soils become fertile and productive through soil conditioning and better management. Therefore, the same practice would be expected to apply in the proposed irrigation area and soil condition would be improved along with the increase of crop productivity.

Enhancement measures:

- Use crop rotation methods to enable cultivation of leguminous plants with nitrogen fixation capability
- Select crops suited or adapted to the local climate and soil condition
- Avoid water logging of the farm field
- Avoid over irrigation and ground water table rise to overcome associated soil salinity. Apply only the required amount of water on the irrigation field
- Protect the farm field from soil erosion
- Increase the organic matter content in the soil by applying organic matter such as crop residue, compost and manure
- Practice integrated nutrient management to avoid nutrient depletion or accumulation
- Proper use of inorganic fertilizers

6.3.2.5 Increased access to water resources in the area

Efficient use of water resources is crucial for the development of a country's socio-economic condition. Hence, the irrigation system will optimize water allocation, ensures equitable access, and buffers extreme events.

Enhancement measures:

- Encourage community ownership through formation of farmer's groups
- Avoid water quality deterioration and pollution
- Collect and treat farm drainage before discharging to the nearby drainage lines, streams or rivers.
- Determine the quantity and quality of water needed for crop production and apply only the required amount of water in the irrigation field.
- Select crops compatible with water availability

- Reduce evaporation by avoiding midday irrigation
- Reduce seepage losses in channels by lining them and using quality materials.

6.3.2.6 Local socio-economic diversification and improvement

The implementation of the project is anticipated to positively impact both the local and national economy by fostering socio-economic benefits within and surrounding the project area. The resulting economic expansion is expected to stimulate the development of alternative businesses and livelihood opportunities, contributing to broader community resilience. Additionally, increased earnings among staff and project workers will likely be reinvested locally, thereby strengthening existing enterprises and encouraging the emergence of new micro and small businesses. This dynamic will promote inclusive growth and diversify the local economic landscape.

6.3.2.7 Improvement of living standards of local population

The project is expected to contribute to the improvement of living standards for the local population, with over 10,000 people set to benefit directly and indirectly from the irrigation infrastructure to improve their agricultural productivity on 3073ha. Revenues generated from various socioeconomic initiatives, along with the creation of both temporary and permanent employment opportunities to about 450 local workers and suppliers, will help increase household incomes. These benefits are anticipated to enhance the overall quality of life and strengthen opportunities for local business and other economic activities.

6.3.2.8 Increased livestock production and productivity

A total of 75 water troughs will be constructed within the command area to ensure adequate livestock watering. With the introduction of irrigation and livestock water supply, the feed shortage for cattle can be addressed through the increased availability of crop residues, fodder crops, and by-products from crop processing, thereby improving livestock productivity. Furthermore, the provision of clean drinking water at multiple points within and along the periphery of the command area will directly benefit cattle, goats, and sheep, while also facilitating better access to animal products for surrounding communities.

6.3.2.9 Increase overall economic development of the region

Expansion of irrigation farms can contribute to overcoming recurring drought problems and associated failure of the rain fed farming system. It will assure sustainable crop production at all years without depending on the rain fall and increased household income. This would contribute to the overall economic development of the country through reducing dependence on rainfall and creating reliable job opportunities for many jobless people.

Enhancement measures:

- Select high value crops
- Create market access
- Establish agro processing industries to add value on the farm products
- Manage properly the farms

- Adopt labor intensive farm system

6.3.2.10. Increase aesthetic value of the area

The existing agricultural practice in the area is traditional. The project will introduce new modern and climate smart agriculture that will attract learners in the area of agriculture to get knowledge. Additionally, it will attract tourists across in the field and thus, aesthetic value will increase. Hence, developing a modern irrigation farm would increase aesthetic and economic value of the area provided that it is managed and monitored in accordance with the proposed environmental and social management and monitoring plan forwarded in this ESIA report. Planting evergreens and ornamental trees on the roadsides, canal sides and farm boundaries would add beauty on the proposed farm areas.

Enhancement measures:

- Planting ornamental as well as indigenous tree species on the boundaries of irrigated farm plots and road sides,
- Attracting water fowls by introducing fish and creating appropriate buffer zones around the reservoir for feeding, breeding and recreation.
- Allocate buffer zones on both sides of the river and plant indigenous trees to enrich riverine forest.

6.3.2.11 Improved land value

Nominal land prices may increase due to improved agricultural land on 3073 ha with irrigation infrastructure. Therefore, it will lead to the high value of irrigable land useful for cultivation and marketability which was otherwise less favored due to drought. As a result, due to the improved potential of its productivity, it would increase the land value.

6.3.2.12 Food security and improved nutrition

Currently, local farmers used to have only one season, which puts them under food insecurity. The irrigation project implementation will allow them to have three seasons and this will increase crop productivity, especially fruits. Through increasing crop productivity, the project will contribute to food security at local and national level and hence this would imply that if the production is improved, there will be more food, thus resulting in a decrease in food prices and making crops affordable to all local population and those outside the project areas.

Additionally, the increased and diversified crop productivity is expected during the operation phase of the project. This implies that if the production is improved, there will be more food hence making it affordable to all local communities. The project will increase the production of fruits and vegetables, which are essential in nutrition.

6.4. Negative environmental and social impacts

6.4.1. During pre-construction phase

6.4.1.1 Loss of land and physical displacement

In total, 1657 project affected households (PAHs) and one public institution will be affected through loss of their own land and its latrines.

The households that will lose their assets for main canal construction will be compensated. The total area that will be taken to accommodate the main canal is 189.7ha, of which 2.280m² belongs to Government of Rwanda (Nsheke Primary School).

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Loss of land and physical displacement	Short-term ²⁹	Site specific ³⁰ to Local ³¹	Moderate ³² to High ³³	Reversible ³⁴	Definite ³⁵	High ³⁶

Mitigation measures:

- RWB has prepared a detailed Resettlement Action Plan to guide land expropriation and based on clear criteria for eligibility
- RWB in collaboration with local authorities will provide full replacement cost of all affected population as per the National Expropriation/Compensation Law, and in observance of the AfDB ISS policies, prior to the start of the works
- The affected persons will have priority of job opportunity during the recruitment in the beginning and during implementation of project activities.
- The Project Affected Persons (have been and) will be continually meaningfully consulted and given opportunities to participate in the planning and implementation of resettlement program
- The ESIA establishes a credible, independent and empowered local grievance and redress mechanism to receive, facilitate and follow up on the resolution of affected people's grievances and concerns about the environmental and social performance of the project.

The implementation of the above proposed mitigation measures will reduce the significance of the residual impact from high to minor within the receptors as shown below:

²⁹ Impact is expected to last in the short term (<5 years)

³⁰ within the site boundary (less than 500m)

³¹ limited to specific individuals or communities or environmental receptors at or close to the site (within a radius of 0m-5km)

³² observable-impacts reversible with rehabilitation

³³ Has a measurable and sustained positive or negative impact on social or environmental aspects.

³⁴ Impact requires mitigation and rehabilitation to ensure reversibility

³⁵ Impact with over 85 % probability to occur.

³⁶ The impact is unacceptable and further mitigation measures must be implemented to reduce the significance

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Loss of land and physical displacement	Pre-construction	High	Minor

6.4.1.2 Affected Infrastructure

Public roads (4 roads sections) owned by the district will be crossed by the canals will be affected and will be relocated. In addition, one institution, Nsheke Primary School, will be affected by the main right canal, particularly through the loss of its fence and toilet facilities

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Loss of infrastructure service	Short-term	Local	Moderate	Reversible	Definite	Medium

Mitigation measure:

- During the construction of irrigation canals that intersect the roadway, box culverts will be installed and canal construction will proceed by excavating and working on one lane at a time, while the other lane remains open to ensure continuous access for both vehicles and pedestrians. In addition, cross bridge will be constructed to restore transport and accessibility.
- Provide fair and adequate compensation for the loss of the school's fence, land and toilet facilities, in line with national resettlement and compensation regulations.
- RWB will collaborate with affected institutions such as REG and Nyagatare district authorities to confirm where to relocate the affected electric poles.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Loss of infrastructure service(road)	Pre-construction	Medium	very low

6.4.1.3 Loss of livelihood

The land use of the proposed irrigation command area is mainly used for traditional agriculture and grazing. The local people are farmers and pastoralists who depend mainly on cattle rearing and crop growing. Therefore, establishing irrigation canals and pivot structures on land would

significantly affect 2078 PAPs and their farmlands and 2,560 fruit trees according to RAP survey. Other loss of land will occur due to temporary site installations, quarry and borrow areas.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Loss of livelihood	short-term	Local	Moderate ³⁷ to High	Reversible	Definite	High

Mitigation Measures

- Livelihood restoration plan will be developed during RAP preparation by RWB via consultant and will target agricultural and livestock-based support programs and financial literacy to rebuild affected households' income and strengthen resilience.
- Inclusive Land Reallocation to ensure redistributed land is productive and near original locations, preserving cultural ties and access to essential resources.
- Compensation on full replacement cost and support to provide fair payment for lost land and temporary use zones, with transitional support to stabilize income during adaptation.
- Tailored resettlement strategy to respect community preferences by relocating families nearby and offering support to those opting for relocation elsewhere.
- Skills development and job creation to employ locals in irrigation scheme activities and promote non-farm vocational paths for income diversification.
- Grievance redress mechanism (GRM) should be established and be responsive, culturally sensitive system to address concerns and improve implementation fairness.
- Monitoring and adaptive management should be conducted regularly and ensure community-involvement and evaluations to adjust restoration strategies and ensure effectiveness over time.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from high to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Loss of livelihood	Pre-construction	High	very low

6.4.2. During construction phase

6.4.2.1 Impact on Terrestrial Biodiversity

Construction of irrigation structures may affect the existing ecosystem near the proposed irrigation command areas and from the Muvumba Wetland in general. Grey Crowned Cranes

³⁷ Effects observable-environmental impacts reversible with time

(*Balearica regulorum*) were spotted in the vicinity of the project area and found to be on IUCN Red List of Threatened Species listed as Endangered. However, IBAT shows these as native to areas more than 50km from the project site thus supporting that these may be migratory and attracted by the marsh in Muvumba 8 area as well as the forest gallery in approx. 525.23m from the nearest main canal which not be directly affected by the project activities as shown in Fig.5-17.

Existing grasses and agroforestry trees (approx. 12,345 trees) in the farmyards of the community found in the project area will be affected. The identified flora inventory in the project area as shown in section 5.2.2.1 as listed in Table 5-9 of flora inventory.

Further section 5.2.2.2 and table 5-10 shows various animals e.g. hare, guinea fowl, doves which are often subject to small scale hunting – activities which will be strictly prohibited on site.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts on terrestrial biodiversity	Short-term	Regional ³⁸	Moderate	Reversible	Probable ³⁹	High

Mitigation measures

- At construction stage, the contractor will prepare Specific Contractor Environmental and Social Management Plan (C-ESMP) which include among others a Vegetation Restoration Plan and Soil and Sedimentation Control Plan, Hazardous waste Management Plan, Spoil Management Control Plan and Waste Management Plan.
- The C-ESMP should indicate how he will implement the mitigation measures indicated in this ESIA. This will include activities that prevent and minimize water pollution, noise, dust (particulate matter) and other disturbances to flora and fauna.
- Prohibit clearing of vegetation cover at least from the 10 m buffer zone centered on the river channel on both sides of the river in the irrigation command area. Conserving this area would maintain the unique habitat and its microclimate and provide a corridor for the movement of a variety of wildlife.
- Plant enrichment tree plantation in the buffer zone in consultation and collaboration with the relevant Rwanda Forest Authority (RFA). Use certified crop seeds that do not contain seeds from invasive alien species;
- The project will restore 12,345 agroforestry trees removed for pivot installation through replanting, in close collaboration with the local authority.

³⁸ extends substantially beyond the site boundary

³⁹ between 40 % and 60 % sure that the impact will occur

- Undertake a census of the areas to be cleared in collaboration with the required authorities (the District forestry/environmental office). Where trees need to be cut, they have to be marked jointly and inventory kept. Where permits are required prior to cutting, the contractor will seek them prior to work execution;
- Prohibit construction teams from fish harvesting or other aquatic organisms without the written permission of responsible authority or organization. Prohibit any hunting on the site including birds or any other animals;
- Clean out any salvage from the construction sites after the completion of works and restore areas to their natural state e.g., temporal sites installations for offices and storage of equipment;
- Utilize field borders to conserve natural vegetation;
- Both Contractor and RWB institute a broad water quality monitoring system such as to focus on the incoming flows, water quality variations along the construction areas near the river, treated water and water downstream of the construction areas. Regular water testing to be undertaken by the contractor through recognised and registered laboratories. Maintain appropriate records on water quality as required by the law.
- Sensitise the Contractor, farmers and staff that hunting in the project area as well as adjacent nearby gallery forest is strictly prohibited.

The implementation of the proposed mitigation measures will reduce the significance of the residual impact from high to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts on terrestrial ecosystems & biodiversity	Construction	High	very low

6.4.2.2 Impact on aquatic ecosystem & biodiversity

Given the presence of a permanently flowing river and Muvumba Wetland, the Muvumba Valley is an important ecosystem, and the reduction in water flow (volume) of which would significantly affect the ecosystem of the area and may impact some aquatic biota, including fish species. Furthermore, construction debris, oil spills, and soil can contaminate the downstream water and increase turbidity and solid particles in the river. This condition in turn may cause a major disturbance to the aquatic flora identified in section 5.2.2.2 on Fauna, especially in Table 5-10 of fauna inventory. In addition, disposal of sewerage and oil pollutants can greatly impact the fish species in the nearby Muvumba Wetland.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts on aquatic ecosystems & biodiversity	Short-term	Regional ⁴⁰	Moderate	Reversible	Probable ⁴¹	Medium

Mitigation

- The contractor shall avoid pollution of river by using sediments traps where applicable, avoid dumping wastes and excavated soil into the rivers;
- Temporal sites installations for offices and storage of equipment to be located away from the river to avoid contamination with waste water discharge systems and prohibit any direct discharge from these temporal sites installations (offices and storage of equipment) or construction works to the river or its tributaries;
- Construction activities should take place during the dry conditions, where possible;
- Prohibit dumping of solid and liquid wastes from the temporal sites installations for offices and storage of equipment and spoils from construction sites into the rivers and wetlands;
- Do not locate quarry sites or dumping sites in riverbeds and banks;
- All wastewater which may be contaminated with oily substances must be managed in accordance with the elaborated contractor Waste Management Plan (WMP);
- Prohibit washing construction equipment or vehicles near or into streams and rivers. As the design shows that workshops (possibly with washing bays) are part of the temporal site installations, national and AfDB policies must be adhered to in the setting up and construction of these places to ensure the project does not result in any soil, water and biodiversity pollution from oil leakage and chemicals. Preferably, no garages should be located on site and vehicle maintenance should be undertaken off site in licensed garages to avoid any disposal of chemicals, fuel and lubricants into wetlands and streams;
- Sensitisation of the contractor staff and farmers that fishing in Muvumba river is strictly prohibited

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts on terrestrial ecosystems & biodiversity	Construction	Medium	very low

⁴⁰ extends substantially beyond the site boundary

⁴¹ between 40 % and 60 % sure that the impact will occur

6.4.2.3 Air Pollution

This ESIA has assessed air quality as a baseline data for future monitoring of the project impact on air quality as shown in baseline section 6.2.1.10. The results indicate that particulate matter (PM₁₀ and PM_{2.5}), Gases of NO₂, SO₂, CO, and O₃ are in the range of good air quality with levels below permissible limits set by Rwanda Standard Board (RSB) and World Health Organization (WHO).

The main pollutants expected to be generated during construction works are particulate matter and nitrogen dioxide. Particulate Matter will be generated from dust emission because of construction of access roads, quarrying activities like blasting and excavation and movement of lateritic soil in uncovered trucks, while nitrogen dioxide will be released because of combustion of fossil fuel from trucks.

The major effects on air quality during the construction period will be an increase in suspended particles from blasting, excavation, and movement of heavy machinery and other vehicles over unpaved or dusty access roads. Motorised vehicles and equipment including trucks, excavators etc will generate SO_x, NO_x and PM₁₀. Dust will also be generated by movement of motorised vehicles. Therefore, good site practices must be followed by the Contractor to minimize dust production and vehicle emissions to avoid or reduce impact on sensitive receptors including Nsheke Primary school and the nearby urban settlement areas and homes as well as animals and birds found in the project area.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Air pollution	Short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation Measures

- The Contractor will prepare an Air Quality and Dust Management Plan in the C-ESMP based on this ESIA's ESMP as well as regular and scheduled monitoring through tests against the baseline provided in this ESIA;
- Vehicles and machinery must be kept in good condition to prevent excessive smoke from exhausts;
- Reduce dust by watering the access road surface regularly and sufficiently especially near sensitive receptors such as schools, health centres;
- Prevent the generation of air pollutants during the construction period by watering during crushing and screening of aggregates;
- Prohibit burning of materials such as tires, plastic, rubber products or other materials that creates heavy smock or nuisance odor;
- Avoiding disposing of any volatile chemicals to the air;
- Plan potentially dusty activities so that these are located as far from receptors as feasible
- Remove dusty materials from the site as soon as possible if not being re-used. If being re-used, cover them;

- Impose speed limits on haul routes and in construction compound to reduce dust generation
- Minimize drop heights when loading stockpiles or transferring materials Undertake monitoring close to dusty activities, noting that this may be daily visual inspections, or passive/active monitoring;
- Workers who may unavoidably have to work in dusty workplaces should be provided with requisite PPE including nose and ear masks to protect them from excessive dust;
- Undertake watering to attenuate dust near sensitive receptors. The duration and frequency of this should be set out in the Dust Management Plan and will consider water availability and any stakeholder grievances;
- Liaise with local communities to forewarn of potentially dusty activities.
- Since construction activities will affect the operations of Nsheke Primary School, they will be scheduled during school holidays to avoid pupils' exposure to health risks, particularly from dust emissions and other construction-related disturbances

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Air pollution	Construction	Medium	Very low

6.4.2.4 Impacts from noise pollution and vibrations

Increase of noise levels is expected during construction phase resulting from operating machineries and vehicles, blasting, and aggregate production. Current ESIA baseline data indicate that the project area experience noise levels of 44.59 dBA on average, which is below the permissible limits set by RSB and. The most sensitive receptors that are prone to such impacts include residential and Nsheke Primary school as well as animals and birds found in the project area. Consequently, noise that will be generated from the construction site can be a major annoyance to nearby residents. Therefore, it is recommended that noisy operations like crushing plants should not be located near noise sensitive areas. During civil works, vibrations from machines that are involved in compaction of roads could lead to damage of houses.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Noise and vibration effects	Short-term	Local	Moderate	Reversible	Definite	Medium

Mitigation Measures

- Construction activities that generate disturbing noise levels are to take place during conventional working hours wherever possible; Any night works or extended hours require a night works management plan
- Equipment producing high levels of noise should be screened when working near sensitive receptors such as people in nearby residential areas, noise sources such as rock crusher must be far from the settlement and noise sensitive areas;
- Avoid the use of explosives and where not possible, seek prior authorization of the Minister in charge of internal security upon the recommendation of the competent authority.
- Requirements for granting the authorisation referred to in the previous sentence are determined by an Order of the Minister in charge of internal security to promote a systematic blasting schedule and plan.
- Contractor then prepares a safe blasting plan and procedures in line with the law including evacuation procedures.
- Safety procedures pertaining to noise and blasting, such as provision and wearing of PPE e.g. ear protection and safety devices e.g. blasting cages should be provided for the workers who involve in noisy as well as risky operations.
- No hooting near sensitive receptors such as schools and health centres.
- Compensate houses that will be damaged by vibrations in accordance to the national expropriation and AfDB policy on involuntary resettlement. Involve GRCs to record and lodge all complaints related to houses damaged by vibrations;
- To communicate as early as possible to the most sensitive receptors about the activities that are going to generate noise and vibrations. Maintain vehicle and equipment according to manufacturers' specifications.
- Install adequate noise prevention devices, e.g., mufflers on noise generating sources.
- Switch off engines of vehicles and machinery while not in use.
- Workers who may unavoidably have to work with noise generating equipment, e.g., earthmoving equipment should be provided with ear plugs and advised to put them on.
- Siting noisy equipment as far away as possible from Noise Sensitive Receptors (NSRs), and use of barriers (e.g., acoustic sheds or partitions) to reduce the level of construction noise at receptors wherever practicable;
- Where practicable noisy equipment will be orientated to face away from the nearest NSRs;
- Working hours for significant noise generating construction work will be daytime only
- Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units, will be used, where practicable
- Where practicable, stationary equipment will be in an acoustically treated enclosure
- For machines with fitted enclosures, doors and door seals will be checked to ensure they are in good working order; also, that the doors close properly against the seals;

- Throttle settings will be reduced, and equipment and plant turned off, when not being used;
- Equipment will be regularly inspected and maintained to ensure it is in good working order. The condition of mufflers will also be checked; and;
- Fitting of mufflers or silencers of the type recommended by manufacturers.
- Conduct regular noise and vibration monitoring at nearby community
- Since noise from construction activities is likely to affect the school operation, construction works nearby the school will be scheduled during school holidays to avoid pupils' exposure to health risks, particularly from noise emissions

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Noise and vibration effects	Construction	Medium	Low

6.4.2.5 Impact from Access Roads

As such there would be very minimal traffic disturbance due to rehabilitation of roads as there is little traffic in these areas. It will be only in a few isolated places where the existing roads (access roads) are not in good conditions and will need to be rehabilitated, and thus no new resettlement. For this, the Contractor will deploy staff at such locations to control traffic (even in these cases the traffic will be very less) and noise.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts from access roads	Short-term	Local	Moderate	Reversible	Definite	Medium

Mitigation measures:

- The Contractor/s will make all the possible efforts to minimise the period of disturbance and control the movement of traffic by deployment of staff at locations where access roads intersect existing roads for controlling traffic;
- Wherever applicable/required the contractor will deploy trained flagmen/marshals to guide and control of the traffic;
- Any disturbance to residential properties and commercial area will also be kept minimum by providing access at all times; Should the project block any access roads, alternative well

maintained roads must be provided

- Construction materials should be stacked in a suitable place and away from the intersection of the access road with regular (existing) road so that it does not cause any obstruction to the traffic movement on existing roads.
- Contractor/s will ensure that effective public information campaigns are launched prior to the implementation of any traffic management;
- In any case, the Engineer will provide guidance and assistance to the Contractor and supervise the preparation of the traffic management plan as is necessary and upon finalization will submit the plan to the client for approval;
- Construction traffic shall not use the cut formation and finished subgrade without the prior permission of the Engineer;
- Any damage arising out of such use shall be made good by the Contractor at his own expense.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts from access roads	Construction	Medium	Very low

6.4.2.6 Impact from Quarry sites and Borrow Areas

Quarry sites and borrow pits unless properly rehabilitated can cause environmental problems like erosion, creation of mosquito breeding site, unaesthetic view, loss of vegetation and loss of productive land etc. The design team has proposed a list of quarries and borrow pits. These are, however, not covered by this ESIA and will require site specific ESIA's after list is finalized.

.Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts from quarry sites and borrow area,	Short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation Measures

- The Contractor will prepare site specific ESIA's for the borrow pits and quarry sites whose ESMPs will cover among other measures;
- The Contractor will prepare Specific Contractor Environment and Social Management Plan (C-ESMP) for borrow pits and quarry sites which includes among others a safety plan and communication strategy for protecting communities and properties around the quarry during the blasting period.

- As per the stipulated by the law No 58/2018, the Environmental rehabilitation guarantee for these quarries and borrow pits must be deposited to Rwanda Green fund (FONERWA) after approval and prior to construction works;
- Prepare a blasting plan, if explosives entailed. Use of dynamites in mining and quarry operations require prior authorization of the Minister in charge of internal security upon the recommendation of the competent authority. This includes preparation of specific ESIA's to cover the borrow pits, quarries and dumpsites etc;
- Rehabilitate all quarries and borrow sites to the satisfaction of the supervisor and Client, as well as the land owner for the leased land. temporary site installations and access roads after the completion of construction works, decommission in line with the prepared rehabilitation plans;
- Ensure appropriate measures for storage of explosives where in use (in line Rwanda Mines, petroleum and Gas Board (RMB) requirements for issuance of a recommendation letter for granting authorization to import, manufacture, transport, trade in and use of dynamites in mining and quarrying operations, including:
 - Design of the storage facility in line with the requirements of regulations
 - Safety plan for safeguarding the storage facilities
 - Safety plan for communities/other persons around the storage facility
 - Prepare an ESIA of the area proposed for storage of explosives,

For rehabilitation, the contractor should:

- Take photographs of the proposed temporal sites, borrow pits and quarry sites prior to any construction works;
- List all the tree species found in the proposed temporal sites, quarry sites, borrow pits and access roads;
- Preserve top soils for reuse to refill borrow sites and quarry areas;
- Do not mix topsoil with base soil;
- After completion of work, reinstate or refill borrow and quarry sites with the stockpiled soil;
- After reinstating, plant appropriate tree species (indigenous trees) or grasses to recover the original vegetation and to improve the ecological and aesthetic value of these sites;
- Provide proper drainage to avoid storage of water in quarry and borrow sites to reduce malaria outbreak through reduction of mosquito breeding sites
- The land taken for temporal sites, installations for offices and storage of equipment and access roads should be reinstated to productive state when construction is completed by removing the applied selected/foreign material, plowing/loosing compacted materials and covering with top soils.
- Puddles shall be promptly refilled to prevent waterborne diseases and proliferation of insects' vectors.
- The grounds of material sources shall be backfilled and flattened. Native species of plants as well as socially/culturally valuable species shall be planted when establishing a landscape management plan. Valuable geological or cultural assets shall be reported immediately to the

relevant authority as soon as it is discovered

- Select quarry and borrow sites far from settlement and environmentally sensitive areas and get approval of site from supervising Engineer and RMB before exploiting. Do not locate temporal site, quarry areas and borrow sites near forest area, rivers and streams
- Prior to developing a material source, the contractor shall Prepare and get the approval for the management and rehabilitation plan for the borrow pits, quarries and dumpsites, seek a permit/license and a restoration plan to the relevant authorities and perform an initial environmental examination (IEE). Baseline survey of houses/developments around the quarries including photos.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium-high to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts from quarry sites and borrow area,	Construction	Medium to High	Low

6.4.2.7 Workers' Health and Safety including Labor Rights

In addition, due to excavation for irrigation channel installation and construction of main irrigation infrastructures, there is likely the generation of dust and exhaust fumes from the vehicles and machineries. Inhalation of dust, smokes and exhaust fumes can result in possible respiratory irritation, discomfort, or illness to workers if not properly mitigated. Risk of injury and accidents on the construction site is also significant due to use of machinery, vehicles in excavated works.

During project implementation, unclean drinking water or washing water not fulfilling the health requirements could result in disease propagation among workers and indirectly to their family members hence creating illness and most probably fatalities.

Impacts on workers' rights from violations of labour laws with respect to labour conditions of hiring and payment for work undertaken, enforcement of health and safety measures by the employer such as the use of appropriate PPEs during construction of the proposed works etc.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Workers' health and Safety	Short-term	Local	Moderate	Reversible-irreversible	Probable	Medium to High

Mitigation Measures:

- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others occupational Health and Safety (OHS) plan (as

shown in Annex 8) being that of contractual agreement by the contractor to outline procedures for avoiding health and safety incidents and for emergency medical treatment will also includes among others an Emergency Response Plan (ERP) in cooperation with local emergency authorities and hospitals.

- Provide education/training to personnel of the contractor about safety procedures and emergency response plans associated with their task,
- Provide safe water supply & appropriate waste disposal facilities including the provision of sanitary latrines in the temporal sites installations for offices and storage of equipment and various sites where workers are working,
- Provide insurance and ensure all workers on site have insurance in case they get injured.
- Provision and wearing of recommended quality Personal Protective Equipment (PPE) by workers on site at all times. Active replacement of worn out of PPE.
- Sufficient training to all workers on site on safe methods pertaining to their area of work to avoid injuries including inductions
- Contractor to designate/hire a lead fully time Safety Environment and Health Officer to enforce the safety and health management plan (as shown in Annex 8) on site and to monitor implementation for the duration of the construction work.
- Contractor to ensure all machines and equipment on site serviced as required and are in proper working condition.
- Contractor to have an on-site well-stocked Clinic room, ambulance and first aid kits. The contractor will also make arrangements with nearby local hospitals for the provision of ambulance services.
- Proper signages at strategic places for information and warning e.g., excavation sites to warn on fall risks.
- The contractor will keep an incident occurrence book, and insure vehicles, workers and third parties. All accidents to be reported to the Developer within the required timelines. Contractor to prepare and share with the proponent a contingency/emergency response plan for accident response.
- Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signage and fence off all dangerous areas.
- For COVID 19, frequently wash hands with soap and clean water; cover mouth and nose with flexed elbow or tissue, avoid close contact with others and clean and disinfect surfaces around your home and workplace.
- Regular control of vehicles and other machines to avoid spreading of smokes and exhaust fumes.
- Use insect repellents in times of malaria outbreak and provide a clinic or medical facilities at

the temporal sites installations for offices etc.

- Drinking water must be provided in accordance with the applicable of national and WHO recommendations and guidelines; The water must be tested once per week if it is served from tanks or containers and stored at a cool and shadowed place.
- Contractor will develop a Human Resources Policy, which will outline worker rights to be included in all contracts including restrictions on working hours in line with applicable ILO standards, compensation including consideration of overtime, holidays etc.
- Contractor will require its subcontractors to put in place policies in line with national legislation and applicable international legislation and contractor Code of Conduct and Policies as shown in Annex 3.
- Contractor will establish contractual clauses to be embedded in the contracts of all subcontractors that require adherence to Rwandan law and international standards to be upheld related to worker rights.
- Contractor will prohibit the use of alcohol or drugs, which could adversely affect the ability the employee to perform the work safely or adversely affect the health and safety of other employees, community members or the environment.
- Contractor and self-employed contractors will assess the H&S risks related with the tasks to be performed during the construction phase.
- Pre-employment medical assessments will be put in place as a workforce risk management tool to screen individuals for risk factors that may limit their ability to perform a job safely and effectively.
- Expected benefits of conducting pre-employment medical assessments include a safer working environment, reduction in workplace injuries, minimized downtime, matching the capacity of the employee with the role, and overall recruitment cost and risk reduction.
- The contractor will ensure that training on health and safety measures is provided to all construction workers prior to starting to work on the Project and that supervisors have adequate experience to deliver on their responsibilities.
- The contractor will implement regular health and safety checking and audits of its workers, and subcontractors and implement sanctions in case of breaches of national standards and the Project's specific standards. Such audits include workplace H&S; worker contracts, working hours, pay and conditions; housing and food standards.
- The contractor will develop and implement a Workers' Grievance Mechanism for the Project workforce including workers and subcontractors.
- The contractor will ensure that workers sign a Code of Conduct (as shown in Annex 3) and ensure that it is followed to regulate the performance and behaviour of all workers, including provision for disciplinary sanctions for anti-social behaviour and non-compliance with health and safety regulations such breaches of using PPEs.

- The contractor will ensure that Health and Safety guidelines regarding the construction and management of workers and the provisions of medical facilities at the worksite are followed.
- The contractor will ensure that adequate clean water, adequate food and access to medical care is provided to all workers on the worksite.
- The Contractor will develop and implement a Traffic Management Plan covering aspects such as vehicle safety, driver and passenger behaviour, use of drugs and alcohol, operating hours, rest periods, community education on traffic safety and accident reporting and investigations.
- Proper signages at strategic places for information and warning e.g., excavation sites to warn on fall risks.
- Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits.
- Institute a worker's grievance redress mechanism

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Workers' health and Safety	Construction	Medium to High	Low

6.4.2.8 Risk of traffic incidents and Community injury on/offsite

The socio-economic baseline survey identified Nsheke Primary School, alongside nearby community settlements, as sensitive receptors given that the irrigation canal alignment will partially traverse the school compound. These receptors are at increased risk of traffic-related accidents due to the movement of vehicles transporting construction materials. In particular, the close proximity of the main irrigation canal to the school compound may significantly disrupt school operations, with pupils being especially vulnerable to safety risks and interference from construction traffic.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Risk of traffic incident and community injury on/offsite	Medium	Local	High	–irreversible	Probable	Medium to High

Mitigation Measures

- The Contractor will prepare Specific Management Strategy and Implementation Plans (MSIPs) which includes among others a customized, Traffic Management Plan covering aspects such as vehicle safety, driver and passenger behavior, use of drugs and alcohol, operating hours, rest periods, speed limits, community education on traffic safety and accident reporting and investigations.
- Provide alternative pedestrian routes wherever existing ones are interrupted. In case access roads have to be closed, inform local communities and road users in advance.
- Use clear, labeled properly and meaningful traffic signs and speed limits, especially at road crossing of the people, near sensitive receptors such as schools and conjunction of animals;
- Provide traffic awareness amongst the community and especially at schools, religious and other risky places on roads in use by both the community and the construction vehicles, as well as on site. These can be expanded to include elements of drugs/drug abuse. Minimum requirement of third-party Insurance for all vehicles in use by the contractor. Hiring of drivers to ensure only qualified personnel.
- Key design-related safety measures to be considered include speed breakers, paths for pedestrians, etc. on roads in use by both the community and the construction vehicles, as well as on site.
- Hire traffic marshals to control movement of trucks, heavy equipment, and machineries on site, and near community receptors such as schools.
- Inform local communities about the construction programme in advance.
- Establish a clear GRM mechanism for communities to lodge their grievances including a hot line for reporting of the same. Contractor to prepare and share with the proponent a contingency/emergency response plan for accident response.
- Provide site security to deter trespass on site;
- Contractor will develop Emergency Response Plans (ERPs) in cooperation with local emergency authorities and hospitals.
- The contractor will extend the Worker Code of Conduct (as shown in Annex 3) to include guidelines on worker –community interactions and will provide training on the worker code of conduct to all employees including subcontractors and truck drivers as part of the induction process.
- Contractor will provide primary health care and first aid at construction site to avoid pressure on local healthcare infrastructures.
- Contractor will implement a Community Grievance Mechanism Contractor will develop and monitor implementation of a Community Health and Safety Management Plan (CHSMP) which will include undertaking a programme of stakeholder engagement and consultation to educate local communities and identified receptors of the risks of trespassing onto sites, the meaning of signs, and the dangers of playing on or near equipment or entering fenced areas.
- Special attention to be paid on residential areas, primary and secondary schools.
- Where the contractor accidentally interferes with population' structures and assets, he/she

should make the due compensation in coordination with local authorities and project proponent;

- Sensitize the community as well as identified receptors on risks of trespass, controlled access in and out of site with all visitors sign in at points of entry, Issuance of workers with badges or identification cards to differentiate between workers and other community members etc.
- To effectively safeguard pupils at Nsheke Primary School, construction works near (and within) the school compound will be scheduled during school holidays to minimize exposure to traffic hazards and construction-related disturbances.

In addition, to ensure the long-term safety and sustainability of the school in relation to the nearby canal, a protective fence will be constructed to prevent potential accidents, such as pupils falling into the canal.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Risk of traffic incident and community injury on/offsite	Construction	Medium	Low

6.4.2.9 Increased risks of communicable diseases

During the construction period, communicable diseases primarily associated with the influx of people to the project area would be the major health problem. Health risks like sexually transmitted diseases including HIV/AIDS are expected to be increased. Also, malaria cases could be increased as the construction activities create a conducive environment for the breeding of mosquitoes.

Specifically, the proximity of Nsheke Primary School to the construction works presents a potential risk of increased exposure of pupils and teachers to communicable diseases. Large construction projects often attract an influx of workers and traders, which can increase social interaction between the school community and external populations. Such interactions may heighten the risk of transmission of communicable diseases, particularly HIV/AIDS and other sexually transmitted infections (STIs), alongside respiratory infections (linked to dust and air quality), and waterborne diseases (arising from poor waste disposal or stagnant water around construction sites). Children and adolescents are especially vulnerable to indirect exposure through their families and community networks, while any outbreak of disease could disrupt school attendance, academic performance, and the overall well-being of pupils and staffs

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Increased risks of communicable diseases	Short-term	Regional	Moderate-High	Reversible-irreversible	Probable	High

Mitigation measures:

- Ensure all workers including subcontractors receive education around transmission and symptoms of communicable diseases of concern and STDs.
- Confine access to restricted work sites (including those with operation of mechanical and electric equipment) to persons with permits.
- Fill up all depressions to avoid pools of stagnant water that may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes which cause malaria.
- Restore borrow pits and quarry areas to minimize breeding sites for mosquitoes Provide health education to the work force and community mainly focusing on HIV transmission and prevention.
- Provide free counseling and distribute condoms & leaflets to the workforce and vulnerable groups of nearby communities.
- Do not induce malaria outbreaks by creating temporary & permanent water holding areas which favor mosquito breeding.
- Take care when selecting temporary site installations in such a way that it should not invite close interaction with the local community.
- The contractor will develop *Emergency Response Plans (ERPs)* in cooperation with local emergency authorities and hospitals.
- The contractor will put in place measures geared towards prevention of spread on Covid 19 between community members and the project workers. Such measures will be aligned to prevention protocol as per the prevailing ministry of health directives including (i) Ensuring social distance among workers, (ii) provision of face masks to workers and (iii) provision of hand washing dispensers and soap or alcohol-based sanitizers at workplaces.
- To mitigate the risk of communicable disease transmission to Nsheke Primary School, construction activities will be undertaken during school holidays to minimize pupil-worker interaction.
- Medical screening of workers prior to allocation of work sites, with regular updates

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Increased risks of communicable diseases	Construction	Medium	Low

6.4.2.10 Labor influx and Conflict among workers and local population

Projects involving major works include, often, the potential for the occurrence of social conflicts between workers who temporarily settle in the local area, job seekers and the hosting community. Such behaviors are generally related to competition for available jobs, cultural differences as well as socially unacceptable behavior according to local social standards. Thus cases of drunkenness and disregard/lack of respect for local customs may occur. This impact should be considered even though an important part of the manpower will be recruited locally.

In addition, the construction of the irrigation canal near Nsheke Primary School is likely to attract a workforce from outside the local area. This labor influx may increase interactions between construction workers and pupils, leading to several potential school-related impacts, including:

- Safety and security risks to pupils due to the presence of unfamiliar adults near the school compound;
- Increased exposure to communicable diseases, including HIV/AIDS and other sexually transmitted infections (STIs), through indirect interactions with the workforce and the community;
- Indirect psychosocial impacts, such as higher absenteeism of pupils or staff resulting from safety concerns or tensions within the community

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Labour Influx and Conflict among workers and local people	Short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation measures

- As part of the C-ESMP contractor to prepare a labour management plan and labour influx plan to ensure labour issues are well managed. Semi-skilled and unskilled labour will first be sought in the project's vicinity i.e., locals especially the unskilled will receive priority to reduce the labor influx that would come with other negative repercussions.
- Implement a set of rules for the workplace, including the Code of Conduct (as shown in Annex 3) to be signed by all workers. The standards should include, inter alia, the entry of persons outside the service.
- Explain to workers about the importance of keeping a good relationship with local communities; and the temporal site installations should be well fenced.
- Sensitization of workers on cultural sensitivities and issues of relevance
- To minimize the risks associated with labor influx near Nsheke Primary School, construction activities will be scheduled during school holidays.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Labour Influx and Conflict among workers and local people	Construction	Medium	Low

6.4.2.11 Disruption of public utilities

As some activities of the project will be executed in populated areas, there will be possibility to encounter electricity supply lines, water supply and communication cables. Any disruption of electricity, communication facilities and water may cause loss in socio-economic activities of local residents and neighboring communities. In addition, road diversions may occasionally interrupt community movement from one area to another.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Disruption of public utilities	Short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation measures

- The contractor in collaboration with public institutions in charge of electricity, communication facilities and water will be required to coordinate with relevant authorities to identify and map the location of existing underground utilities such as electricity and communication cables, prior to undertaking any work
- Plan for immediate intervention by the service providers for any damages to utilities during project execution; Notify the community of any planned interruptions in advance.
- Replace (or compensate) for public and private physical assets damaged due to disruption. For each damaged utility, fix the damage to the satisfaction of the service provider. Reparation work shall be treated as an emergency and undertaken without undue delay;
- Provide prior public information about the likely disruption of services;
- Where practical, the contractor shall work carefully to avoid damages to the electricity and communication cables, and water lines if any.
- Ensure immediate reinstatement of services.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Disruption of public utilities	Construction	Medium	very low

6.4.2.12 Gender based Violence, Sexual Harassment and Sexual Exploitation

Gender-Based Violence (GBV) is an umbrella term for any harmful act perpetrated against a person's will that is based on socially ascribed (i.e., gender) differences between males and females. It includes acts that inflict physical, sexual, or mental harm or suffering, threats of such acts, coercion, and other deprivations of liberty. Such acts can occur both in public and in private spaces.

The proximity of the irrigation canal construction to Nsheke Primary School may increase the vulnerability of pupils, particularly girls, to gender-based risks. Labor influx associated with construction can result in higher interactions between external workers and the local community, including children and adolescents. This may lead to potential occurrences of gender-based violence, sexual harassment, or sexual exploitation targeting pupils, directly or indirectly. Such incidents could have severe physical, psychological, and social impacts on the affected children, including trauma, reduced school attendance, and disruption of academic performance.

The presence of unfamiliar adults near the school compound, especially during construction activities, heightens the risk of opportunistic exploitation. Girls may face increased vulnerability during travel to and from school or while accessing school facilities if adequate protective measures are not in place. Additionally, these risks can indirectly affect the school environment by creating fear, anxiety, or tension among pupils and staff, which may impair learning and teaching activities.

The nine core types of GBV are: -

- ❖ Rape,
- ❖ Sexual assault,
- ❖ Sexual harassment: Sexual Harassment at workplace might occur between a project worker against another project worker.
- ❖ Sexual exploitation and abuse: This impact refers to sexual exploitation and abuse committed by Project staff against communities and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEA in the Project. Such risks also occur where project workers with some level of authority abuse this power e.g., through promise of jobs in return for sexual favours.
- ❖ Sexual favours;
- ❖ Physical assault,
- ❖ Forced marriage,
- ❖ Denial of resources, opportunities or services,
- ❖ Psychological /emotional abuse

Given the number and diversity of workers under the irrigation project, there will be a high risk of Gender Based Violence (GBV) among project workers or with the neighboring communities.

GBV constitutes acts of gross misconduct and are therefore grounds for sanctions, penalties and/or termination of employment. All forms of GBV including grooming are unacceptable be it on the work site, or the work site surroundings. Prosecution of those who commit to be pursued.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of	Impact

					occurrence	significance
GBV, SH, SEA related impacts	Short-term	Local	Moderate	Irreversible	Possible	Medium

Mitigation measures:

- Prepare and conduct awareness program to all workers and the community on GBV avoidance and related risks
- Contractor to prepare and Implement a GBV/SEA/SH prevention action plan that covers:
 - ✓ Measures for prevention of SEA/SH: sensitization
 - ✓ Response to SEA/SH: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures,
 - ✓ Engagement with the community and workers (sensitization and awareness raising etc), and
 - ✓ Management and Coordination: including integration of SEA in job descriptions, employments contracts, code of conduct (as shown in Annex 3), performance appraisal systems, development of contract policies related to SEA, having designated PSEA focal points in the project and trained community liaison officers. The contractor SEA/SH management plan will be binding to the subcontractors and their employees as well. The
- Contractor shall require his employees, sub-contractors, sub-consultants, and any personnel thereof engaged in construction works to individually sign and comply with a Code of Conduct with specific provisions on protection from sexual exploitation and abuse and sexual harassment.
- The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including Effective and on-going community engagement and consultation and Review of specific project components that are known to heighten GBV risk at the community level, e.g., compensation schemes; employment schemes for women; etc.
- All employees are required to attend an induction-training course prior to commencing work on site to ensure they are familiar with the GBV Code of Conduct.
- The contractor will mainstream Gender Inclusivity in hiring of workers;
- Female workers should be sensitized on their rights and encouraged to report any gender-based violence or threat.
- To mitigate risks of gender-based violence, sexual harassment, and sexual exploitation at Nsheke Primary School, construction activities near the school will be scheduled during school holidays.

- Employ a concrete GBV/SEA campaign within the school including a GBV focal person (teacher) accompanied by GBV sensitization and awareness creation

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
GBV, SH, SEA related impacts	Construction	Medium	Low

6.4.2.13 Child Abuse and Exploitation

Children under 18 years, particularly in poor rural areas are easy targets for cheap labour. Sometimes their families encourage them to work rather than go to school, while other times the children themselves may skip school to be employed at the project to earn cash. Projects such as this therefore carry the risk of Child Abuse/ Exploitation (CAE) due to labor influx. Child Labor law violation may also take place if proper mitigation measures are not put in place.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Child abuse and exploitation	Short-term	Local	Moderate	Irreversible	Possible	Medium

Mitigation measures:

- The contractor should be aware of labor Law and most importantly the Article on Child Labor.
- All staff of the contractor (and sub-contractors) must sign a code of conduct (as shown in Annex 3), committing themselves towards protecting children, which clearly defines what is and is not acceptable behavior.
- Children under the minimum legal working age will not be hired on site.
- Potential employment seekers at site will be required to provide identification document to verify age.
- Construction activities near Nsheke Primary School should be scheduled during school holidays to avoid the risk of child abuse and exploitation associated with the works.
- Employ a concrete GBV/SEA campaign within the school including a GBV focal person (teacher) accompanied by GBV sensitization and awareness creation

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Child abuse and exploitation	Construction	Medium	Low

6.4.2.14 Creation of slopes and accumulation of earth materials during excavation works

The topography in the project areas is characterized by a gentle slope on the hillside which ends in Muvumba and Akagera Rivers' wetlands. The slopes vary between 2% and 15% making most of the land in the project areas accessible for development activities.

The implementation of this project, especially the construction of intakes and installation of irrigation channels and drains will involve considerable earthworks. Unmanaged disposal of these can result in sterilization of productive land and the creation of ongoing erosion, sedimentation, drainage problems or esthetical view. The accumulation of soil excavated and deposited all along the channel lines should be compacted or collected and transferred to an appropriate dumping site. The original landscape would be affected by excavation works and stripping of channel's embankments to create inclined slopes in order to minimize erosion phenomenon.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Creation of slopes and accumulation of earth materials during excavation works	Short-term	Local	Low	Reversible	Probable	Low ⁴²

Mitigation measures

- Construction activities should take place during the dry conditions. Identify erosion prone areas,
- Identify permanent erosion control measures (applicable for a particular site) and plan construction works and sites to limit the quantity of material likely to be eroded and transported by water or wind.
- Protective measures such as reinforcement of slopes, "Cross-slope" vegetation barriers and vegetation planting will be applied where necessary; Erosion in hilly or undulating terrain can be prevented by constructing catch water drains, to break the impact of runoff.
- An appropriate dumping site for excessed excavated earth materials should be selected and recommended by local authorities; Sediments eroded from cultivated lands may clog irrigation channels;
- Soil erosion from the spoil banks and cultivated fertile soils will lead to clog of installed channels as well as soil infertility if fertile lands are covered by deposits of excavated areas.
- Scarifying the site of topsoil combined with soil compaction all along the installed channels will result in reducing capacity of the ground to retain water and increase surface water run-off during periods of rainfall.

⁴² little effect- negligible disturbance

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from low to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Creation of slopes and accumulation of earth materials during excavation works	Construction	Low	Very low

6.4.2.15 Increased wastes (solid & liquid)

Construction process of site installations, intakes and other irrigation infrastructures will involve the creation of various solid and liquid wastes such as: remaining cement covers, metal scraps, plastics and wood, kitchen wastes, workshop wastes including used oil filters, and various liquid wastes including used oils and solvents.

Like any other construction activity, there is the possibility of accidents and spills, the two most likely being contamination of soil by used engine oils and the spillage of diesel from machines. Contaminated soil is injurious to plant growth and must be removed. Contamination of water is potentially more serious since pollutants may move fast and the receiving environment is highly sensitive. The solid waste generated in temporary sites installations for offices if not treated properly may cause leaching and environmental pollution.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Increased solid and liquid wastes	Short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation measures

- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others Spill and containment plan as well as a solid and liquid waste management Plan which should contain:
- An inventory of the types and quantities of waste to be produced. The most appropriate waste management approach for each type of waste including details on (temporary) storage, transport and destination of the waste. An assessment of any opportunities for reducing solid and liquid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes.
- The Contractor is to improve solid waste management services through reducing the generation of solid waste, but also improving collection, sorting, handling and disposal in appropriate dumping sites.
- Contractor to sensitize workers on waste management and the C-ESMP.

- Construction wastes shall be properly segregated and separated to encourage recycling of some useful waste materials i.e., some stone and concrete materials can be used as backfills.
- Solid waste will be collected at a central location on site, sorted and will be stored temporarily until removal to an appropriately permitted disposal site.
- Contractor to provide waste skips/ bins to contain wastes on-site e.g., for paper, used cement bags, used face masks etc.
- Contractor to hire a licensed solid waste handler for collection and disposal of all waste.
- Measures to ensure that waste materials from the Project are disposed of at suitable sites will be taken. These will include engaging only reputable truckers and conducting appropriate spot checks to verify that disposal is done in accordance with the requirements of REMA.
- Burning of waste on site shall be prohibited,
- Waste oil should be properly collected and stored in clearly labelled metallic drums with lids for reuse (within a HAZMAT) as well as provision of adsorption to prevent oil leakage; the remaining oil shall be disposed by licensed handlers in line with national regulations.
- For human wastes from contractor temporary sites, movable toilets with septic tanks and capable of de-sludging will be installed.
- Maintenance and servicing of vehicle, machinery and equipment must be carried out in a designated area (protected service bays) within the workshop area only and where oils are completely restrained from reaching the ground. Such areas should be covered to avoid storm water from carrying away oils into the soil or water systems. As workshops (possibly with washing bays) are part of the temporal site installations, national and AfDB policies must be adhered to in the setting up and construction of these places to ensure the project does not result in any soil, water, biodiversity etc. pollution from oils and chemicals. Preferably, no garages should be located on site and vehicle maintenance should be undertaken off site in licensed garages.
- Oil, paints, fuels and other chemical materials should be stored in impervious site stores. They should be handled appropriately to avoid spills and leak; All applicable national laws, regulations and standards for the safe use, handling, storage and disposal of hazardous waste to be followed;
- In case of any hazardous substance spills, immediate spill containment and clean up shall be initiated. Spill and containment plan to be developed.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Increased solid and liquid wastes	Construction	Medium	Low

6.4.2.16 Disruption of existing patterns of access

Basically, the project involves constructing several kilometers of main channels plus many field ditches and drains. For instance, canals will be kept full of water throughout the year to minimize seepage losses and the drains will be partly full of water.

During the construction of irrigation infrastructures, the contractor will need to access the site. Traffic disturbance as a result of canal construction, cross drainages, roads and other irrigation infrastructures are ranked as very minimum because it is expected to have little disturbance and this will only occur in few isolated places where the new access roads cross existing ones. Considering that this disturbance is temporal and very limited, the impact is low.

Informal small bridges may be constructed with associated hydraulic performance and human safety issues.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Disruption of existing access	Short-term	Local	Low	Reversible	Highly Probable	Minor

Mitigation measures

- Quick rehabilitation of disrupted existing patterns of access to facilitate movement of people and their belongings
- Notify the community of any planned interruptions well in advance
- Avail temporally diversion ways for local population and passengers. The contractor will provide appropriate and practical alternative routes where key community roads are blocked or affected.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from minor to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Disruption of existing access	Construction	Medium	very low

6.4.2.17 Impacts from the Construction of temporary site installations

Depending on the length of irrigation primary canals, the consultant for irrigation detailed design has proposed six temporal sites along these main canals. These sites will be used by the contractor for storage of machines and different construction equipment and temporal resting of contractor's workers. These sites shall not be used for accommodation during project construction and operation phases.

However, temporary site installations for the irrigation system can have various environmental and social impacts both during their establishment and throughout their operation. Here are some predicted environmental and social impacts related to temporal sites installations:

1. Land disturbance: the establishment of temporary sites, installations for offices and storage of equipment for irrigation system will often involve clearing land.
2. Water consumption: officers, workers resting areas etc., require significant amounts of water for drinking, sanitation and other purposes. Excessive water consumption can strain local water sources, especially in the Muvumba areas which are already experiencing water scarcity or drought conditions.
3. Waste generation: temporal sites installations for offices and storage of equipment generate substantial amounts of wastes including construction debris. Improper disposal or inadequate waste management can lead to Muvumba water pollution.
4. Energy consumption: Temporal sites will rely on electric energy for lighting, heating, cooling and powering equipment.
5. Noise and air pollution: The presence of heavy machinery at site can produce noise, disturbing communities. Additionally, dust and emissions from construction vehicles and machinery can contribute to air pollution, affecting both human health and surrounding ecosystem
6. Cultural and social impacts: These sites can impact local communities. Increased traffic and influxes of workers can affect the social structure or culture of the area.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts from the Construction of temporary site installations	Short term	Local	Moderate	Reversible	Possible	Medium

General Mitigation Mesuares:

- The temporal sites will be subjected to a separate site specific ESIA and rehabilitation plan once all design elements are finalized.
- Because land is leased for temporary campsites use, the contractor shall ensure that leasing arrangements are fair, transparent, and consistent. RWB will have full responsibility to ensure the lease negotiations are free of coercion and fair arrangements are provided to the persons.⁴³

The lease agreement shall include:

1. **Environmental and Social Impact Assessments (ESIAs):** A site-specific ESIA shall be prepared in advance, addressing potential environmental and social impacts associated with the campsites.

⁴³ If a purchase, lease, or other type of land transfer includes land on which people other than the owner live or have use, whether formally or as customary or informal occupants at the time of the transaction, OS5 will apply.

2. **Rehabilitation Plans:** Detailed rehabilitation plans shall be developed as a part of ESIA's and shall outline measures for full restoration of the land to its pre-lease condition or to an improved state, as agreed. These ESIA's and rehabilitation plans will be annexes to the leasing contracts
3. **Financial and Performance Safeguards:** The agreement shall specify financial arrangements (e.g., rental fees, and rehabilitation guarantee) to guarantee implementation of the rehabilitation plan.
4. **Handover Conditions:** Handover of the leased site shall only occur after joint inspection and confirmation that all rehabilitation measures have been satisfactorily implemented, and the land owner signs off
5. **Remedies for Non-Compliance:** In the event that rehabilitation obligations are not fully or partially met, the agreement shall include provisions for the contractor to undertake the works at the cost of the defaulting party e.g themselves or a sub contractor. RWB is responsible to ensure the Contractor's Contract clearly stipulates obligations related to the leasing arrangements and liabilities therein including provision of environmental security.

These provisions shall ensure that temporary land use for campsites is managed responsibly, with clear obligations for rehabilitation and full restoration of the affected sites.

Applicable mitigation measures:

To improve energy use efficiency and reduce energy cost, the following measures shall be applied:

- Effective site management will improve efficient utilization and energy conservation on-site.
- Maintenance of plants and equipment in a serviceable and good working condition to maximize their fuel efficiency.
- The choice of machines intended for activities for which they have designed.
- Regular monitoring and control of trucks is also essential to enhance operational efficiency and reduce fuel waste.

For water consumption, the project shall use the following measures:

- Technical feasible water conservation measures, use of alternative water supplies, water consumption offsets to maintain total demand for water resources within the available supply,

For the management of solid and human waste management:

- Waste collection points will be established within the site to dispose temporarily solid wastes generated on site. The project will hire a licensed contractor to collect and dispose of those wastes in the district landfills;
- Toilets will be constructed to facilitate the disposal of human wastes. The location of these toilets within the sites will consider areas with deep water tables and not near sensitive areas,
- Masonry sewage treatment facilities will also be used to treat sewages. Mobile sanitation

facilities will be provided where needed.

- The restoration of these temporal site installations will be done based on the existing site conditions prior to construction phase. Because these sites are not determined at the time of conducting this ESIA study, the initial environmental examination of these sites shall be conducted to record the existing state of these sites which will serve as baseline.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts from the Construction of temporary site installations	Construction	Medium	Low

6.4.2.18 Cultural Disruptions and Protection of Archaeological and Historical Sites

The construction and development of the Irrigation canals is expected to affect archeological and historical assets. Though the current RAP report has identified no visible cultural site, during construction works, the contractor may encounter unmarked graves or other culturally sensitive artifacts. In case they are found during excavation works, they will be relocated.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Cultural disruptions and protection of archaeological and historical sites	Short-term	Local	Moderate	Reversible	Possible	Medium

Mitigation measures:

- Deviation of the canal routing as an alternative way to avoid compensation and disruption of the canal alignment;
- In case deviation is not possible, apply Cash compensation based on national expropriation law and AfDB policies to relocate the graves prior to any works on ground;
- During construction works, if the contractor encounters unmarked graves or other culturally sensitive artifacts then Chance Find procedures requirements as discussed in Annex 6 will be adopted.
- Enough time be given enough time to relocate the grave;
- The PAP will be assisted for burial ceremonies;

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Cultural disruptions and protection of archaeological and historical sites	Construction	Medium	very low

6.4.2.19 Impact on water quality, possible contamination and competition over water

Project activities will interact with water resources within the project area in the following ways:

- ❖ There will be direct interaction during clearing and construction near to or in surface water resources. There will be indirect interaction in the case of erosion of soils into water resources.
- ❖ Site activities such as excavations during site levelling could result in loosening of soils that could result in sedimentation and siltation of storm water drainage channels and eventually flowing into the river.
- ❖ There will be direct interaction from the abstraction of water from the river for construction (e.g., for dust control).
- ❖ Un-serviced plant and equipment on site could result in oils and fuels leaks that could contaminate the river's rising the BoD and adversely affect aquatic organisms in the rivers/ streams.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impact on water quality, Possible contamination and competition over water	Short-term	National	Moderate	Reversible	Probable	Medium

Mitigation measures

- At the construction stage, the contractor will prepare a Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others; Soil and Sedimentation Control Plan, Spoil Management Control Plan and Waste Management Plan.
- Should the Client allow sourcing of Water from the river for construction works, required permits must be sought and amounts should be pre-determined by the relevant authority to avoid conflict with the community and ensure no competition for water with the community. Should it suffice that the water is not sufficient for both parties, the contractor should seek alternatives.
- All wastewater which may be contaminated with oily substances must be managed in accordance with an appropriate Waste Management Plan (WMP).
- No hydrocarbon-contaminated water may be discharged into the river;

- Provide workers at the development site with sanitation facilities during this phase of the development.
- Store all raw materials away from the vicinity of water bodies located on the project area to avoid contamination in these areas.
- General waste generated during this phase of the development must be stockpiled in one central area of the project site, away from existing reservoir and collected, transported and disposed of appropriately at the designated disposal site by relevant authorities;
- Community access to water sources should not be restricted. Should sites used by the community previously for water abstraction be affected, RWB and the Contractor is to work with the local community and authorities to identify clear alternative sites for the community to continue abstracting water.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impact on water quality, Possible contamination and competition over water	Construction	Medium	very low

6.4.2.20 Impact from High job expectation

During the public consultations, the local population has expressed their expectations about job opportunities in the project. Indeed, although the project will create employment opportunities, the jobs will be limited and it is therefore important that the procurement processes should be clear and fair. It is expected that creation of not enough jobs will increase frustration on behalf of the local people and conflicts may occur or be generated in relation to the lack of promised jobs.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts from high job expectation	Short term	Local	Low to moderate	reversible	Highly Probable	High

Mitigation measures:

- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes customization of the Labour Management Plan (LMP) prior to the start of any recruitment works
- The principles and procedures for hiring should, as far as possible, give priority to the hiring of capable PAPs and local workers e.g. Prioritize semi and unskilled job positions for locals from the project area;
- For various types of trade e.g., drivers, cleaners, safety officers, the contractor should disclose

the exact number of jobs available, the applicable period and the remuneration to be allocated for each type of work;

- The hiring requirements must be clear and properly publicized before the start of the recruitment process and respected by the designated contractor.
- Contractor can work with local authorities and project committees to ensure proper reach of the adverts.
- For a better impact on the communities this process should be conducted with the involvement of local leaders;
- Job adverts should be clear on the necessary skills required for each position.
- In the event there are local expectations for employment that cannot be met by the project, the limited availability of places should be made known to the interested parties through local authority.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from high to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts from high job expectation	Construction	High	Low

6.4.3. During operation phase

6.4.3.1 Impact on Environmental flow and transboundary issues

Water diversion for irrigation within command areas can significantly alter the hydrological regime of the Muvumba River downstream of the dam. Such changes can disrupt natural habitats along the river, potentially leading to biodiversity loss. If environmental flows are not adequately maintained, aquatic flora and fauna could be adversely affected. Additionally, lagoons and wetland habitats formed during seasonal flooding may dry up, causing further degradation of biological diversity.

For infrastructure projects like the Muvumba Multipurpose Dam and the associated irrigation system, it is essential to avoid altering flow regimes in ways that compromise the river's ability to sustain vital upstream and downstream ecosystems. These ecosystems play a key role in providing ecological services to local communities. Impounding water behind the dam reduces flow to downstream marshy areas, threatening the ecological functioning of wetlands.

Evaporation, which is intensified by the high temperatures experienced for most of the year in the project area, presents an additional challenge. Water wastage may also occur within the distribution network and at the user level due to the perception of water abundance, a limited understanding of its value, and insufficient awareness of sustainable water use practices.

According to the data from Environmental Flow Impact Assessment shown in baseline chapter, section E, water diversion for irrigation within command areas will not affect the downstream as the report indicates 100% environmental flow satisfaction. . However, inadequate environmental flows could severely affect aquatic species and result in the drying of seasonal wetlands and lagoons, which are critical to biological diversity. The Muvumba Dam has been equipped with facilities specifically designed to release environmental flows that mimic natural seasonal patterns. These releases are informed by findings from the Hydrology Study of the Muvumba Multipurpose Dam and Hydropower Plant Project, located upstream of Bushara.

Downstream flow levels are also supported by tributaries inflows, notably from the Mutojo river, especially during dry months when ecosystems are most vulnerable. Maintaining environmental flows is therefore crucial to preserving ecological balance in the Muvumba River system and sustaining the livelihoods of local communities that depend on these ecosystems. Additionally, evaporation losses, intensified by high ambient temperatures in the project area, and wastage in the distribution system due to poor water-use awareness, present further challenges. Targeted awareness campaigns should be initiated to promote responsible and efficient water use at the community level.

To mitigate these impacts, the Muvumba Multipurpose Dam has been equipped with facilities designed to release environmental flows to maintain ecological integrity downstream. These releases are guided by findings from the Hydrology Study of the Muvumba Multipurpose Dam and Hydropower Plant Project, located upstream of Bushara.

Monitoring indicates that released flows are carefully managed to reflect natural seasonal patterns. Downstream of the dam, flow levels are slightly increased due to additional contributions from tributaries such as the Mutojo and Karungeri rivers. These combined flows help ensure that environmental flow requirements are met, particularly during critical dry months when ecosystems are most vulnerable. Maintaining environmental flows is essential for preserving the ecological balance of the Muvumba River and safeguarding the livelihoods and well-being of the communities that depend on it.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts on environmental flow	Short-term	National/international	Moderate	Reversible	Probable	High

Mitigation measure

- ❖ Environmental flows have been integrated into the design of the Muvumba Multipurpose Dam to help mitigate changes in the hydrological regime downstream. It is essential that this flow regime is maintained or even improve to ensure sufficient water allocation for downstream ecological functions and human water use. To protect downstream ecosystems, the environmental flow released should never fall below 30% of the natural flow at any time.

- The RWB should design and implement a robust monitoring program to verify that the flows are being released and that the targeted ecological conditions are being met. This monitoring will provide critical feedback, supporting adaptive management of environmental flows based on observed outcomes.
- Where monitoring reveals that certain flow components or ecological objectives are not being met, revisions to the flow allocation should be considered to better support ecosystem health. Implementation of an agreed flow regime must remain flexible and responsive to changing environmental conditions and scientific findings.
- Muvumba river is shared between Rwanda and Uganda. In order to comply with international best practices on the use of shared water resources, there should be continued bilateral meetings aimed at the management of Muvumba river. Given that the Muvumba River is a shared watercourse between Rwanda and Uganda, ongoing bilateral cooperation is essential.
- Regular joint meetings should be held to promote sustainable and equitable water management in accordance with international best practices for transboundary rivers.
- Conserve irrigation water by reducing evapotranspiration by avoiding midday irrigation and by reducing seepage losses in canals by lining them or using close conduits;
- Indigenous trees and shrubs with low water dissipation capacity should be encouraged around the buffer zone to minimize loss of water through evapo-transpiration processes,
- Ensure enhanced monitoring maintenance of the transmission and distribution pipelines upon commissioning to ensure minimal loss of water through leakages.

Water conservation measures must also be prioritized to reduce pressures on river flow:

- Promote irrigation practices that minimize evapotranspiration, such as avoiding midday irrigation.
- Reduce seepage losses in canals through lining of quality materials
- Encourage the planting of indigenous trees and shrubs with low water demand around buffer zones to minimize evaporation.
- Upon commissioning, ensure enhanced maintenance and monitoring of water distribution infrastructure to minimize leakage losses.

The implementation of the proposed mitigation measures will reduce the significance of the residual impact from high to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts on environmental flow	Operation	High	very low

6.4.3.2 Water borne disease related impact

Creation of impoundment and irrigation canals would create a conducive environment for the multiplication of mosquitoes enhancing spread of malaria. Consumption of untreated river water could also cause stomach illnesses.

The irrigation project has the potential to increase the risk of infections by creating additional habitat for the snail vector, increasing exposure of the population, especially children, to water, and increasing opportunities for completion of the parasite's life cycle from humans to snails (channels in and near settlements).

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Increased health impacts	Short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation measure

- Remove vegetation from the margin of the reservoir and drainage structures;
- Design and construct irrigation canals and drainage structures in such a way that there could not be permanent water collection sites and formation of swamps;
- Irrigation and drainage canals should be cleaned regularly;
- Establish effective vector monitoring program around the reservoir and irrigation canals
Sensitize the community on the need to ensure river water is properly treated before consumption;
- In order to mitigate malaria spreading, health centers recommend house spraying with residual insecticides or reduction of contacts between humans and Anopheles by the use of impregnated bed nets;
- Sensitization of the community on risk of consumption of untreated water

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Increased health impacts	Operation	Medium	very low

6.4.3.3 Soil and Water Contamination by farming methods and chemicals, waste disposal

The major impact on the water resource of the project area and its downstream of the irrigation area will be deterioration in water quality, which will be exacerbated by the reduced flow, and use of fertilizers and pesticides for the purpose of maximizing crop production. Also, the drainage water from the irrigation field is expected to carry increased levels of dissolved solids and turbidity.

Unless treated and managed well, domestic waste from settlement areas would deteriorate surface and ground water quality of the project area and its downstream.

Poor farming methods may also increase sediments in the irrigation water affecting quality of water reaching downstream users.

It is also obvious that the impoundment of water in the Muvumba reservoir will alter the natural flow regime of the river. This will have negative impacts on downstream ecosystems and downstream users. Moreover, water quality that may be released from the reservoir would deteriorate due to physico-chemical reactions, which took place in the reservoir. Considering an increasing use of fertilizers, at the upstream one can expect reservoir eutrophication. Unless mitigation measures are taken starting from the beginning, symptoms of eutrophication such as overproduction of aquatic plants, algae and suspended materials, decrease in transparency, increase in water temperature, anoxic conditions in deeper water layers and subsequent release of hydrogen sulfide and toxic metals would appear in the reservoir.

Further, with improvement in livestock production due to water access, increase in use of acaricides is expected. Control of tick-borne diseases is mainly by spraying with acaricides using a bucket spraying pump. The other rarely used methods are hand dressing, pour-on and hand picking.

These ectoparasite control involves the use of Acaricides from which has been reported increased environmental contamination and enhanced public health concerns. For example, the residue levels of different types of Amitraz (2,4- dimethylaniline), deltamethrin (Br2CA and PBA) and cypermethrin (3-phenoxybenzoic acid PBA) pesticides used by farmers. Pesticides constitute the majority of organic contaminants, which are poisonous and can move and cause toxicity in the environment (Barth et al., 2007). Different studies have been carried out focused on pesticides contamination in water, soil sediment and aquatic weeds (Abong'o et al., 2018) and their effect on humans' health and environment (Obong'o et al., 2014). Most of the contaminants in soil are pesticides that persist for many years and affect the geological nature of soils by lowering their biodiversity and soil quality.

Effects on pesticides use are a global public health concern particularly in developing nations where frequent exposure by both farmers and other populations is rampant (Garming et al., 2009). Constant exposure leads to acute health complications such as headaches, stomach aches, skin rashes, eye irritations and coma while chronic illnesses are cancer and disruption of endocrine systems. Similarly, fatalities are common from direct pesticides exposure (Dasgupta et al; 2005).

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Soil and water contamination by farming method and chemicals and waste disposal	Long-term	Regional	Moderate	Reversible	Probable	Medium

Mitigation measures

- RWB/RAB are developing Integrated Pest Management Plan (IPMP) that will be disclosed together with this ESIA prior to start of the operations of the irrigation and ensure its application including sensitization of farmers;
- Consider the strategic option of promoting organic agriculture in the schemes;
- Collect and treat irrigation farm drainage water before discharging to the river. Water quality monitoring will be instituted to ensure quality standards are met. Baseline data will be established at the start of the operation of the project followed by subsequent monitoring during the operation phase;
- Improve unused/expired agrochemical waste disposal system of the nearby settlements, including sensitization of communities on waste disposal;
- Enhance extension and agronomic advisory services to ensure proper use of pesticides and fertilizers applied in the irrigation far;
- Do not dispose fuel and lubricants into wetlands and streams. Servicing of plants, equipment and vehicles should be carried out at a workshop area. The workshop area should be equipped with secured storage areas for fuels, oils and other fluids. The storage should be constructed in such a way as to contain any spillages which may occur. Similar storage should be constructed to store used fluids prior;
- Avoid dumping of solid and liquid wastes from the project into the rivers and wet lands
- Promote watershed management work to control soil erosion, nutrient wash and associated water quality deterioration and reservoir siltation;
- Apply integrated land treatment measures (e.g., planting trees, terracing, contour farming, and crop residue management);
- Apply physical/ biological treatment of inflowing run-off by using riparian vegetation buffer.
- Sensitize the community on proper usage of fertilisers and herbicides. Encourage less harmful technologies such as Integrated pest management, and organic fertilizers.
- Interdiction of dangerous pesticides/acaricides such as DDT which with Dieldrin were banned in 1976 for use in livestock as acaricides because the ticks developed resistance, bio-accumulation in oily tissues of cattle and were detected in dairy products (Keating, 1983);
- Recommendation to use of bio-pesticides that lack adverse effects on livestock and environment such as *Metarhizium anisopliae sensu stricto* (Metsch) a fungal found by International Center for Insect Physiology and Ecology (ICIPE) to be effective for ticks' control that could be commercialized (Bailey et al; 2010)
- All containers and bags for pesticides, herbicides and fertilizers should be handled as hazardous waste, and disposed of accordingly. They should not be reused. Records of chemical use and application amounts should be kept. Hazardous waste shall be disposed of by licensed dealers as per the law.
- Use of Personal Protective Equipment during handling, spraying of pesticides especially acaricides for livestock protection against tick-diseases;
- When emptying dipping tanks, dig a deep well and pour away the water containing acaricides residues for a slow degradation and decomposition of contaminants in the deep soil;
- Records keeping that hind at Policy formulation aiming to reduce acaricides poisoning among

vegetation and livestock farmers;

- Delimit a small area in the concession where acaricides will be always sprayed on the animals during ticks' killing.
- Installation of a limited buffer zone all along the irrigation channels by performing mid-term and long-term vegetation management;
- Intensive awareness campaigns aiming to prevent local residents throwing debris and all types of solid and liquid wastes into flowing waters in channels;
- Periodical clearing/cleaning irrigation channels' embankments and regular control of dikes destruction.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
soil and water contamination by farming method and chemicals and waste disposal	Operation	Medium	very low

6.4.3.4 Crop intensification and loss of traditional landraces

Rwanda constitutes a center of genetic diversity for several important crop species. By promoting improved crop varieties in the country and within Nyagatare District in particular, agricultural productivity will increase, but traditional crops could be displaced by modern varieties, causing a loss of crop genetic diversity. More importantly, the intensified cropping systems will rely on improved crop varieties which tend to require agrochemical inputs to attain their yield potentials. Their widespread use will contribute to a reduction in overall crop varietal diversity, therefore increasing the risk of pest and disease outbreaks.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Loss of traditional landraces	Short-term	local	Moderate	Reversible	Probable	Medium

Mitigation measures

- Use improved varieties which are already grown in the region and have proved to be well adapted;
- Development and delivery of a preventive extension packages (farmer training in problem avoidance and management techniques);
- Prevention and control techniques for the major insects, weeds and disease problems in the area;
- Constitute a Gene Bank for traditional landraces;

- Provide easy access to inorganic fertilizers.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Loss of traditional landraces	Operation	Medium	Very low

6.4.3.5 Impact on soil salinity and decrease in soil fertility

The impact of the irrigation on soil salinity depends on the soil chemistry, water quality and overall management of the irrigation field. Laboratory results of water and soil in the area indicate that both are suitable for the development of irrigation farms. Therefore, salinity impact that could originate due to the soil and water quality would be minimal. However, unwise use of water in the irrigation field could cause water logging and associated salinity problems. Overuse of water may raise saline groundwater tables and could contribute to the increase of salt at the root zone of the crops and may affect crop production.

In addition, Incorrect water management in the command areas and inadequate drainage could result in a rise of the water table, and consequently known secondary salinization of the topsoil.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impacts on soil salinity and decrease in soil fertility	Long-term	Regional	Moderate	Reversible	Probable	Medium

Mitigation measures

- Organized trainings for water users' associations and farmers' groups to acquire knowledge and skills necessary to minimize surplus water applications;
- Enhance drainage maintenance both on and off- command area;
- Establish a timely close monitoring to provide early warning of problems.
- Avoid overuse of water in the irrigation field Avoid excessive application of fertilizers and pesticides;
- Drain water logging areas of the farm;
- Classify irrigation field according to soil salinity class and grow salt tolerant crops on saline plots;
- Apply periodic leaching of saline soils;
- Regular application of organic matter and lime shall be needed to maintain and improve soil properties.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impacts on soil salinity and decrease in soil fertility	Operation	Medium	Very low

6.4.3.6 Introduction of invasive species

The continuous operations of the irrigation project could create an ongoing risk of the introduction and spread of invasive species of plants and animals. Indeed, some alien plant species could be introduced at any moment if, for example, channel maintenance equipment is brought from an infected area of another country and not cleaned prior to being used on the project. This could also be through seeds for crop cultivation. Unfortunately, once invasive species arrive in a new environment control becomes very difficult or impossible to eradicate, so prevention is the preferred choice of counter-measure.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Introduction of invasive species	Short-term	Local	Moderate	Reversible	Unlikely	Low

Mitigation measure

- All equipment brought from outside the project area for channel maintenance should be cleaned prior to being used on the project.
- Introduction of a surveillance system to ensure any new species are quickly identified and maintained;
- Developing pest management plan by RWB/RAB that will be disclosed together with this ESIA.
- Ensure use of clean and certified seed for crop production

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from low to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Introduction of invasive species	Operation	Low	Very low

6.4.3.7 Diseases transmission in cattle and decrease of livestock productivity

With the first option of alternative B dedicated to group livestock within the command areas with a considerable number of livestock and feed them in the same location (community farming), there will be movement of animals searching for food and water and therefore disease

transmission in cattle from one group to another leading to decreasing livestock productivity. This option has been discouraged in favor of the second option dedicated to keep the livestock in the irrigation command areas, where all farms which are under command area boundary will be supplied water for livestock by providing a hydrant and trough, the later constructed and connected to this hydrant.

Within farms located under command area boundary, diseases such as trypanosomiasis reported as a serious cattle disease especially in Sectors bordering the Akagera National Park (Karangazi, Rwimiya) and Helminthiasis reported to be a major disease burden especially in riverine Sectors of Matimba and Nyagatare will affect cattle, leading to lower livestock productivity. Furthermore, tick-borne diseases were also reported to be the most common health problems in cattle. Lastly, the use of dip tanks or spray-races is still very rare in the Nyagatare District, which makes tick control very difficult. The control of tsetse flies which spread trypanosomiasis is also more difficult as it requires regional control measures (*Socioeconomic and Livestock water supply study, 2022*).

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Diseases transmission in cattle and decrease of livestock productivity	Long-term	Local	Moderate	Irreversible ⁴⁴	Highly probable	High

Mitigation measures

- Give priority to the second option of alternative B related to the fact that all farms which are under command area boundary will be supplied water for livestock by providing a hydrant and trough.
- Increasing perimeter fencing would help to control different diseases especially tick- borne diseases;
- Increasing the possibility of dip tanks and/or installation of individual or communal spray-races use against tick-borne diseases, would help greatly to reduce the losses incurred from mentioned diseases in livestock reared in the command area and vicinities;
- Regular disinfection of cows, goats and sheep using appropriate medicinal products dedicated to reared domestic animals;
- Initiate and effectively participate in a regional campaigns and tsetse flies control measures in order to eliminate Trypanosomiasis disease.
- Initiate regular disease surveillance and monitoring

⁴⁴ between 60 % and 85 % sure that the impact will occur

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from high to low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Diseases transmission in cattle and decrease of livestock productivity	Operation	High	Low

6.4.3.8 Conflict between water users

Basically, the project will construct all irrigation and drainage infrastructure down to tertiary level. There will be no need to construct channels delivering water to the basic irrigation units by the Water Users Associations (WUA). Nevertheless, the conflict between livestock and agricultural farmers is always recurrent because of competition over water use. This is exacerbated in periods of drought and water scarcity. This conflict can also occur amongst water users of the same nature (farmers to farmers and livestock keepers to livestock keepers).

The scheme is to be managed by a water users' committee and assisted by a platform called District irrigation steering committee to solve water related conflicts. The committee is composed by vice mayor in charge of economic development, District and sector agronomist and RAB irrigation engineer.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Conflict between water users	Short-term	Local	Moderate	Reversible	Highly probable	High

Mitigation measures

- Provide technical and logistical support for training water users on management of irrigation infrastructure and benefits of sharing;
- Give responsibility to Grievances Redress Committees (GRC) for helping on records of complaints and active participation in conflict resolution. Normally when there are conflicts among water users related to irrigation water, there is a platform called District irrigation steering committee which is normally tasked to solve such conflicts. This committee is composed of the Vice mayor in charge of economic affairs, District and sector agronomists. RAB irrigation engineers based at every station may also be involved.
- Monitor the water levels and adjust water supply to users in line with availability and well-established water sharing arrangements.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from high to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Conflict between water users	Operation	High	Very low

6.4.3.9 Greenhouse gas emissions

Creation of a large command area can contribute to GHG emissions. Gases generated by aerobic and anaerobic decomposition are mainly carbon dioxide, methane (CH₄) and nitrous oxide (N₂O). The formation of methane, which has a greater warming potential, is attributed to an intensive area that will be used for paddy fields.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
GHG emissions	Long-term	National	Moderate	Reversible	Definite	High

Mitigation measures:

One way to reduce methane and nitrous oxide is to use the Alternate Wetting and Drying (AWD) method. AWD is an irrigation method in which rice paddies are intermittently irrigated and water is not added until the soil is dry. When it dries, oxygen is distributed to the soil and the action of microorganisms that produce methane is suppressed.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from high to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
GHG emissions	Operation	High	Very low

6.4.3.10 Flooding in command area

Some parts of irrigated areas could be flooded by channels discharging flows and these could cause crop losses if farmers have adjusted to non-flooding conditions, and could also lead to physical damage to property if the floods are severe or if the irrigation scheme management is not well adapted.

The risk of flooding and emergency evacuation can also be exacerbated given most of the water for the irrigation will be held in the dam. In the event of dam break, irrigation infrastructure such as the canals can increase the reach and extent of flood waters.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Poor flood management in the command area	Short-term	local	Moderate	Reversible	Probable	Medium

Mitigation measures

- RWB/RAB to update the dam emergency preparedness and response plan to cover irrigation component and areas, sensitize the community on action and carry out periodic drills to test

response measures and evacuation procedures; The updated plan will be prepared during implementation and will be provided to the Panel and Bank for review not later than one year before the projected date of the initial filling of the reservoir ie at least 1 year prior to dam impoundment.

- Cross drainage structures have been proposed (and designed) for safely carrying discharges corresponding to 1 in 50-year return period rainfalls;
- One proposed solution consists of preventing the water from entering into the irrigation; systems of command area, with interceptor drains;
- Drain water for irrigation in pipes and use sprinkler for watering crops in command areas.
- Regularly monitor the performance of the irrigation scheme.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Poor flood management in the command area	Operation	Medium	Low

6.4.3.11 Siltation and clogging of irrigation infrastructures

Sediments originating in the catchments adjacent to the irrigated areas will continue to affect channels and drains leading to siltation and sometimes clogging of irrigation infrastructures, unless watershed conditions are improved. In fact, grazing pressure and cultivation of lands in the vicinity of command areas affect watershed conditions. As a result, surface erosion could spread, with significant volumes of sediment being moved downstream in the irrigated area, clogging irrigation infrastructures.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Siltation and clogging of irrigation infrastructure	Short-term	Site specific	Moderate	Reversible	Probable	Medium

Mitigation measures

- Improvement of watershed management conditions, especially promoting ecological agriculture;
- Creation of limited buffer zone all along the irrigation channels and grass planting for soil fixation;

- Improved farming methods including contour and terracing of farms among others.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Siltation and clogging of irrigation infrastructure	Operation	Medium	Very low

6.4.3.12 Biotic constraints (weeds, insects and diseases)

The intensification of agriculture is highly likely to result in the increase of pests and diseases problems. In Sub-Saharan Africa, crop pests and diseases cause major economic losses in the agriculture systems. But, most damage is caused by insects, followed by weeds, storage pests, and plant diseases.

In the Muvumba command area, the proposed cropping pattern includes vegetables, legumes (beans, fresh beans and soya), cereal crops (maize and rice) as well as Irish potatoes. Among limiting factors include lack of water and irrigation and drainage will remove this primary constraint to crop productivity. Plant growing will need fertilizers, followed by the most significant limiting factor which is biotic constraints (weeds, insects and diseases) especially for horticultural crops.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Biotic constraints	Short-term	local	Moderate	Reversible	Probable	Medium

Mitigation measures:

- Development and delivery of preventive extension packages (farmer training in problem avoidance and management techniques);
- Prevention and control techniques for the major insects, weeds and disease problems in the command area.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Biotic constraints	Operation	Medium	Very low

6.4.3.13 Infrastructure Sustainability Challenges

Breakdown of irrigation schemes is often rooted in weak governance within Water User Associations (WUAs), leading to poor financial management, lack of accountability, and inability to cover recurrent costs like electricity and maintenance. Infrastructure deteriorates without proper oversight, jeopardizing both agricultural output and livestock water access. This undermines long-term sustainability and community confidence in water service delivery.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Infrastructure Sustainability Challenges	long-term	local	Moderate	Reversible	Probable	Medium

- Establishing and building the capacity of Water Users Associations (WUAs) and farmers' groups (cooperatives), as well as operationalizing the WUAs through the provision of two years of operating costs, as agreed with the Rwanda Agricultural Board (RAB). This includes training in financial literacy, governance, and record-keeping. Encourage transparent leadership and internal audits to foster accountability.
- Introduce affordable and context-sensitive water tariffs to ensure regular payments for electricity and operational costs without excluding vulnerable users.
- Conduct periodic technical assessments of irrigation water systems. Design improvements with energy-efficient components and low-maintenance layouts to reduce long-term costs.
- Establish community-based operations and maintenance (O&M) teams with incentivized roles. Ensure gender inclusivity and link with district support services.
- Design watering points with durable materials and gravity-fed systems where feasible to minimize energy needs. Provide training on rotational use and livestock behavior management.
- Pilot schemes where WUAs receive support contingent on meeting governance and maintenance benchmarks, encouraging proactive management.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from medium to low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Infrastructure Sustainability Challenges	Operation	Medium	Low

6.4.3.14 Impact on biodiversity

During site reconnaissance, it was observed that a gallery forest exists near the project area but beyond the 3073ha project command area (see Fig. 5-18). The shortest distance between the forest and the extended canal is estimated as 0.65km with a human settlement, Nsheke Primary, farms and a National Road (Nyagatare-Ryabega road separating the two. Construction works will not therefore impact the forest.

The gallery forest runs along Muvumba river and accommodates a huge diversity of bird's community including *Ardea cinerea*, ducks, Black-head weavers and so forth as well as mammals such as baboons. Generally, 19 species were found in the gallery forest.

Next to the gallery forest (and even further from the project area) is the Muvumba wetland area of which part is occupied by rice farms and marsh. The ESIA team sighted the grey crowned crane in one of the fields within the reice fields– presumably attracted by the rice fields/paddies and likely having migrated from the National parks especially Akagera (over 100kilometres away). The crane is a protected species in line with the Ministerial Order No 007/2008 establishing the list of protected animals and plant species in Rwanda and appears on the IUCN List of endangered species.

One-quarter of the Rwandan Grey Crowned Crane population depends on marsh areas and, its abundant and diverse aquatic plant life. Plants here serve as food sources and play a vital role in stabilizing the marsh ecosystem by preventing erosion of the fertile volcanic soil and maintaining water quality. The crane often plucks insects, small reptiles and plant material from the marsh/wetland.

Given the proximity of some of the communities to the forest/wetland (during the operation of the irrigation scheme as Fig. 5-17 and 5-18 shows), its possible that the crane may be attracted to the new irrigation fields thus mitigation measures are needed to sensitise the community on the importance of the grey crowned crane and need to preserve it should they sight any in their fields in the future.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impact on Biodiversity	long-term	Local	Moderate	Reversible	Probable	High

Mitigation Measures

- Develop a deliberate campaign for sensitization of the irrigation community on the importance of the grey crowned crane and need to preserve it should they sight any in their fields in the future. The plan will be developed one year prior to the operationalization of the irrigation scheme and integrated into the regular sensitization of the cooperatives and WUAs.
- Establish collaboration with concerned conservation organizations/institutions in the area, in monitoring grey crowned crane precence in the project area proximity area as part of project monitoring to ensure effective measures are taken to support them when deem necessary.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from High to low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Impact on Biodiversity	Operation	High	Low

Table 6-45: Summary of Impacts significance during pre-construction, construction and operation phases of this project

Assessed negative E&S impacts	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Pre-construction phase						
Loss of land and physical displacement	Short-term ⁴⁵	Site specific ⁴⁶ to Local ⁴⁷	Moderate ⁴⁸ to High ⁴⁹	Reversible ⁵⁰	Definite ⁵¹	High ⁵²
Loss of graves	Short-term	Site specific	Moderate	Reversible	Definite	Medium
<u>Loss of infrastructure service</u>	Short-term	Local	Moderate	Reversible	Definite	Medium
Loss of livelihood	short-term	Local	Moderate ⁵³	Reversible	Definite	High
Construction phase						
Impacts on terrestrial ecosystems & biodiversity	Short-term	Regional ⁵⁴	Moderate	Reversible	Probable ⁵⁵	High
Impact on aquatic biodiversity	Short-term	Regional ⁵⁶	Moderate	Reversible	Probable ⁵⁷	Medium
Loss of natural vegetation	Short-term	Local	High	Reversible - irreversible	Highly probable ⁵⁸	High

⁴⁵ Impact is expected to last in the short term (<5 years)

⁴⁶ within the site boundary (less than 500m)

⁴⁷ limited to specific individuals or communities or environmental receptors at or close to the site (within a radius of 0m-5km)

⁴⁸ observable-impacts reversible with rehabilitation

⁴⁹ Has a measurable and sustained positive or negative impact on social or environmental aspects.

⁵⁰ Impact requires mitigation and rehabilitation to ensure reversibility

⁵¹ Impact with over 85 % probability to occur.

⁵² The impact is unacceptable and further mitigation measures must be implemented to reduce the significance

⁵³ Effects observable-environmental impacts reversible with time

⁵⁴ extends substantially beyond the site boundary

⁵⁵ between 40 % and 60 % sure that the impact will occur

⁵⁶ extends substantially beyond the site boundary

⁵⁷ between 40 % and 60 % sure that the impact will occur

⁵⁸ between 60 % and 85 % sure that the impact will occur

Assessed negative E&S impacts	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Modification of Muvumba water flows downstream of the constructed dam	Short-term	local	Moderate	Reversible	Possible	Medium
Impacts on wildlife (migration of bird and fishes)	Short-term	Local	Moderate	Reversible	Probable	Medium
Impacts on air pollution	Short-term	Local	Moderate	Reversible	Probable	Medium
Noise and vibration effects	Short-term	Local	Moderate	Reversible	Definite	Medium
Impacts from access roads	Short-term	local	Moderate	Reversible	Definite	Medium
Impacts from quarry sites and borrow area,	Short-term	Local	Moderate	Reversible	Probable	Medium
Workers' health and Safety	Short-term	Local	Moderate	Reversible-irreversible	Probable	Medium
Risk of traffic incident and community injury on/offsite	Medium	Local	High	Reversible	Probable	Medium
Increased risks of communicable diseases	Short-term	Regional	Moderate-High	Reversible-irreversible	Probable	Medium
Labour Influx and Conflict among workers and local people	Short-term	Local	Moderate	Reversible	Probable	Medium
Disruption of public utilities	Short-term	Local	Moderate	Reversible	Probable	Medium
GBV, SH, SEA related impacts	Short-term	Local	Moderate	Irreversible	Possible	Medium
Child abuse and exploitation	Short-term	Local	Moderate	Reversible	Possible	Medium
Poor hygiene and sanitation	Short-term	Local	Moderate	Reversible	Probable	Medium
Creation of slopes and accumulation of earth materials during excavation works	Short-term	Local	Low	Reversible	Probable	Low ⁵⁹
Poor solid and liquid waste management	Short-term	Local	Moderate	Reversible	Probable	Medium
Disruption of existing access	Short-term	Local	Low	Reversible	Highly Probable	Low
Cultural disruptions and protection of archaeological and historical sites	Short-term	Local	Moderate	Reversible	Possible	Medium
Impacts from the Construction of temporary site	Short term	Local	Moderate	Reversible	Possible	Medium

⁵⁹ little effect- negligible disturbance

Assessed negative E&S impacts	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
installations						
Impact on water quality, Possible contamination and competition over water	Short-term	National	Moderate	Reversible	Probable	Medium
Other impacts from construction of temporal sites installations	Short-term	Local	Moderate	Reversible	Probable	Medium
Impacts from high job expectation	Short term	Local	Low to moderate	reversible	Highly Probable	High
Operation phase						
Impacts on environmental flow	Short-term	National/international	Moderate	Reversible	Probable	High
Increased health impacts	Short-term	local	Moderate	Reversible	Probable	Medium
soil and water contamination by farming method and chemicals and waste disposal	Long-term	Regional	Moderate	Reversible	Probable	Medium
Impacts on soil salinity and decrease in soil fertility	Long-term	Regional	Moderate	Reversible	Probable	Medium
GHG emissions	Long-term	National	Moderate	Reversible	Definite	High
Poor flood management in the command area	Short-term	local	Moderate	Reversible	Probable	Medium
Siltation and clogging of irrigation infrastructure	Short-term	Site specific	Moderate	Reversible	Probable	Medium
Loss of traditional landraces	Short-term	local	Moderate	Reversible	Probable	Medium
Biotic constraints	Short-term	local	Moderate	Reversible	Probable	Medium
Introduction of invasive species	Short-term	Local	Moderate	Reversible	Unlikely	Low
Conflict between water users	Short-term	Local	Moderate	Reversible	Highly probable	High
Diseases transmission in cattle and decrease of livestock productivity	Long-term	Local	Moderate	Irreversible ⁶⁰	Highly probable	High
Infrastructure Sustainability Challenges	long-term	local	Moderate	Reversible	Probable	Medium

⁶⁰ between 60 % and 85 % sure that the impact will occur

Assessed negative E&S impacts	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Impact on Biodiversity	Long-term	Local	Moderate	Reversible	Probable	High
Decommissioning phase						
Waste generation	Short-term	Local	Low	Reversible	Probable	Low
Air pollution	Short-term	Local	Low	Reversible	Probable	Low
Occupational health and safety risks	Short-term	Local	Low	Reversible	Probable	Low
Termination of Labourers and loss of income	Medium	Regional	Medium	Reversible	Definite	High

6.4.4. Decommissioning Phase

6.4.4.1 Waste generation

Decommissioning involves dismantling irrigation infrastructure, clearing temporary structures, and removing machinery. This process generates significant volumes of solid waste, including scrap metal, concrete debris, plastic liners, piping materials, and general construction litter. If poorly managed, these materials can lead to soil contamination, water pollution, and health hazards for nearby communities and livestock, particularly in grazing corridors and water access points.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Waste generation	short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation Measures

- The contractor shall develop a detailed inventory of expected waste streams and categorize them into recyclable, reusable, hazardous, and non-recyclable components for targeted management.
- The contractor shall partner with local recycling initiatives to recover usable materials (e.g., metal, plastic, and aggregate).
- Encourage repurposing of non-contaminated items for community or agricultural use.
- Ensure hazardous components, like oil residues, chemical containers, or electrical parts, are handled by licensed waste handlers and disposed of according to national environmental regulations.
- Involve local stakeholders in site cleanup efforts, offer awareness on waste sorting practices, and create temporary waste collection points to prevent dumping.
- Clear waste residues fully and rehabilitate affected areas through planting, soil stabilization, or regrading to restore ecological function and aesthetics.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from low to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Waste generation	Decommissioning	Low	Very low

6.4.4.2 Air Pollution

Decommissioning activities, such as demolition, excavation, transportation of materials, and machinery use, can release dust, particulate matter (PM₁₀ & PM_{2.5}), and exhaust emissions into the air. These pollutants may affect respiratory health for local communities and livestock, reduce visibility, and contribute to localized atmospheric degradation. In dry zones like Nyagatare, dust nuisance is exacerbated by wind exposure and bare soils, making mitigation crucial for maintaining ambient air quality.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Air pollution	short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation Measures

- The contractor shall regularly water down exposed soils, dismantling sites, and access roads to minimize airborne particulate generation during peak decommissioning periods.
- Use well-maintained machinery with low-emission engines or retrofit filters to reduce release of harmful exhaust gases, particularly from diesel equipment.
- The contractor shall schedule demolition during low-wind periods and employ dust screens or barriers around high-risk zones to limit dispersion toward inhabited areas.
- The contractor shall avail to workers with protective gear (e.g., masks) and conduct periodic health checks to detect respiratory issues early and ensure occupational safety.
- Engagement with local residents with timely information about decommissioning schedules and establish ambient air monitoring stations to track pollution levels and guide adaptive responses.

6.4.4.3 Occupational health and safety risks

During the decommissioning of temporally infrastructure, workers may be exposed to multiple occupational health and safety risks that demand proactive and site-specific mitigation strategies. Dust and diesel emissions from excavation machinery and demolition activities can compromise respiratory health, especially in semi-arid zones where particulate matter disperses readily. Extended exposure to high noise levels and ground vibrations from drills and jackhammers poses risks of hearing impairment and stress-related fatigue.

Physical injuries, ranging from muscle strains to fractures, can occur while dismantling heavy components or navigating uneven terrain, particularly if ergonomic practices and lifting protocols are ignored. Handling residual chemicals such as lubricants, pesticides, also presents toxicological threats, requiring strict containment and disposal procedures. Moreover, prolonged work under intense heat, especially when wearing PPE, increases the risk of dehydration and heat exhaustion. These risks are magnified in rural settings with limited access to emergency care, underscoring the need for comprehensive safety audits, appropriate protective equipment, health surveillance, and daily safety briefings to safeguard worker well-being throughout the decommissioning process.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Occupational health and safety risks	short-term	Local	Moderate	Reversible	Probable	Medium

Mitigation Measures

- The contractor shall map out hazard zones, outline evacuation routes, and identify vulnerable workspaces. Prevention begins with awareness.
- No compromises: masks, goggles, boots, gloves, and ear protection must be worn like armor in battle.
- Empower workers with the science of safe lifting, because good posture is cheaper than rehab.
- Lockout-tagout systems and daily equipment inspections prevent life-altering accidents.
- Rotating shifts, cooling zones, and electrolyte solutions keep workers alert, safe, and hydrated.
- A culture of open reporting improves safety for future phases and generates trust.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from low to very low (negligible) within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Occupational health and safety risks	Decommissioning	Medium	Very low

6.4.4.4 Termination of manpower and loss of income

Decommissioning will lead to contract closure and reduction of labor demand, affecting skilled and unskilled workers engaged during construction and operational phases. This abrupt termination can result in income insecurity, especially for those lacking alternative employment, financial buffers, or vocational adaptability. In rural areas, ripple effects may include increased dependency ratios, migration pressure, and erosion of community economic stability.

Impact	Duration	Extent	Magnitude	Reversibility	Likelihood of occurrence	Impact significance
Termination of manpower and loss of income	Moderate	Regional	Moderate	Reversible	Definite	High

Mitigation Measures

- Develop workforce exit strategies early such as issuance of contracts that clearly states employment terms, including periods of employment to aid workers plan accordingly.
- Offer short-term courses in skills transferable to other sectors (e.g., masonry, plumbing, welding, agri-business) with recognized certifications to improve future employability.
- Create databases of decommissioned workers and prioritize them for recruitment in related infrastructure or agricultural schemes.
- Encourage workers to use local saving schemes such as SACCO programs that to help them save part of their earning for future small-scale businesses or restore their livelihoods during job termination.

The implementation of the proposed mitigation above measures will reduce the significance of the residual impact from low to low within the receptors as shown below:

Impact	Project Phase	Significance (Pre-Mitigation)	Residual Impact Significance (Post-Mitigation)
Termination of manpower and loss of income	Decommissioning	High	low

6.4.5. Cumulative Impact Assessment (CIA)

The U.S. Council on Environmental Quality defines cumulative impact as the impact on the environment which results from the incremental impact of the action when added to their past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such other action. These impacts can be individually limited but cumulatively considerable, or for which the incremental effects of individual projects are considerable.

Cumulative impact assessment (CIA), under this section, comprises the analysis of the potential impacts and risks of proposed development of irrigation project in the context of the potential effects of other projects, human activities and natural environment and social drivers on the chosen valued environmental and social components (VECs) over time and proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risks to the extent possible. That is to say-how the impact of this proposed project might combine, cumulatively, with the potential impacts of other activities either existing or future projects. The assessment of cumulative impact in this project focuses on the following objectives:

- Assess the potential impacts of ongoing projects; planned future plans, programs and development projects that will add to the impacts of already assessed impacts caused by irrigation project.
- Indirect impacts of this project on biodiversity or on ecosystem services upon which affected communities are dependent;
- Incremental impacts on resources used directly impacted by the project from other existing, planned or reasonably defined development at the time the risks and impacts identification process is conducted.
- Verify that the proposed development's cumulative social and environmental impacts and risks will not exceed a threshold that could compromise the sustainability or viability of selected VECs.
- Confirm that the proposed development's value and feasibility are not limited by cumulative social and environmental effects.

It is important to note that there are no facilities identified as *associated* in this project that could be the cause of incremental impacts.

6.4.5.1 Valued Environmental and Social Components

Chapter 5 above (baseline conditions) provides details on flora and fauna present in the project area. The gallery forest dominated by acacia kirkii and accommodating a variety of birds and mammals are discussed under this chapter and are considered as VECs for this project. In addition, the Muvumba river water is also considered as VEC. These VECs were selected because of their ecological and socio-economic importance.

Because there is a concern that they could be affected by this project as discussed in the impact chapter, an appropriate CIA need to be undertaken to ensure that the sustainability of viability of these VECs will not be compromised. The ongoing/existing projects that could be considered as source of cumulative impacts are indicated in Table 6-6.

Table 6-56: Ongoing projects within the Muvumba command area

Project	Proximity to or location to the proposed irrigation project	Opportunities/overlap risks
Muvumba multipurpose dam construction and power plant installation project	Located at the upstream of the Muvumba command area where M-5&M-8 are located	Considering that the water that will be used for irrigation will be abstracted from the Muvumba multipurpose dam, which is located upstream of the irrigation project, the irrigation project will add pressures/influence the environment and communities over time and space. This includes additional land acquisition, vegetation clearance, and job creation as well as additional infrastructures.
Commercialization and De-risking for agricultural transformation project (CDAT)	The project is located in the command area in the downstream part. This project targets interventions related to irrigation development and Muvumba P8 rehabilitation as well as land husbandry activities in the vicinity catchment	Though their irrigation type differs: pivot vs surface irrigation for this project vs CDAT respectively, CDAT project and the proposed irrigation project have irrigation development interventions in common. This project will significantly increase the irrigated area, employment opportunities, infrastructure development, and improved livelihood in the target sectors of Rwempasha, Tabagwe, Karama, Rukomo and Nyagatare. On the negative side, both project abstract water from Muvumba river. There is a need to work concurrently in planning to avoid conflicts on water use as both projects use water from Muvumba river.

6.4.4.2 Cumulative impact assessment

The Irrigation Project is a critical intervention aimed at enhancing agricultural productivity and sustainable water resource management in Rwanda's Eastern Province. In the same geographic landscape, two (2) other initiatives/projects are concurrently unfolding: The Muvumba Multipurpose Dam Construction and Power Plant Installation Project (MMD), which serves as a backbone for regional water regulation and energy generation being implemented by RWB; the Commercialization and De-risking for Agricultural Transformation Project (CDAT), focused on scaling climate-smart agriculture and enhancing market access that is being implemented by Rwanda Agriculture and Animal Development Board (RAB).

The spatial and ecological interplay among these projects presents overlapping environmental and social pressures. This analysis identifies key shared impacts and evaluates their cumulative effects, offering insights essential for integrated safeguards planning, long-term ecosystem resilience, and equitable community outcomes. The possible negative/adverse impacts of irrigation project on the VECs were considered and explicitly discussed in the impact chapter. Considering the ongoing/existing projects, the significance of cumulative impacts ranges from low to Major. These impacts accumulate as a result of combined/shared impacts from the three concurring projects (CDAT, MMD and this proposed project) over a time as shown in the Table 6-7

Overall, the likely cumulative impacts identified at the time of this ESIA was found to range from low to high in magnitude. These may include inadequate Muvumba River flow due to abstracted volume to Muvumba dam and possible inundation of the scheme, among other issues which may, in the future, affect downstream projects if located close to the irrigation project. The following subsections discuss some possible cumulative impacts:

6.4.4.2a Impact of environmental flow

Inadequate water flow from Muvumba multipurpose dam will negatively affect irrigation in downstream areas where the new future/proposed schemes will be developed.

Mitigation measures:

- To maintain the allowed flow to sustain the development of downstream activities including this proposed new scheme.
- The hydrological study for irrigation project shows that adequate environmental flows are available in Muvumba river on the downstream of the Muvumba dam, as mentioned in the environmental baseline chapter. Therefore, to maintain the development of downstream activities, the environmental flow will be regularly maintained.

6.4.4.2b Impact on river ecology and biology

The implementation of the Irrigation scheme will automatically have consequences of the change of land use/cover and water use in the project area, cumulative effects on the land around the project and on aquatic ecosystems that share the catchment. This is in several ways:

The associated irrigation facilities and secondary effects may have a cumulative effect by enhancing habitat fragmentation and loss of connectivity between the terrestrial and aquatic environment.

For the terrestrial environment this is related to land conversion while for the aquatic environment this is related to flow regulation, channel diversion as well as the irrigable area and production activities targeted. Low efficacy of the irrigation structures, in the long-term, may lead to unusual rise in the local water-table (waterlogging). The poor water reticulation and distribution systems, coupled with poor main system management and inefficient in-field irrigation practices will certainly lead to water logging. Coupled with hot weather and high water table may lead to rising groundwater through capillary action which will evaporate, leaving salts in the soil. Poor or extensive use of pesticides is likely to affect plants, fish and other aquatic biodiversity, birds and mammals including humans.

Persistent use of such pesticides is in itself a danger as these pesticides, soluble or not soluble, may bond chemically to soil particles and may be transported by erosion even beyond the Muvumba Catchment. Use of organochlorine insecticides such as DDT, dieldrin and endosulfan, is particularly hazardous to aquatic systems and become rapidly concentrated in the food chain up to the higher tier (human beings). Also nonspecific herbicides can rapidly affect the supply of food, and yet the associated risks are likely to increase if a monoculture is practiced, as is typical of many developed irrigation systems that are aimed at increasing overall production.

In addition, the use of both natural and chemical fertilizers may result in an excess of nutrients as all may not be picked by the crops, which excess nutrients can cause problems in the adjoining wetlands, and River Muvumba. Key nutrients of target include the nitrates and phosphate. Whereas nitrates are highly soluble and therefore may quickly reach water bodies, the phosphates tend to be fixed to soil particles and therefore will reach water courses when soil is eroded or during flooding. The excessive nutrients that reach water bodies may result in eutrophication and increased algal blooms, and due to death and rotting of algal matter and resulting in depletion of oxygen in water bodies. Increase in salinity: Salts carried in the irrigation water are liable to build up in the soil profile, as water is removed by plants and the atmosphere at a much faster rate than salts. Solutes applied to the soil in the form of artificial and natural fertilizers as well as some pesticides will not all be utilized by the crops;

Mitigation measures:

- Set the field application efficiency for irrigation for the different seasons at levels that ensure well balanced levels of the groundwater;
- The area should adopt integrated pest management including considering of use of low use of chemical methods and or use of natural herbicides.
- Limit use of non-specific and non-target use of agrochemicals Adopt a rigorous water quality monitoring system from filling to the operation phase.
- There is need for careful soil monitoring before and during the operational phase of the irrigation project with regular soil sampling and testing.
- Use of fertilizers and chemicals should be appropriately guided based on the nutrient assessment and kind of crops targeted;
- The irrigation water supply and flooding should allow for flushing of the soils and irrigation facilities.

6.4.4.2c Loss of private land

The simultaneous implementation of the Muvumba Multipurpose Dam and the downstream irrigation project will result in significant cumulative land acquisition across the catchment. While each project has distinct infrastructure needs, their combined footprint intensifies pressure on land resources, livelihoods, and local institutions.

Mitigation measures

- Ensure fair and full replacement cost compensation across both projects to avoid and reduce claims/appeal among affected persons.
- Design bundled support interventions such as agricultural inputs, vocational training, and irrigation access for households impacted by either or both projects, prioritizing those facing multiple disruptions.
- Engage communities in mapping formal and customary land use to identify overlaps, avoid ecologically sensitive areas, and minimize fragmentation of productive and communal land.
- Establish an accessible GRM platform for both projects, sector-sensitive outreach, and real-time feedback integration to enhance transparency and responsiveness.

Table 6-67: Summary of Cumulative Negative Impact and their Significance

Impact Type	CDAT Project (significance)	MMD Project (Significance)	“This Project” (significance)	Cumulative Impacts (Significance)
Loss of land and physical displacement	Very low	Major	High ⁶¹	High
Impacts on terrestrial ecosystems & biodiversity (loss of vegetation)	Medium	Medium	High	High
Impact on aquatic ecosystems & biodiversity	Medium	Medium	Medium	Medium
Modification of Muvumba water flows downstream of the constructed dam (environmental flow)	Medium	High	Medium	Medium
Disruption of public utilities	Medium	Medium	Medium	Medium
soil and water contamination by farming method and chemicals and waste disposal	Medium	Medium	Medium	Medium

⁶¹ The impact is unacceptable and further mitigation measures must be implemented to reduce the significance

7. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLANS

7.1. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The Environmental Management Plan aims to make this project conform to the applicable environmental legal requirements and also to help all stakeholders to find their roles and responsibilities in the environmental preservation during the implementation of irrigation project.

This Environmental Management Plan synthesizes the information given concerning the potential environmental impacts and the specific mitigation measures proposed in the previous sections. It proposes the institutional responsibilities for the implementation of the mitigation measures, the timing and indicates the source of implementation cost of proposed mitigation measures.

This ESMP reflects the obligation of the RWB, contractor and supervising consultant. The contractor shall develop C-ESMP based on the ESMP developed in this section and it will be updated every six (6) months. It will be reviewed during the life cycle of the project in order to ensure that it remains fit for purpose and continues to meet policies, laws and regulatory requirements. It should be noted that, irrigation project was classified under high-risk category under AfDB project risk categorization. This will necessitate the contractor through RWB to share the developed C-ESMP to the Bank for clearance. Similarly, any changes in the construction methodology or activities or project scope undertaken on the site will be followed by agreement with the Bank on the required safeguards actions e.g. if totally new activities introduced, or change in irrigation design with new components, then a site specific ESIA is required. At the same time, these changes to the C-ESMP content will need to be updated and approved by the Supervisor Engineer.

After completion of the irrigation system installation, the responsibility for environmental and social management in the newly developed scheme will mainly be in charge of scheme users through water user association and will be overseen by the District Authority. In addition, for some of the proposed mitigation measures, local authorities and government organizations with specific mandates will have to be involved in supervision or monitoring during and after irrigation system installation/construction. For example, REMA will carry out environmental audit to verify environmental compliance.

Table 7-1: Environmental and Social Management Plan

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
Pre-construction phase				
Loss of land and physical displacement	Construction of right main canal of 26.6km long and 16m wide, and left main canal of 43.1km long and 22m wide, will require a total area of 211.0.52ha of which 2280 ha belong to the Government of Rwanda particularly Nsheke Primary school.	- RWB has prepared a detailed Resettlement Action Plan to guide land expropriation and based on clear criteria for eligibility - RWB in collaboration with local authorities will undertake fair expropriation/compensation of all affected population as per the National Expropriation/Compensation Law, and in observance of the AfDB ISS policies, prior to the start of the works - The affected persons will have priority of job opportunity during the recruitment in the beginning and during implementation of project activities. - The Project Affected Persons will be meaningfully consulted and given opportunities to participate in the planning and implementation of resettlement program - The ESIA establishes a credible, independent and empowered local grievance and redress mechanism to receive, facilitate and follow up on the resolution of affected people's grievances and concerns about the environmental and social performance of the project.	RWB in collaboration with Nyagatare District	5,643,528,487 as Captured in the RAP
Loss of livelihood	The land acquisition for construction of main canals, which are mainly used by local community who depend on traditional agriculture and cattle grazing.	Livelihood restoration plan has been developed during RAP preparation by RWB via consultant and will target agricultural and livestock-based support programs and financial literacy to rebuild affected	RWB	51,382,840 as Captured in the RAP under livelihood restoration

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		households' income and strengthen resilience. • Inclusive Land Reallocation to ensure redistributed land is productive and near original locations, preserving cultural ties and access to essential resources. • Compensation on full replacement cost and support to provide fair payment for lost land and temporary use zones, with transitional support to stabilize income during adaptation. • Tailored resettlement strategy to respect community preferences by relocating families nearby and offering support to those opting for relocation elsewhere. • Skills development and job creation to employ locals in irrigation scheme activities and promote non-farm vocational paths for income diversification. • Grievance redress mechanism (GRM) should be established and be responsive, culturally sensitive system to address concerns and improve implementation fairness. • Monitoring and adaptive management should be conducted regularly and ensure community-involvement and evaluations to adjust restoration strategies and ensure effectiveness over time.		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
Loss of infrastructure service	- Construction of main canals also will affect Nsheke Primary School's infrastructure, namely school fence, and toilet facility. - Construction of irrigation main canals will affect public roads (4 roads) owned by the district will be crossed by the canals and	- Compensation in cash (including 5% disturbance allowance) for the school infrastructures (fence, and latrines) in compliance with the national expropriation law and AfDB regulation on involuntary resettlement. - RWB will collaborate with affected institutions such as REG and Nyagatare district authorities to confirm where to relocate the affected electric poles. - Installation of culverts will be installed, and construction will proceed by excavating and working on one lane at a time, while the other lane remains open to ensure continuous access for both vehicles and pedestrians. In addition, cross bridge will be constructed to restore transport and accessibility.	RWB	51,579,411 as captured in RAP
Sub total				5,746, 490,738
Construction Phase				
Impacts on terrestrial ecosystems & biodiversity	- Construction of irrigation structures will affect the existing ecosystem including grasses and agroforestry trees (approx. 12,345 trees) in the farm yards of the community. The identified flora inventory in the subproject area as shown in 5.2.2.1. Flora and listed in the Table 5-9 of flora inventory. - Exploitation temporally stone quarry and Construction of camp sites,	- At construction stage, the contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which include among others a Vegetation Restoration Plan and Soil and Sedimentation Control Plan, Hazardous waste Management Plan, Spoil Management Control Plan and Waste Management Plan. - The contractor should develop C-ESMP indicating how he will implement the mitigation measures indicated in this ESIA. This will include activities that prevent and minimize water pollution, noise, dust (particulate matter) and other disturbances to flora and fauna.	- Implementation: Contractor Supervision: Supervision consultant	516 850 280

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		• Prohibit clearing of vegetation cover at least from the 10 m buffer zone centered on the river channel on both sides of the river in the irrigation command area. Conserving this area would maintain the unique habitat and its microclimate and provide a corridor for the movement of a variety of wildlife. • Avoid wherever possible the destruction of habitats used by animal species with conservation interest. Areas used for breeding, nesting, feeding, migration and congregation shall be demarcated and clearly signposted. Access to these areas is prohibited. Where these species cannot be avoided, they will be relocated to other suitable locations that will not be disturbed, under the supervision of qualified specialists; • Plant enrichment tree plantation in the buffer zone in consultation and collaboration with Rwanda Forestry Authority (RFA) forestry authorities. Use certified crop seeds that do not contain seeds from invasive alien species; • To mitigate impacts from trees lost, 12,345 agroforestry lost trees due to canal construction will be replaced by 144,976 indigenous trees, in close collaboration with the local authority to minimize impact on biodiversity from the affected trees • Undertake a census of the areas to be cleared in collaboration with the required authorities (the District forestry/environmental office). Where trees need to be cut, they have to be marked jointly and inventory kept. Where		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		permits are required prior to cutting, the contractor will seek them prior to work execution; - Establish collaboration with concerned conservation organizations/institutions in the area, and conduct joint monitoring of grey crowned crane presence in the project area as part of project monitoring to ensure effective measures are taken to support them when deemed necessary - Develop awareness campaign on to the contractor workers and farmers on the importance of conservation and protection of grey crowned cranes and other species and sharing their information in case they are found in the area, - Sensitise the Contractor, farmers and staff that hunting in the project area as well as adjacent nearby gallery forest is strictly prohibited.		
Impacts on aquatic ecosystems & biodiversity	Construction activities including main canals, temporal quarry and camp sites would generate debris, oil spills, and soil can contaminate the downstream water by runoffs and increase turbidity and solid particles in the river. This condition in turn may cause a major disturbance to the aquatic flora identified in section 5.2.2.2 on Fauna, especially in Table 5-10 of fauna inventory. In addition, disposal of sewage and oil pollutants can	- The contractor shall avoid pollution of river by using sediments traps where applicable, avoid dumping wastes and excavated soil into the rivers; - Temporal sites installations for offices and storage of equipment to be located away from the river to avoid contamination with waste water discharge systems and prohibit any direct discharge from these temporal sites installations (offices and storage of equipment)	- Implementation: Contractor - Supervision: Supervision consultant	2.400,000 ⁶²

⁶² The water test will be conducted once per year. The estimated cost for one year is 800,000 and the total cost for 3 years will be 2.4M

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	greatly impact the fish species in the nearby Muvumba Wetland.	or construction works to the river or its tributaries; • Construction activities should take place during the dry conditions, where possible; • Prohibit dumping of solid and liquid wastes from the temporal sites installations for offices and storage of equipment and spoils from construction sites into the rivers and wetlands; • Do not locate quarry sites or dumping sites in riverbeds and banks; • All wastewater which may be contaminated with oily substances must be managed in accordance with the elaborated contractor Waste Management Plan (WMP); • Prohibit washing construction equipment or vehicles near or into streams and rivers. As the design shows that workshops (possibly with washing bays) are part of the temporal site installations, national and AfDB policies must be adhered to in the setting up and construction of these places to ensure the project does not result in any soil, water and biodiversity pollution from oil leakage and chemicals. Preferably, no garages should be located on site and vehicle maintenance should be undertaken off site in licensed garages to avoid any disposal of chemicals, fuel and lubricants into wetlands and streams; Sensitisation of the contractor staff and farmers that fishing in Muvumba river is strictly prohibited		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
Impacts on air quality resulting into air pollution	• Vehicular traffic in the project area is expected to generate dusts into the air, • Vehicular gas emissions during transportation of construction materials and compaction of main canals, • The stockpiles excavated during construction activities may generate dust emission during windy episodes.	• The Contractor will prepare an Air Quality and Dust Management Plan in the C-ESMP based on this ESIA's ESMP as well as regular and scheduled monitoring through tests; • Vehicles and machinery must be kept in good condition to prevent excessive smoke from exhausts; • Reduce dust by watering the access road surface regularly and especially near sensitive receptors such as residential • Prevent the generation of air pollutants during the construction period by watering during crushing and screening of aggregates; • Prohibit burning of materials such as tires, plastic, rubber products or other materials that creates heavy smoke or nuisance odor; • Avoiding disposing of any volatile chemicals to the air; • Plan potentially dusty activities so that these are located as far from receptors as feasible • Remove dusty materials from the site as soon as possible if not being re-used. If being re-used, cover them; • Impose speed limits on haul routes and in construction compound to reduce dust generation • Minimize drop heights when loading stockpiles or transferring materials Undertake monitoring close to dusty activities, noting that this may be daily visual inspections, or passive/active monitoring;	- Implementation: Contractor - Supervision: Supervision consultant	3,250,000 ⁶³

⁶³ Cost derived from calculation of 30,000Rwf per trip, spraying once in 2 days for 5 dry season months, it will require 75 sprayings*30,000 Rwf per trip.

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		- Workers who may unavoidably have to work in dusty workplaces should be provided with requisite PPE including nose and ear masks to protect them from excessive dust; - Undertake watering to attenuate dust near sensitive receptors. The duration and frequency of this should be set out in the Dust Management Plan and will consider water availability and any stakeholder grievances; - Liaise with local communities to forewarn of potentially dusty activities. - Since construction activities will affect the operations of Nsheke Primary School, they should be scheduled during school holidays to avoid pupils' exposure to health risks, particularly from dust emissions and other construction-related disturbances		
Exposure to Noise and vibration	- Operating machineries and vehicles, blasting/crushing, and aggregate production are expected to generate noise. - Additionally, during civil works, vibrations from machines that are involved in compaction of canals could generate unwelcome noise.	- Construction activities that generate disturbing noise levels are to take place during conventional working hours wherever possible; Any night works or extended hours require a night works management plan - Equipment producing high levels of noise should be screened when working near sensitive receptors such as people in nearby residential areas, noise sources such as rock crusher must be far from the settlement and noise sensitive areas; - Avoid the use of explosives and where not possible, seek prior authorization of the Minister in charge of internal security upon the	- Implementation: Contractor - Supervision: Supervision consultant	10,000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		recommendation of the competent authority. • Requirements for granting the authorisation referred to in the previous sentence are determined by an Order of the Minister in charge of internal security to promote a systematic blasting schedule and plan. • Contractor then prepares a safe blasting plan and procedures in line with the law including evacuation procedures. • Safety procedures pertaining to noise and blasting, such as provision and wearing of PPE e.g. ear protection and safety devices e.g. blasting cages should be provided for the workers who involve in noisy as well as risky operations. • No hooting near sensitive receptors such as schools. • Compensate houses that will be damaged by vibrations in accordance to the national expropriation and AfDB policy on involuntary resettlement. Involve GRCs to record and lodge all complaints related to houses damaged by vibrations; • To communicate as early as possible to the most sensitive receptors about the activities that are going to generate noise and vibrations Maintain vehicle and equipment according to manufacturers' specifications.		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		• Install adequate noise prevention devices, e.g., mufflers on noise generating sources. • Switch off engines of vehicles and machinery while not in use. • Workers who may unavoidably have to work with noise generating equipment, e.g., earthmoving equipment should be provided with ear plugs and advised to put them on. • Siting noisy equipment as far away as possible from Noise Sensitive Receptors (NSRs), and use of barriers (e.g., acoustic sheds or partitions) to reduce the level of construction noise at receptors wherever practicable; • Where practicable noisy equipment will be orientated to face away from the nearest NSRs; • Working hours for significant noise generating construction work will be daytime only • Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units, will be used, where practicable • Where practicable, stationary equipment will be in an acoustically treated enclosure • For machines with fitted enclosures, doors and door seals will be checked to ensure they are in good working order; also, that the doors close properly against the seals; • Throttle settings will be reduced, and equipment and plant turned off, when not being		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		- used; - Equipment will be regularly inspected and maintained to ensure it is in good working order. The condition of mufflers will also be checked; and; - Fitting of mufflers or silencers of the type recommended by manufacturers. - Conduct regular noise and vibration monitoring at nearby community - Since noise from construction activities is likely to affect the school operation, construction works nearby the school should be scheduled during school holidays to avoid pupils' exposure to health risks, particularly from noise emissions		
Impact from Access Roads	- Road rehabilitation will be only in a few isolated places where the existing roads (access roads) are not in good conditions and will need to be rehabilitated, and thus no new resettlement. - Construction of irrigation main canals that will cross existing roads at four cross points.	- The Contractor/s will make all the possible efforts to minimise the period of disturbance and control the movement of traffic by deployment of staff at locations where access roads intersect existing roads for controlling traffic; - Wherever applicable/required the contractor will deploy trained flagmen/marshals to guide and control of the traffic; - Any disturbance to residential properties and commercial area will also be kept minimum by providing access at all times; Should the project block any access roads, alternative well maintained roads must be provided	- Implementation: Contractor - Supervision: Supervision consultant	7,200,000 ⁶⁴

⁶⁴ A flag man or woman earns 30, 000 Frw per month (experience from existing project)

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		- Construction materials should be stacked in a suitable place and away from the intersection of the access road with regular (existing) road so that it does not cause any obstruction to the traffic movement on existing roads. - Contractor/s will ensure that effective public information campaigns are launched prior to the implementation of any traffic management; - In any case, the Engineer will provide guidance and assistance to the Contractor and supervise the preparation of the traffic management plan as is necessary and upon finalization will submit the plan to the client for approval; - Construction traffic shall not use the cut formation and finished subgrade without the prior permission of the Engineer; - Any damage arising out of such use shall be made good by the Contractor at his own expense		
Impacts from quarry sites, borrow pits, site installations	- Quarrying of construction materials such as stones, sand, etc. - Borrow pits formation after quarry activities which need to be rehabilitated or else can cause environmental problems like erosion, creation of mosquito breeding site, unaesthetic view, loss of vegetation and loss of productive land etc. The design team has proposed a list of quarries and borrow pits. These are, however, not comprehensively covered by this ESIA	- The Contractor will prepare site specific ESIAs for the borrow pits and quarry sites whose ESMPs will cover among other measures; - The Contractor will prepare Specific Contractor Environment and Social Management Plan (C-ESMP) for borrow pits and quarry sites which includes among others a safety plan and communication strategy for protecting communities and properties around the quarry during the blasting period. - As per the stipulated by the law No 58/2018, the Environmental rehabilitation guarantee for these quarries and borrow pits must be deposited to Rwanda Green fund (FONERWA)	- Implementation: Contractor - Supervision: Supervision consultant	2,700,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	Establishment or construction of campsites in the project area.	after approval and prior to construction works; - Prepare a blasting plan, if explosives entailed. Use of dynamites in mining and quarry operations require prior authorization of the Minister in charge of internal security upon the recommendation of the competent authority. This includes preparation of specific ESIAs to cover the borrow pits, quarries and dumpsites etc.; - Rehabilitate all quarries and borrow sites to the satisfaction of the supervisor and Client, as well as the land owner for the leased land. temporary site installations and access roads after the completion of construction works, decommission in line with the prepared rehabilitation plans; - Ensure appropriate measures for storage of explosives where in use (in line Rwanda Mines, petroleum and Gas Board (RMB) requirements for issuance of a recommendation letter for granting authorization to import, manufacture, transport, trade in and use of dynamites in mining and quarrying operations, including: ➤ Design of the storage facility in line with the requirements of regulations ➤ Safety plan for safeguarding the storage facilities ➤ Safety plan for communities/other persons around the storage facility ➤ Prepare an ESIA of the area proposed for storage of explosives For rehabilitation, the contractor should: - Take photographs of the proposed temporal		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		sites, borrow pits and quarry sites prior to any construction works; • List all the tree species found in the proposed temporal sites, quarry sites, borrow pits and access roads; • Preserve top soils for reuse to refill borrow sites and quarry areas; • Do not mix topsoil with base soil; • After completion of work, reinstate or refill borrow and quarry sites with the stockpiled soil; • After reinstating, plant appropriate tree species (indigenous trees) or grasses to recover the original vegetation and to improve the ecological and aesthetic value of these sites; • Provide proper drainage to avoid storage of water in quarry and borrow sites to reduce malaria outbreak through reduction of mosquito breeding sites • The land taken for temporal sites, installations for offices and storage of equipment and access roads should be reinstated to productive state when construction is completed by removing the applied selected/foreign material, plowing/loosing compacted materials and covering with top soils. • Puddles shall be promptly refilled to prevent waterborne diseases and proliferation of insects' vectors. • The grounds of material sources shall be backfilled and flattened. Native species of plants as well as socially/culturally valuable species shall be planted when establishing a landscape management plan. Valuable		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		geological or cultural assets shall be reported immediately to the relevant authority as soon as it is discovered - Select quarry and borrow sites far from settlement and environmentally sensitive areas and get approval of site from supervising Engineer and RMB before exploiting. Do not locate temporal site, quarry areas and borrow sites near forest area, rivers and streams - Prior to developing a material source, the contractor shall Prepare and get the approval for the management and rehabilitation plan for the borrow pits, quarries and dumpsites, seek a permit/license and a restoration plan to the relevant authorities and perform an initial environmental examination (IEE). Baseline survey of houses/developments around the quarries including photos		
Poor Workers health and safety including labour rights	- Excavation for irrigation main canals and campsite construction, are likely the generation of dust and exhaust fumes from the vehicles and machineries. Inhalation of dust, smokes and exhaust fumes can result in possible respiratory irritation, discomfort, or illness to workers if not properly mitigated. Risk of injury and accidents on the construction site is also significant due to use of machinery, vehicles in excavated works. - Quarrying activities to obtain	- Provide education/training to personnel of the contractor about safety procedures and emergency response plans associated with their task, - Provide safe water supply & appropriate waste disposal facilities including the provision of sanitary latrines in the temporal sites installations for offices and storage of equipment and various sites where workers are working, - Provide insurance and ensure all workers on site have insurance in case they get injured. - Provision and wearing of recommended quality Personal Protective Equipment (PPE) by workers on site at all times. Active replacement	- Implementation: Contractor - Supervision: Supervision consultant	3, 000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	construction material may cause health issues in disease propagation among workers and indirectly to their family members hence creating illness and most probably fatalities. Violations of labour laws with respect to labour conditions of hiring and payment for work undertaken, enforcement of health and safety measures by the employer such as the use of appropriate PPEs during construction of the proposed works etc.	of worn out of PPE. - Sufficient training to all workers on site on safe methods pertaining to their area of work to avoid injuries including inductions - Contractor to designate/hire a lead fully time qualified Safety Environment and Health Officer to enforce the safety and health management plan (as shown in Annex 3) on site and to monitor implementation for the duration of the construction work. - Contractor to ensure all machines and equipment on site serviced as required and are in proper working condition. - Contractor to have an on-site well stocked Clinic room, ambulance and first aid kits. The contractor will also make arrangements with nearby local hospitals for the provision of ambulance services. - Proper signage at strategic places for information and warning e.g., excavation sites to warn on fall risks. - The contractor will keep an incident register book, and insure vehicles, workers and third parties. All accidents to be reported to the Developer within the required timelines. Contractor to prepare and share with the proponent a contingency/emergency response plan for accident response. - Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signage and fence off all dangerous areas. - For COVID 19, frequently wash hands with soap and clean water; cover mouth and nose		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		with flexed elbow or tissue, avoid close contact with others and clean and disinfect surfaces around your home and workplace. • Regular control of vehicles and other machines to avoid spreading of smokes and exhaust fumes. • Use insect repellents in times of malaria outbreak and provide a clinic or medical facilities at the temporal sites installations for offices etc. • Drinking water must be provided in accordance with the applicable of national and WHO recommendations and guidelines; The water must be tested once per week if it is served from tanks or containers and stored at a cool and shadowed place. • Contractor will develop a Human Resources Policy, which will outline worker rights to be included in all contracts including restrictions on working hours in line with applicable ILO standards, compensation including consideration of overtime, holidays etc. • Contractor will require its subcontractors to put in place policies in line with national legislation and applicable international legislation and contractor Code of Conduct (as shown in Annex 3) and Policies. • Contractor will establish contractual clauses to be embedded in the contracts of all sub-contractors that require adherence to Rwandan law and international standards to be upheld related to worker rights. • Contractor will prohibit the use of alcohol or drugs, which could adversely affect the ability		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		the employee to perform the work safely or adversely affect the health and safety of other employees, community members or the environment. • Contractor and self-employed contractors will assess the H&S risks related with the tasks to be performed during the construction phase. • Pre-employment medical assessments will be put in place as a workforce risk management tool to screen individuals for risk factors that may limit their ability to perform a job safely and effectively. • Expected benefits of conducting pre-employment medical assessments include a safer working environment, reduction in workplace injuries, minimized downtime, matching the capacity of the employee with the role, and overall recruitment cost and risk reduction. • The contractor will ensure that training on health and safety measures is provided to all construction workers prior to starting to work on the Project and that supervisors have adequate experience to deliver on their responsibilities. • The contractor will implement regular health and safety checking and audits of its workers, and subcontractors and implement sanctions in case of breaches of national standards and the Project's specific standards. Such audits include workplace H&S; worker contracts, working hours, pay and conditions; housing and food standards. • The contractor will develop and implement a Workers' Grievance Mechanism for the Project		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		workforce including workers and subcontractors. • The contractor will ensure that workers sign a Code of Conduct (as shown in Annex 3) and ensure that it is followed to regulate the performance and behaviour of all workers, including provision for disciplinary sanctions for anti-social behaviour and non-compliance with health and safety regulations such breaches of using PPEs. • The contractor will ensure that Health and Safety guidelines regarding the construction and management of workers and the provisions of medical facilities at the worksite are followed. • The contractor will ensure that adequate clean water, adequate food and access to medical care is provided to all workers on the worksite. • The Contractor will develop and implement a Traffic Management Plan covering aspects such as vehicle safety, driver and passenger behaviour, use of drugs and alcohol, operating hours, rest periods, community education on traffic safety and accident reporting and investigations. • Proper signage at strategic places for information and warning e.g., excavation sites to warn on fall risks. • Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits. • Institute a workers' grievance redress mechanism		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
Risk of accidents from traffics and community injuries on/offsite	- Construction works near residential and Nsheke primary school pose risks of injury and accidents because of people and students who may trespass the working site. - Vehicular and machinery movements that could increase the risk of accidents to the local communities, particularly children and cattle, especially when they are crossing access roads or moving around the dam construction areas.	- The Contractor will prepare Specific Management Strategy and Implementation Plans (MSIPs) which includes among others a customized, - Traffic Management Plan covering aspects such as vehicle safety, driver and passenger behavior, use of drugs and alcohol, operating hours, rest periods, speed limits, community education on traffic safety and accident reporting and investigations. - Provide alternative pedestrian routes wherever existing ones are interrupted. In case access roads have to be closed, inform local communities and road users in advance. - Use clear, labeled properly and meaningful traffic signs and speed limits, especially at road crossing of the people, near sensitive receptors such as Nsheke Schools and conjunction of animals; - Provide traffic awareness amongst the community and especially at Nsheke school, and other risky places on roads in use by both the community and the construction vehicles, as well as on site. These can be expanded to include elements of drugs/drug abuse. Minimum requirement of third-party Insurance for all vehicles in use by the contractor. Hiring of drivers to ensure only qualified personnel. - Key design-related safety measures to be considered include speed breakers, paths for pedestrians, etc. on roads in use by both the community and the construction vehicles, as well as on site. - Hire traffic marshals to control movement of	- Implementation: Contractor - Supervision: Supervision consultant	3,500,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		trucks, heavy equipment, and machineries on site, and near community receptors such as schools. • Inform local communities about the construction programme in advance. • Establish a clear GRM mechanism for communities to lodge their grievances including a hot line for reporting of the same. Contractor to prepare and share with the proponent a contingency/emergency response plan for accident response. • Provide site security to deter trespass on site; • Contractor will develop Emergency Response Plans (ERPs) in cooperation with local emergency authorities and hospitals. • The contractor will extend the Worker Code of Conduct (as shown in Annex 3) to include guidelines on worker –community interactions and will provide training on the worker code of conduct to all employees including subcontractors and truck drivers as part of the induction process. • Contractor will provide primary health care and first aid at construction site to avoid pressure on local healthcare infrastructures. • Contractor will implement a Community Grievance Mechanism Contractor will develop and monitor implementation of a Community Health and Safety Management Plan (CHSMP) which will include undertaking a programme of stakeholder engagement and consultation to educate local communities and identified receptors of the risks of trespassing onto sites, the meaning of signs, and the dangers of		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		playing on or near equipment or entering fenced areas. • Special attention to be paid on residential areas, primary and secondary schools. • Where the contractor accidentally interferes with population' structures and assets, he/she should make the due compensation in coordination with local authorities and project proponent; • Sensitize the community as well as identified receptors on risks of trespass, controlled access in and out of site with all visitors sign in at points of entry, Issuance of workers with badges or identification cards to differentiate between workers and other community members etc. • To effectively safeguard pupils at Nsheke Primary School, construction works near and within the school compound will be scheduled during school holidays to minimize exposure to traffic hazards and construction-related disturbances. • In addition, to ensure the long-term safety and sustainability of the school in relation to the nearby canal, a protective fence will be constructed to prevent potential accidents, such as pupils falling into the canal.		
Increased risks of communicable diseases	• Recruitment of labor outside the project area causing influx of people to the project area would be the major health problem. • Attempting unprotected sex which may cause communicable diseases	• Ensure all workers including subcontractors receive education around transmission and symptoms of communicable diseases of concern and STDs. • Confine access to restricted work sites (including those with operation of mechanical and electric equipment) to persons with	- Implementation: Contractor - Supervision: Supervision consultant	1,530,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	such as including HIV/AIDS are expected to be increased. • Construction activities that create a conducive environment for the breeding of mosquitoes causing malaria. • Poor hygiene at site and congestion of workers in a confined space	permits. • Fill up all depressions to avoid pools of stagnant water that may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes which cause malaria. • Restore borrow pits and quarry areas to minimize breeding sites for mosquitoes Provide health education to the work force and community mainly focusing on HIV transmission and prevention. • Provide free counseling and distribute condoms & leaflets to the workforce and vulnerable groups of nearby communities. • Do not induce malaria outbreaks by creating temporary & permanent water holding areas which favor mosquito breeding. • Take care when selecting temporary site installations in such a way that it should not invite close interaction with the local community. • The contractor will develop <i>Emergency Response Plans (ERPs)</i> in cooperation with local emergency authorities and hospitals. • The contractor will put in place measures geared towards prevention of spread on Covid 19 between community members and the project workers. Such measures will be aligned to prevention protocol as per the prevailing ministry of health directives including (i) Ensuring social distance among workers, (ii) provision of face masks to workers and (iii) provision of hand washing dispensers and soap or alcohol-based sanitizers at workplaces.		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		To mitigate the risk of communicable disease transmission to Nsheke Primary School, construction activities will be undertaken during school holidays to minimize pupil-worker interaction.		
Labour influx and conflict among workers and local people	- Recruitment of non-local workers, - Behavior of workers due to their interaction with other workers of opposite gender, - Personal interest that may engage some workers to use their power over the less privileged workers. - Limited knowledge on worker's rights, - Late payment	- As part of the C-ESMP contractor to prepare a labour management plan and labour influx plan to ensure labour issues are well managed. Semi-skilled and unskilled labour will first be sought in the project's vicinity i.e., locals especially the unskilled will receive priority to reduce the labor influx that would come with other negative repercussions. - Implement a set of rules for the workplace, including the Code of Conduct (as shown in Annex 3) to be signed by all workers. The standards should include, inter alia, the entry of persons outside the service. - Explain to workers about the importance of keeping a good relationship with local communities; and the temporal site installations should be well fenced. - Sensitization of workers on cultural sensitivities and issues of relevance - To minimize the risks associated with labor influx near Nsheke Primary School, construction activities will be scheduled during school holidays.	- Implementation: Contractor - Supervision: Supervision consultant	0
Disruption of public utilities	Additionally, fence and toilet facility of Nsheke Primary School will be affected by main canal construction.	The contractor in collaboration with public institutions in charge of electricity, communication facilities and water will be required to coordinate with relevant authorities	- Implementation: Contractor - Supervision: Supervision	8,000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	Public roads at four (4) cross points will be affected by the construction of main canals,	to identify and map the location of existing underground utilities such as electricity and communication cables, prior to undertaking any work - Plan for immediate intervention by the service providers for any damages to utilities during project execution; Notify the community of any planned interruptions in advance. - Replace (or compensate) for public and private physical assets damaged due to disruption. For each damaged utility, fix the damage to the satisfaction of the service provider. Reparation work shall be treated as an emergency and undertaken without undue delay; - Provide prior public information about the likely disruption of services; - Where practical, the contractor shall work carefully to avoid damages to the electricity and communication cables, and water lines if any. - Ensure immediate reinstatement of services.	consultant	
Gender based Violence, Sexual Harassment and Sexual Exploitation	- Uncontrolled labor influx and migrant workers during construction works; - Limited knowledge on GBV by both parties; - The hiring process lacking transparency, with unclear criteria and limited communication throughout. - Poorly Supervised Worksites	- Conduct GBV awareness sessions for all construction workers, school staff, and local community members. - Provide child protection and sexual harassment training for Nsheke Primary School personnel. - Limit construction activities near schools during school hours and establish clearly marked, restricted zones. - Set up anonymous reporting channels for GBV incidents involving children, students, or community members. - Regularly monitor construction sites and school	- Implementation: Contractor - Supervision: Supervision consultant	1,530,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	• Insecure gender (male and female) separate facilities (hygiene, living/camping) • Economic Vulnerability; • Lack of Awareness and Training; • Construction works of irrigation canal nearby Nsheke primary school	perimeters for compliance with child protection and GBV mitigation measures. • Ensure strict disciplinary measures for workers found violating GBV, harassment, or child protection protocols. • Prepare and conduct awareness program to all workers and the community on the avoidance and related risks to GBV; • Contractor to prepare and Implement a GBV/SEA/SH prevention action plan that covers: ✓ Measures for prevention of SEA/SH: sensitization ✓ Response to SEA/SH: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures, ✓ Engagement with the community and workers (sensitization and awareness raising etc.), and ✓ Management and Coordination: including integration of SEA in job descriptions, employments contracts, code of conduct (as shown in Annex 3), performance appraisal systems, development of contract policies related to SEA, having designated PSEA focal points in the project and trained community liaison officers. The contractor SEA/SH management plan will be binding to the subcontractors and their employees as well.		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		• The Contractor shall require his employees, sub-contractors, sub-consultants, and any personnel thereof engaged in construction works to individually sign and comply with a Code of Conduct with specific provisions on protection from sexual exploitation and abuse and sexual harassment. • The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including Effective and on-going community engagement and consultation and Review of specific project components that are known to heighten GBV risk at the community level, e.g., compensation schemes; employment schemes for women; etc. • All employees are required to attend an induction-training course prior to commencing work on site to ensure they are familiar with the GBV Code of Conduct. • The contractor will mainstream Gender Inclusivity in hiring of workers; • Female workers should be sensitized on their rights and encouraged to report any gender-based violence or threat. • To mitigate risks of gender-based violence, sexual harassment, and sexual exploitation at Nsheke Primary School, construction activities near the school will be scheduled during school holidays. • Employ a concrete GBV/SEA campaign within the school including a GBV focal person		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		(teacher) accompanied by GBV sensitization and awareness creation.		
Child abuse and exploitation	- Recruitment policy which lack child protection; - Construction works in high unemployment area; - Violation of child Labor law which may also take place if proper mitigation measures are not put in place. - Absence of protective supervision in community or workplace settings, increasing vulnerability to abuse. - Neglect in reporting and monitoring mechanisms, allowing abuse cases to go unnoticed or unaddressed.	- The contractor should be aware of labor Law and most importantly the Article on Child Labor. - All staff of the contractor (and sub-contractors) must sign a code of conduct (as shown in Annex 3), committing themselves towards protecting children, which clearly defines what is and is not acceptable behavior. - Children under the minimum legal working age will not be hired on site. - Potential employment seekers at site will be required to provide identification document to verify age. - Construction activities near Nsheke Primary School should be scheduled during school holidays to avoid the risk of child abuse and exploitation associated with the works. - Employ a concrete GBV/SEA campaign within the school including a GBV focal person (teacher) accompanied by GBV sensitization and awareness creation	- Implementation: Contractor - Supervision: Supervision consultant	1,500,000
Creation of slopes and accumulation of earth materials during excavation works	- Creation of inclined slopes through stripping of channel embankments to reduce erosion. - Accumulation of excavated soil along channel lines without proper management. - Extensive earthworks during construction of intakes, irrigation channels, and drains.	- Construction activities should take place during the dry conditions. Identify erosion prone areas, - Identify permanent erosion control measures (applicable for a particular site) and plan construction works and sites to limit the quantity of material likely to be eroded and transported by water or wind. - Protective measures such as reinforcement of slopes, "Cross-slope" vegetation barriers and vegetation planting will be applied where necessary; Erosion in hilly or undulating terrain	- Implementation: Contractor - Supervision: Supervision consultant	1,400,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	Failure to compact or relocate soil to designated dumping sites, exacerbating landscape disruption.	can be prevented by constructing catch water drains, to break the impact of runoff. - An appropriate dumping site for excessed excavated earth materials should be selected and recommended by local authorities; Sediments eroded from cultivated lands may clog irrigation channels; - Soil erosion from the spoil banks and cultivated fertile soils will lead to clog of installed channels as well as soil infertility if fertile lands are covered by deposits of excavated areas. - Scarifying the site of topsoil combined with soil compaction all along the installed channels will result in reducing capacity of the ground to retain water and increase surface water run-off during periods of rainfall.		
Pollution from Poor waste management (solid and liquid wastes)	- Construction works will generation of construction debris (e.g., concrete, metal scraps, packaging materials) without proper disposal plans. - Use of machinery equipment would pose potential risk to Leakage or spillage of fuels, lubricants, and hydraulic fluids, contaminating soil and water sources. - Worker Camps and Facilities would lead to accumulation of domestic solid waste (food scraps, plastics, paper) without collection or treatment; discharge of untreated wastewater from toilets, kitchens, and showers into surrounding areas.	- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others Spill and containment plan as well as a solid and liquid waste management Plan which should contain: - An inventory of the types and quantities of waste to be produced. The most appropriate waste management approach for each type of waste including details on (temporary) storage, transport and destination of the waste. An assessment of any opportunities for reducing solid and liquid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes. - The Contractor is to improve solid waste management services through reducing the generation of solid waste, but also improving	- Implementation: Contractor - Supervision: Supervision consultant	2,250,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		collection, sorting, handling and disposal in appropriate dumping sites. • Contractor to sensitize workers on waste management and the C-ESMP. • Construction wastes shall be properly segregated and separated to encourage recycling of some useful waste materials i.e., some stone and concrete materials can be used as backfills. • Solid waste will be collected at a central location on site, sorted and will be stored temporarily until removal to an appropriately permitted disposal site. • Contractor to provide waste skips/ bins to contain wastes on-site e.g., for paper, used cement bags, used face masks etc. • Contractor to hire a licensed solid waste handler for collection and disposal of all waste. • Measures to ensure that waste materials from the Project are disposed of at suitable sites will be taken. These will include engaging only reputable truckers and conducting appropriate spot checks to verify that disposal is done in accordance with the requirements of REMA. • Burning of waste on site shall be prohibited, • Waste oil should be properly collected and stored in clearly labelled metallic drums with lids for reuse (within a HAZMAT) as well as provision of adsorption to prevent oil leakage; the remaining oil shall be disposed by licensed handlers in line with national regulations. • For human wastes from contractor temporary sites, movable toilets with septic tanks and capable of de-sludging will be installed.		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		- Maintenance and servicing of vehicle, machinery and equipment must be carried out in a designated area (protected service bays) within the workshop area only and where oils are completely restrained from reaching the ground. Such areas should be covered to avoid storm water from carrying away oils into the soil or water systems. As workshops (possibly with washing bays) are part of the temporal site installations, national and AfDB policies must be adhered to in the setting up and construction of these places to ensure the project does not result in any soil, water, biodiversity etc. pollution from oils and chemicals. Preferably, no garages should be located on site and vehicle maintenance should be undertaken off site in licensed garages. - Oil, paints, fuels and other chemical materials should be stored in impervious site stores. They should be handled appropriately to avoid spills and leak; All applicable national laws, regulations and standards for the safe use, handling, storage and disposal of hazardous waste to be followed; - In case of any hazardous substance spills, immediate spill containment and clean up shall be initiated. Spill and containment plan to be developed.		
Disruption of existing pattern of access	- Installation of canals, pipelines, and drains may block traditional footpaths, livestock routes, or access to water sources. - Earthworks and excavation can create physical barriers or unsafe	- Quick rehabilitation of disrupted existing patterns of access to facilitate movement of people and their belongings - Notify the community of any planned interruptions well in advance - Avail temporally diversion ways for local	- Implementation: Contractor - Supervision: Supervision consultant	500,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	terrain for community movement. • Designation of construction zones or fenced areas may limit public access to previously open land. • Reassignment of land for project use may restrict access to farmland, grazing areas, or communal spaces.	population and passengers. The contractor will provide appropriate and practical alternative routes where key community roads are blocked or affected.		
Cultural disruptions and protection of archaeological and historical sites	• Earthworks for canals, drains, and intake structures may disturb or destroy buried cultural artifacts or heritage remains. • Lack of cultural heritage screening during feasibility studies. • Construction in culturally sensitive areas without prior mapping or consultation may encroach on sacred sites, burial grounds, or historical landmarks.	• Deviation of the canal routing as an alternative way to avoid compensation and disruption of the canal alignment; • In case deviation is not possible, apply Cash compensation based on national expropriation law and AfDB policies to relocate the graves prior to any works on ground; • Enough time be given enough time to relocate the grave; • The PAP will be assisted for burial ceremonies; • During construction works, if the contractor encounters unmarked graves or other culturally sensitive artifacts then Chance Find procedures requirements as discussed in Annex 6 will be adopted.	- Implementation: Contractor - Supervision: Supervision consultant	4,500,000
Other impacts from construction of site installations	• Improper storage of construction materials (cement, chemicals, fuels) can lead to spills and contamination; • Alteration of the natural landscape and visual aesthetics. • Generation of domestic waste and wastewater, risking pollution if unmanaged. • Social tension due to influx of non-	• Contractor and RWB to ensure fair leasing arrangements • The temporal sites will be subjected to a separate site specific ESIA once all design elements are finalised • Effective site management will improve efficient utilization and energy conservation on-site. • Maintenance of plants and equipment in a serviceable and good working condition to maximize their fuel efficiency.	- Implementation: Contractor - Supervision: Supervision consultant	2,000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	local labor and pressure on local services. - Emissions of greenhouse gases and air pollutants. - Vibration and noise disturbances to local residents and fauna. - Disturbance of natural drainage patterns and micro-ecosystems. - Removal of vegetation and topsoil, leading to habitat loss and soil erosion.	- The choice of machines intended for activities for which they have designed. - Regular monitoring and control of trucks is also essential to enhance operational efficiency and reduce fuel waste. <i>For water consumption, the project shall use the following measures:</i> - Technical feasible water conservation measures, use of alternative water supplies, water consumption offsets to maintain total demand for water resources within the available supply, <i>For the management of solid and human waste management:</i> - Waste collection points will be established within the site to dispose temporarily solid wastes generated on site. The project will hire a licensed contractor to collect and dispose of those wastes in the district landfills; - Toilets will be constructed to facilitate the disposal of human wastes. The location of these toilets within the sites will consider areas with deep water tables and not near sensitive areas, - Masonry sewage treatment facilities will also be used to treat sewages. Mobile sanitation facilities will be provided where needed. - The restoration of these temporal site installations will be done based on the existing site conditions prior to construction phase. Because these sites are not determined at the		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		time of conducting this ESIA study, the initial environmental examination of these sites shall be conducted to record the existing state of these sites which will serve as baseline.		
Impacts from high job expectation	• Early engagement sessions may unintentionally raise hopes about widespread employment. • Promises or vague statements about job creation without specifying roles, duration, or criteria. • Subcontractors may bypass local labor or exploit workers, undermining community trust. • Gender, age, or ethnic bias in job allocation can deepen social divides. • Preference for skilled or external labor can fuel frustration among unskilled local job seekers. • Absence of clear job advertisements, selection criteria,	• The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes customization of the Labour Management Plan (LMP) prior to the start of any recruitment works • The principles and procedures for hiring should, as far as possible, give priority to the hiring of capable PAPs and local workers e.g. Prioritize semi and unskilled job positions for locals from the project area; • For various types of trade e.g., drivers, cleaners, safety officers, the contractor should disclose the exact number of jobs available, the applicable period and the remuneration to be allocated for each type of work; • The hiring requirements must be clear and properly publicized before the start of the recruitment process and respected by the designated contractor. • Contractor can work with local authorities and project committees to ensure proper reach of the adverts. • For a better impact on the communities this process should be conducted with the involvement of local leaders; • Job adverts should be clear on the necessary skills required for each position. • In the event there are local expectations for employment that cannot be met by the project, the limited availability of places should be made	- Implementation: Contractor - Supervision: Supervision consultant	0

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		known to the interested parties through local authority.		
Impact on water quality, Possible contamination and competition over water	- Disturbance of soil near water bodies can increase sedimentation and turbidity. - Runoff from exposed sites may carry pollutants into rivers or streams. - Spillage of fuels, lubricants, and chemicals can contaminate surface and groundwater. - Improper washing of equipment near water sources introduces oils and sediments.	- At the construction stage, the contractor will prepare a Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others; Soil and Sedimentation Control Plan, Spoil Management Control Plan and Waste Management Plan. - Should the Client allow sourcing of Water from the river for construction works, required permits must be sought and amounts should be pre-determined by the relevant authority to avoid conflict with the community and ensure no competition for water with the community. Should it suffice that the water is not sufficient for both parties, the contractor should seek alternatives. - All wastewater which may be contaminated with oily substances must be managed in accordance with an appropriate Waste Management Plan (WMP). - No hydrocarbon-contaminated water may be discharged into the river; - Provide workers at the development site with sanitation facilities during this phase of the development. - Store all raw materials away from the vicinity of water bodies located on the project area to avoid contamination in these areas. - General waste generated during this phase of the development must be stockpiled in one central area of the project site, away from existing reservoir and collected, transported and disposed of appropriately at the designated	- Implementation: Contractor - Supervision: Supervision consultant	5,000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		disposal site by relevant authorities; Community access to water sources should not be restricted. Should sites used by the community previously for water abstraction be affected, RWB and the Contractor is to work with the local community and authorities to identify clear alternative sites for the community to continue abstracting water.		
Subtotal Cost for Construction				577 110 280
Operation Phase				
Impacts on environmental flow and transboundary issues	- Diversion of Muvumba river for irrigation may reduce downstream availability if the discharge is not controlled. - Failure to engage with transboundary water management institutions or neighboring jurisdictions. - Absence of data sharing or joint planning can escalate tensions and mismanagement.	❖ Environmental flows have been integrated into the design of the Muvumba Multipurpose Dam to help mitigate changes in the hydrological regime downstream. It is essential that this flow regime is maintained or even improve to ensure sufficient water allocation for downstream ecological functions and human water use. To protect downstream ecosystems, the environmental flow released should never fall below 30% of the natural flow at any time. • The RWB should design and implement a robust monitoring program to verify that the flows are being released and that the targeted ecological conditions are being met. This monitoring will provide critical feedback, supporting adaptive management of environmental flows based on observed outcomes. • Where monitoring reveals that certain flow components or ecological objectives are not being met, revisions to the flow allocation should be considered to better support ecosystem health. Implementation of an agreed flow regime must remain flexible and	RWB& Prime Minister's Office&MoE RAB	1,200,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		responsive to changing environmental conditions and scientific findings. • Muvumba river is shared between Rwanda and Uganda. In order to comply with international best practices on the use of shared water resources, there should be continued bilateral meetings aimed at the management of Muvumba river. Given that the Muvumba River is a shared watercourse between Rwanda and Uganda, ongoing bilateral cooperation is essential. • Regular joint meetings should be held to promote sustainable and equitable water management in accordance with international best practices for transboundary rivers. • Conserve irrigation water by reducing evapotranspiration by avoiding midday irrigation and by reducing seepage losses in canals by lining them or using close conduits; • Indigenous trees and shrubs with low water dissipation capacity should be encouraged around the buffer zone to minimize loss of water through evapo-transpiration processes, • Ensure enhanced monitoring maintenance of the transmission and distribution pipelines upon commissioning to ensure minimal loss of water through leakages. Water conservation measures must also be prioritized to reduce pressures on river flow: • Promote irrigation practices that minimize evapotranspiration, such as avoiding midday irrigation. • Reduce seepage losses in canals through lining of quality materials		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		- Encourage the planting of indigenous trees and shrubs with low water demand around buffer zones to minimize evaporation. - Upon commissioning, ensure enhanced maintenance and monitoring of water distribution infrastructure to minimize leakage losses.		
Water borne disease related impact	- Poor drainage or over-irrigation can lead to standing water, creating breeding grounds for mosquitoes and other disease vectors (e.g., malaria, dengue). - Stagnant pools may also harbor pathogens like cholera, typhoid, and schistosomiasis. - Lack of toilets or wastewater treatment systems can lead to open defecation near irrigation zones. - Wastewater may seep into irrigation water, spreading diseases like hepatitis A, dysentery, and E. coli infections. - Farmers may not use protective gear or wash hands after contact with irrigation water.	- Remove vegetation from the margin of the reservoir and drainage structures; - Design and construct irrigation canals and drainage structures in such a way that there could not be permanent water collection sites and formation of swamps; - Irrigation and drainage canals should be cleaned regularly; - Establish effective vector monitoring program around the reservoir and irrigation canals - Sensitize the community on the need to ensure river water is properly treated before consumption; - In order to mitigate malaria spreading, health centers recommend house spraying with residual insecticides or reduction of contacts between humans and Anopheles by the use of impregnated bed nets; - Sensitization of the community on risk of consumption of untreated water	Local authorities, WUA, local farmers, RAB, RWB	1,800,000 ⁶⁵
Deterioration of water quality (surface and ground water) by	Discharge of agrochemicals, wastewater runoff can degrade water quality across shared water systems.	RWB/RAB to Develop and promote Integrated Pest Management Plan prior to start of the operations of the irrigation and ensure its application including sensitization of farmers;	RAB& RWB	13,500,000

⁶⁵ Estimated for a farmer employed to clean canals per year, then considering 30 farmers in WUA

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
agrochemicals(fertilizers and pesticides)	Limited awareness on use and handling of agrochemicals	- Consider the strategic option of promoting organic agriculture in the schemes; - Collect and treat irrigation farm drainage water before discharging to the river. Water quality monitoring will be instituted to ensure quality standards are met. Baseline data will be established at the start of the operation of the project followed by subsequent monitoring during the operation phase; - Improve unused/expired agrochemical waste disposal system of the nearby settlements, including sensitization of communities on waste disposal; - Enhance extension and agronomic advisory services to ensure proper use of pesticides and fertilizers applied in the irrigation far; - Do not dispose fuel and lubricants into wet lands and streams. Servicing of plants, equipment and vehicles should be carried out at a workshop area. The workshop area should be equipped with secured storage areas for fuels, oils and other fluids. The storages should be constructed in such a way as to contain any spillages which may occur. Similar storage should be constructed to store used fluids prior; - Avoid dumping of solid and liquid wastes from the project into the rivers and wet lands - Promote watershed management work to control soil erosion, nutrient wash and associated water quality deterioration and reservoir siltation; - Apply integrated land treatment measures (e.g., planting trees, terracing, contour farming, and crop residue management);		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		• Apply physical/ biological treatment of inflowing run-off by using riparian vegetation buffer. • Sensitize the community on proper usage of fertilisers and herbicides. Encourage less harmful technologies such as Integrated pest management, and organic fertilizers. • Interdiction of dangerous pesticides/acaricides such as DDT which with Dieldrin were banned in 1976 for use in livestock as acaricides because the ticks developed resistance, bio-accumulation in oily tissues of cattle and were detected in dairy products (Keating, 1983); • Recommendation to use of bio-pesticides that lack adverse effects on livestock and environment such as <i>Metarhizium anisopliae</i> sensu stricto (Metsch) a fungal found by International Center for Insect Physiology and Ecology (ICIPE) to be effective for ticks' control that could be commercialized (Bailey et al; 2010) • All containers and bags for pesticides, herbicides and fertilizers should be handled as hazardous waste, and disposed of accordingly. They should not be reused. Records of chemical use and application amounts should be kept. Hazardous waste shall be disposed of by licensed dealers as per the law. • Use of Personal Protective Equipment during handling, spraying of pesticides especially acaricides for livestock protection against tick-diseases; • When emptying dipping tanks, dig a deep well and pour away the water containing acaricides residues for a slow degradation and		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		decomposition of contaminants in the deep soil; • Records keeping that hind at Policy formulation aiming to reduce acaricides poisoning among vegetation and livestock farmers; • Delimit a small area in the concession where acaricides will be always sprayed on the animals during ticks' killing. • Installation of a limited buffer zone all along the irrigation channels by performing mid-term and long-term vegetation management; • Intensive awareness campaigns aiming to prevent local residents throwing debris and all types of solid and liquid wastes into flowing waters in channels; • Periodical clearing/cleaning irrigation channels' embankments and regular control of dikes destruction.		

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
Impacts on soil salinity and decrease in soil fertility	- Excess water leads to waterlogging, which raises the water table and brings salts to the root zone. - Inadequate drainage prevents leaching of salts, causing accumulation over time. - Imbalanced or overuse of fertilizers can lead to nutrient lock-up and salt buildup. - Long-term chemical use without organic amendments degrades soil quality.	- Organized trainings for water users' associations and farmers groups to acquire knowledge and skills necessary to minimize surplus water applications; - Enhance drainage maintenance both on and off- command area; - Establish a timely close monitoring to provide early warning of problems. - Avoid overuse of water in the irrigation field - Avoid excessive application of fertilizers and pesticides; - Drain water logging areas of the farm; - Classify irrigation field according to soil salinity class and grow salt tolerant crops on saline plots; - Apply periodic leaching of saline soils; - Regular application of organic matter and lime shall be needed to maintain and improve soil properties.	RAB&RWB	3,000,000
GHG emissions	- Continuous operation of fuel-based irrigation pumps releases carbon dioxide (CO₂) and nitrous oxides (NO_x), - In areas with poor drainage or rice paddies, anaerobic conditions can lead to methane (CH₄) emissions.	One way to reduce methane and nitrous oxide is to use the Alternate Wetting and Drying (AWD) method. AWD is an irrigation method in which rice paddies are intermittently irrigated and water is not added until the soil is dry. When it dries, oxygen is distributed to the soil and the action of microorganisms that produce methane is suppressed.	RAB&RWB	0
Flood-related impact in command area	Excessive water application beyond crop requirements can saturate soils and overflow fields.	RWB/RAB to update the dam emergency preparedness and response plan to cover irrigation component and areas, sensitize the community on action and carry out periodic	RWB&RWB	5,000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	- Absence or poor design of field drains, collector drains, and escape channels leads to waterlogging and surface flooding. - Uncontrolled or unplanned water discharge can overwhelm downstream channels and fields. - Failure to inspect and repair canals, gates, and drains leads to structural weaknesses. - Lack of real-time monitoring tools to detect rising water levels or system failures.	drills to test response measures and evacuation procedures; the updated plan will be prepared during implementation and will be provided to the Panel and Bank for review not later than one year before the projected date of the initial filling of the reservoir ie at least 1 year prior to dam impoundment, - Cross drainage structures have been proposed (and designed) for safely carrying discharges corresponding to 1 in 50 year return period rainfalls; - One proposed solution consists of preventing the water from entering into the irrigation; systems of command area, with interceptor drains; - Drain water for irrigation in pipes and use sprinkler for watering crops in command areas. - Regularly monitor the performance of the irrigation scheme.		
Siltation and clogging of irrigation infrastructure	- Lack of vegetation cover or erosion control upstream leads to high sediment loads entering canals and intake structures. - Construction or maintenance activities without sediment barriers can introduce loose soil into canals and drains; - Absence of sediment traps, screens, or settling basins allows silt to flow directly into canals. - Unlined or eroded canals contribute	- Improvement of watershed management conditions, especially promoting ecological agriculture; - Creation of limited buffer zone all along the irrigation channels and grass planting for soil fixation; - Improved farming methods including contour and terracing of farms among others.	RAB/ WUA & Local farmers	800,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	to internal sedimentation as soil from canal beds and banks enters the flow.			
Crop intensification and loss of traditional landraces	- Shift away from indigenous crops due to market incentives or project targets. - Distribution of uniform seed, fertilizer, and pesticide kits that favor modern varieties. - Restructuring of smallholder plots into larger units for irrigation infrastructure. - Neglect of local knowledge and practices that sustain traditional landraces.	- Use improved varieties which are already grown in the region and have proved to be well adapted; - Development and delivery of a preventive extension packages (farmer training in problem avoidance and management techniques); - Prevention and control techniques for the major insects, weeds and disease problems in the area; - Constitute a Gene Bank for traditional landraces; - Provide easy access to inorganic fertilizers.	RAB	500,000
Biotic constraints (weeds, insects and diseases)	- Frequent or excessive watering creates humid conditions ideal for fungal and bacterial diseases. - Growing the same crop repeatedly allows pests and pathogens to build up in the soil. - Standing water encourages root rot, leaf blight, and mosquito breeding. - Overuse of nitrogen fertilizers can make crops more susceptible to pests. - Lack of cleaning between planting cycles increases pathogen carryover.	- Development and delivery of preventive extension packages (farmer training in problem avoidance and management techniques); - Prevention and control techniques for the major insects, weeds and disease problems in the command area.	RAB	500,000
Introduction of invasive species	Stagnant water in canals and drains creates ideal conditions for invasive aquatic weeds like <i>Eichhornia</i> (water	- All equipment brought from outside the project area for channel maintenance should be cleaned prior to being used on the project. - Introduction of a surveillance system to ensure	RAB	3,000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	hyacinth). - Use of exotic crops or ornamental plants in landscaping can lead to escape and colonization of nearby habitats. - Transport of soil and materials between sites may introduce seeds or pests.	any new species are quickly identified and maintained - Ensure use of clean and certified seed for crop production - Developing pest management plan that will be disclosed together with this ESIA.		
Conflict between water users	- Absence of clear rules or schedules for water distribution. - Favoritism or unequal access to water among users or zones. - New users added to the system without adjusting water supply or infrastructure. - Agricultural runoff, waste discharge, or poor sanitation affects water quality. - Irrigation needs may conflict with domestic, livestock, or industrial water use.	- Provide technical and logistical support for training water users on management of irrigation infrastructure and benefits of sharing; - Give responsibility to Grievances Redress Committees (GRC) for helping on records of complaints and active participation in conflict resolution. Normally when there are conflicts among water users related to irrigation water, there is a platform called District irrigation steering committee which is normally tasked to solve such conflicts. This committee is composed of the Vice mayor in charge of economic affairs, District and sector agronomists. RAB irrigation engineers based at every station may also be involved. - Monitor the water levels and adjust water supply to users in line with availability and well-established water sharing arrangements.	RAB	2,000,000
Diseases transmission in cattle and decrease of livestock productivity	- Poor drainage or over-irrigation leads to standing water, which becomes breeding grounds for disease vectors like mosquitoes and snails. - Shared Water Sources Between Humans, Livestock, and Wildlife,	- Give priority to the second option of alternative B related to the fact that all farms which are under command area boundary will be supplied water for livestock by providing a hydrant and trough. - Increasing perimeter fencing would help to control different diseases especially tick- borne	RAB	5,000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	- Lack of biosecurity measures during relocation or watering increases risk of disease spread. - Delayed detection and response to outbreaks due to lack of integration in project planning. - Unregulated Movement of Livestock.	- diseases; - Increasing the possibility of dip tanks and/or installation of individual or communal spray-races use against tick-borne diseases, would help greatly to reduce the losses incurred from mentioned diseases in livestock reared in the command area and vicinities; - Regular disinfection of cows, goats and sheep using appropriate medicinal products dedicated to reared domestic animals; - Initiate and effectively participate in a regional campaigns and tsetse flies control measures in order to eliminate Trypanosomiasis disease. - Initiate regular disease surveillance and monitoring		
Infrastructure Sustainability Challenges	- Failure to regularly inspect and maintain canals, pumps, gates, and pipes leads to wear, leaks, and breakdowns. - Expanding irrigated areas or increasing water demand without upgrading infrastructure strains the system. - Poor Water Management Practices - Use of Substandard Materials or Construction, - Sediment buildup reduces flow efficiency and increases wear on pumps and gates; blockages can cause overflow, flooding, or uneven water distribution.	- Establishing and building the capacity of Water Users Associations (WUAs) and farmers' groups (cooperatives), as well as operationalizing the WUAs through the provision of two years of operating costs, as agreed with the Rwanda Agricultural Board (RAB). - Introduce affordable and context-sensitive water tariffs to ensure regular payments for electricity and operational costs without excluding vulnerable users. - Conduct periodic technical assessments of irrigation systems. Design improvements with energy-efficient components and low-maintenance layouts to reduce long-term costs. - Establish community-based operations and maintenance (O&M) teams with incentivized roles. Ensure gender inclusivity and link with	RAB	2,4000,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		district support services. - Design watering points with durable materials and gravity-fed systems where feasible to minimize energy needs. Provide training on rotational use and livestock behavior management. - Pilot schemes where WUAs receive support contingent on meeting governance and maintenance benchmarks, encouraging proactive management		
Impact on biodiversity	- Expansion of irrigated fields near marsh areas, potentially attracting cranes and altering their feeding grounds. - Water abstraction from Muvumba river, possibly affecting downstream wetland hydrology and aquatic plant life. - Use of agrochemicals (fertilizers, pesticides) in rice paddies, risking contamination of marsh ecosystems and crane food sources. - Increased human activity in fields (e.g., farming, harvesting), which may disturb or unintentionally harm visiting cranes.	- Develop a deliberate campaign for sensitization of the irrigation community on the importance of the grey crowned crane and need to preserve it should they sight any in their fields in the future. The plan will be developed one year prior to the operationalization of the irrigation scheme and integrated into the regular sensitization of the cooperatives and WUAs. - Establish collaboration with concerned conservation organizations/institutions in the area, in monitoring grey crowned crane presence in the project area proximity area as part of project monitoring to ensure effective measures are taken to support them when deemed necessary.	RAB	500,000
Subtotal cost for operation				60,800,000
Decommissioning Phase				
Waste generation	- Dismantling of Infrastructure - Demolition of Buildings and Facilities - Disposal of Obsolete Equipment - Decommissioning of Sanitation	- The contractor shall develop a detailed inventory of expected waste streams and categorize them into recyclable, reusable, hazardous, and non-recyclable components for targeted management. - The contractor shall partner with local recycling	Contractor and supervision consultant	300,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
	Facilities	initiatives to recover usable materials (e.g., metal, plastic, and aggregate). • Encourage repurposing of non-contaminated items for community or agricultural use. • Ensure hazardous components, like oil residues, chemical containers, or electrical parts, are handled by licensed waste handlers and disposed of according to national environmental regulations. • Involve local stakeholders in site cleanup efforts, offer awareness on waste sorting practices, and create temporary waste collection points to prevent dumping. • Clear waste residues fully and rehabilitate affected areas through planting, soil stabilization, or regrading to restore ecological function and aesthetics.		
Air pollution	• Breaking down concrete, metal, and other materials releases dust and particulate matter (PM) into the air. • Excavators, trucks, and generators powered by diesel or gasoline release carbon dioxide (CO₂), nitrogen oxides (NO_x), and sulfur dioxide (SO₂). • Disturbance of old insulation, paints, or chemicals may release asbestos fibers, lead dust, or other airborne toxins.	• The contractor shall regularly water down exposed soils, dismantling sites, and access roads to minimize airborne particulate generation during peak decommissioning periods. • Use well-maintained machinery with low-emission engines or retrofit filters to reduce release of harmful exhaust gases, particularly from diesel equipment. • The contractor shall schedule demolition during low-wind periods and employ dust screens or barriers around high-risk zones to limit dispersion toward inhabited areas. • The contractor shall avail to workers with protective gear (e.g., masks) and conduct periodic health checks to detect respiratory issues early and ensure occupational safety.	Contractor and supervision consultant	200,000

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		Engagement with local residents with timely information about decommissioning schedules and establish ambient air monitoring stations to track pollution levels and guide adaptive responses.		
Occupational health and safety risks	- Risk of falling debris, collapsing structures, and sharp materials. - Workers may suffer cuts, fractures, or crush injuries without proper protective gear. - Lifting, carrying, or moving pipes, concrete blocks, and metal parts can cause musculoskeletal injuries. - Contact with old chemicals, fuels, asbestos, or lead-based components can cause respiratory, skin, or neurological issues. - Decommissioning of pumps, control panels, and lighting systems may expose live wires. - Absence or misuse of helmets, gloves, boots, masks, and harnesses leaves workers vulnerable.	- The contractor shall map out hazard zones, outline evacuation routes, and identify vulnerable workspaces. Prevention begins with awareness. - No compromises: masks, goggles, boots, gloves, and ear protection must be worn like armor in battle. - Empower workers with the science of safe lifting, because good posture is cheaper than rehab. - Lockout systems and daily equipment inspections prevent life-altering accidents. - Rotating shifts, cooling zones, and electrolyte solutions keep workers alert, safe, and hydrated. - A culture of open reporting improves safety for future phases and generates trust.	Contractor under supervision consultant	6,000,000
Termination of labors and loss of income	- Termination of ancillary services such as transport, catering, and equipment supply affects small businesses and informal workers. - Local vendors and contractors lose income streams tied to project activities.	- Develop workforce exit strategies early such as issuance of contracts that clearly states employment terms, including periods of employment to aid workers plan accordingly. - Offer short-term courses in skills transferable to other sectors (e.g., masonry, plumbing, welding, agri-business) with recognized certifications to improve future employability. - Create databases of decommissioned	RWB	0

E&S impacts	Activities triggering the impacts	Proposed mitigation measures	Institutional responsibility for implementation of measures	Cost estimates (Rwf)
		workers and prioritize them for recruitment in related infrastructure or agricultural schemes. Encourage workers to use local saving schemes such as SACCO programs that help them save part of their earning for future small-scale businesses or restore their livelihoods during job termination.		
Subtotal cost for decommissioning				6,500,000
Grand Total:				6 390 901 018

7.2. ENVIRONMENTAL AND SOCIAL MONITORING PLAN (ESMOP)

Monitoring refers to the systematic collection, analysis, and interpretation of data through repetitive measurements over time. It is designed to track the performance of environmental, health, safety, and social variables in specific areas throughout the project lifecycle. For the Irrigation System and Livestock Water Use project, environmental and social monitoring is a critical component of responsible project implementation and adaptive management. Monitoring serves several key purposes:

- ✓ To verify compliance with national environmental regulations and international safeguards (e.g., National legislation compliance, AfDB ISS);
- ✓ To assess the effectiveness of mitigation measures outlined in the Environmental and Social Management Plan (ESMP);
- ✓ To detect unforeseen impacts early and trigger corrective actions;
- ✓ To promote transparency and accountability through stakeholder engagement and public reporting.

7.2.1. Objectives of the Monitoring Plan

The Environmental and Social Monitoring Plan (ESMP) aims to:

- Ensure that mitigation measures are effectively implemented and maintained;
- Track environmental quality indicators such as water quality, soil health, and biodiversity;
- Monitor social indicators including land use, livelihoods, gender inclusion, and grievance resolution as shown in Table 9-2;
- Identify and respond to emerging risks, including those related to climate variability, labor influx, and community health and safety;
- Provide data to inform decision-making and continuous improvement throughout the project lifecycle.

7.2.2. Scope of application

The scope of the Environmental and Social Monitoring Plan encompasses all phases of the project lifecycle, including planning, pre-execution, execution, operation, and completion. During the planning phase, monitoring focuses on the collection of baseline environmental and social data, stakeholder engagement, and the identification of potential risks. In the pre-execution phase, emphasis is placed on ensuring that contractors are mobilized in compliance with environmental and social safeguard conditions. The execution phase involves close monitoring of the implementation of mitigation measures, occupational health and safety practices, waste management, and the efficient use of water resources. During the operational phase, the plan monitors the functionality and sustainability of irrigation systems, water quality, and the realization of social benefits such as improved livelihoods and gender inclusion. Finally, in the completion phase, monitoring ensures the restoration of temporarily disturbed areas, evaluates the long-term impacts of the project, and assesses the sustainability of implemented measures. This comprehensive scope ensures that environmental and social risks are proactively managed and that the project delivers its intended benefits in a sustainable and inclusive manner.

Table-7-2 Environmental and Social Monitoring Plan

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
Pre-construction phase						
Loss of land and physical displacement	- RWB has prepared a detailed Resettlement Action Plan to guide land expropriation and based on clear criteria for eligibility. The RAP should be implemented accordingly including PAPs consultation and set up of a GRM - Avoidance of cultural property where possible - Prioritize PAPs in employment by project	- No of RAPs prepared and implemented - ha of land expropriated - No of consultation meetings for PAPs - Set up of a GRM	- The detailed RAP report including Livelihood Restoration Program (LRP) - Compensation records - Consultation minutes and lists of attendance - GRM records - Monthly RAP implementation reports	Monthly	RWB in collaboration with Nyagatare District	500,000
	- RWB in collaboration with local authorities will undertake fair expropriation/compensation of all affected population as per the National Expropriation/Compensation Law, and in observance of the AfDB ISS policies, prior to the start of the works.	- No of PAPs compensated prior to start of construction works - No of PAPs resettled	- Monthly Compensation report/RAP implementation report, field visit reports			
Loss of livelihood	- Minimize the affected population by respecting expropriated area.	- No of ha of land expropriated	- A detailed RAP report including Livelihood restoration Program (LRP) and map of expropriated area	Monthly	RWB	500,000
	- Compensation in cash (including 5% disturbance allowance) for the asset lost in compliance with the national expropriation law and AfDB regulation on involuntary resettlement	- No of PAPs compensated	- Monthly Compensation report/RAP implementation report, field visit reports			
	- The affected persons should have priority of job opportunity during the recruitment in the beginning and during implementation of project activities.	- No of PAPs employed	- Employment records			

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Pre-compensation training mainly on Cash management, entrepreneurship trainings will be provided.	- No of training meetings conducted with list of PAPs attended	- Minutes of the meetings conducted			
Pre-construction subtotal cost						1,000,000
Construction Phase						
Impacts on terrestrial ecosystems & biodiversity	- Prohibit clearing of vegetation cover at least from 10 m buffer zone centered on river channel on both sides of the river in irrigation command area. Conserving this area would maintain the unique habitat and its microclimate and provide corridor for the movement of Variety of wildlife.	- Ha of land cleared	- Monthly ESMP progress report - Field reports	Monthly	- Contractor - Supervision consultant - Additional monitoring by REMA	500,000
	- Prohibit construction teams from harvesting of fish or other aquatic organisms without the written permission of responsible authority or organization	- No of fishes harvested	- ESMP progress report,			
	- Continuous monitoring of noise levels shall be conducted, with thresholds set for both human and wildlife receptors; adaptive measures shall be triggered if limits are exceeded	- Noise levels data inventory	- Monthly report	Monthly	Contractor	
	- Establish GRM in the project area to report and resolve noise issues promptly for immediate corrective action.	- Noise grievance	- GRC Reports	Monthly	- GRCs - RWB	
	- At construction stage, the contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which included among others a Vegetation Restoration Plan and Soil and Sedimentation Control Plan, Hazardous waste Management Plan, Spoil Management Control Plan and Waste Management Plan.	- Vegetation restoration plan, sediment control plan, waste management plan in place	- Prepared plans copies			

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- The contractor shall avoid pollution of river by using sediments traps where possible, avoid dumping wastes and excavated soil into the rivers	- No of sediments traps available, area of dumping sites rehabilitated	- ESMP progress report - Field photos		- Contractor - Supervision consultant Additional monitoring by REMA	
	- Temporal sites installations for offices and storage of equipment to be located away from the river to avoid contamination with appropriate waste water discharges systems and Prohibit any direct discharge from these camps or construction works to the river or its tributaries.	- Location of Temporal sites installations for offices and storage of equipment - No of waste water treatment facilities on site	- ESMP progress report - Field Photos	Monthly	- Contractor - Supervision consultant - Additional monitoring by REMA and RFA	
	- Construction activities should take place during the dry conditions, where possible	- Construction activities timing				
	- Prohibit dumping of solid and liquid wastes from the construction offices, yards etc and spoils from construction sites into the rivers and wetlands	- No of dust bins available on site, - No of waste water treatment facilities on site				
	- Do not locate quarry sites or dumping site in river beds and banks	- Locations of quarry sites established				
	- All waste water which may be contaminated with oily substances must be managed in accordance with an appropriate Waste Management Plan (WMP).	- No of waste water treatment facilities on site, - WMP in place				

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Prohibit washing construction equipment or vehicles near into streams and rivers. Should the contractor and Client construction Temporal sites installations entail garages, workshops, washing bays etc. national and AfdB policies must be adhered to in the setting up and construction of these places.	- Locations of washing construction equipment				
	- Do not dispose chemicals, fuel and lubricants into wet lands and streams	- Area(sq.m) dedicated for storage of hazardous chemicals				
	- Clean out any salvage from the construction sites after the completion of works and restore areas to their natural state e.g., Temporal sites installations for offices and storage of equipment	- Area of land rehabilitated				
	- Utilize field borders to conserve natural vegetation	- Area of land conserved				
	- Both Contractor and RWB to institute a broad water quality monitoring system such as to focus on the incoming flows, water quality variations along the construction areas near the river, treated water and water downstream of the construction areas. Maintain appropriate records on water quality as required by the law upon commissioning of the dam.	- No of water quality tests conducted	- Reports on water quality tests conducted	Quarterly		
	- Sensitise the Contractor, farmers and staff that hunting in the project area as well as adjacent nearby gallery forest is strictly prohibited.	- Awareness campaigns	- Reports	Quarterly	Supervision consultant	
Impacts on aquatic	- The contractor shall avoid pollution of river by using sediments traps where applicable, avoid dumping wastes and excavated soil into the rivers;	- Water quality (TSS and Turbidity)	- Water quality tests	Monthly	- Contractor, supervision consultant	500,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
ecosystems & biodiversity	- Temporal sites installations for offices and storage of equipment to be located away from the river to avoid contamination with waste water discharge systems and prohibit any direct discharge from these temporal sites installations (offices and storage of equipment) or construction works to the river or its tributaries;	- Location of campsites	- Field reports	Monthly	- RWB - Supervision consultant	
	- Prohibit dumping of solid and liquid wastes from the temporal sites installations for offices and storage of equipment and spoils from construction sites into the rivers and wetlands;	- Waste disposal	- Filed reports	Monthly	- RWB - Contractor, consultant	
	All wastewater which may be contaminated with oily substances must be managed in accordance with the elaborated contractor Waste Management Plan (WMP);	- Wastewater	- Field report	Monthly	- Contractor, consultant - RWB	
	- Do not locate quarry sites or dumping sites in riverbeds and banks;	- Quarry sites and dumping sites	- Field reports	Monthly	- RWB - Contractor, consultant	
	- Prohibit washing construction equipment or vehicles near or into streams and rivers. As the design shows that workshops (possibly with washing bays) are part of the temporal site installations, national and AfDB policies must be adhered to in the setting up and construction of these places to ensure the project does not result in any soil, water and biodiversity pollution from oil leakage and chemicals. Preferably, no garages should be located on site and vehicle maintenance should be undertaken off site in licensed garages to avoid any disposal of chemicals, fuel and lubricants into wetlands and streams;	- Car washing station	- Filed reports	Monthly	- RWB - contractor, consultant	

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Sensitisation of the contractor staff and farmers that fishing in Muvumba river is strictly prohibited	- Awareness campaigns	- Reports	Quarterly	- Supervision consulatnt	
Loss of natural vegetation	- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes a Vegetation Restoration Plan prior to the start of any recruitment works.	- Vegetation restoration plan in place - Location of quarries and borrowpits	- C-ESMP monthly implementation report - Field Photos - ESIA's and permits for quarries/borrowpits - Purchase records for seedlings	Monthly	- Contractor - Supervision consultant - Additional monitoring by REMA, RFA and District Authorities	500,000
	- Avoid locating temporal sites, quarries and borrow pits in sensitive vegetated areas. Prior to construction works, all the sites for quarry sources and borrow pits will have specific ESIA's. RWB/Contractor will ensure that the identified quarries and borrow pits are licensed	- ESIA's and approvals for borrow pits and quarries				
	- Before cutting any trees in common and public areas, undertake a joint exercise with the District forestry/environmental officer and the project Environmental and Social Risk Management Specialist for assessment and approval. Contractor to implement a re-afforestation programme to replace the trees.	- Number of trees cut, Ha of land reforested.				
	- PAPs should be allowed adequate time to harvest their trees before destruction, and after compensation					
	- Confine clearing of vegetation to what is absolutely necessary					
	- Planting ornamental trees on the boundaries of the irrigation plots and roadsides would be important. Also, other tree species can be included in consultation with local experts in the field of forestry.	- Length(Km) of land protected along irrigation main canals - Number and Types of				

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- During creation of the limited buffer zone all along installed channels, it is recommended to use pre-existing vegetation species and socioeconomic ones; - Flora restoration through habitats regeneration by planting local species of vegetation in the remaining spaces around infrastructures as well as in created green spaces;	trees planted				
Impacts on wildlife (migration of bird and fishes)	- Develop a database of animal and plant species found in the area as a basis for conservation and monitoring of newly introduced species in the future. - Restore affected areas (e.g., quarries and borrow pits and access roads) through replanting programme. - Relevant wildlife, forestry and agriculture (aquatic) authorities will enforce the protection of wildlife conservation during construction works. - For grey crowned cranes, the following should be applied Prior to the start of any construction works, RWB to prepare a mitigation plan to be developed in consultation with recognised experts - Avoid wherever possible the habitats used by animal species with conservation interest. Areas used for breeding, nesting, feeding, migration and congregation shall be demarcated and clearly signposted. - Undertake a census of the areas to be cleared in collaboration with the required authorities (the District forestry/environmental office). Where trees need to be cut, they are marked jointly and	- Data base in place - Area(Ha) of quarries, borrow pits and access roads rehabilitated - Grey Crowne Mitigation Plan prepared	- Monitoring report on wildlife conservation - ESMP progress implementation report - Grey Crowne Mitigation Plan copy	Monthly	- Contractor - Supervision by Supervision consultant - Additional monitoring by REMA, RDB	500,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	inventory kept. Where permits are required prior to cutting, the contractor to seek these. - Minimization of the impacts by adjusting the severity of the works (blasting, heavy equipment) performed in the vicinity - Making of a record (photograph, number, location) to get current baseline of the site accommodating them - Contractor to secure sites important to cranes during construction - Report to the relevant authorities to support compilation of Rwanda's national data (cran professional at RDB, Akagera National Park rehabilitation project team) - Measures when an injured or dead grey crowned crane is spotted; prompt treatment by reporting to the relevant authority (RDB) / Delivery of the carcass to the authority For weavers - Minimization of removal of Cyprus species and trees that could be inhabited by weavers - Restriction of instant vegetation removal with heavy equipment; prompting evacuation of weavers by warning them with beating the trees, etc. - To keep construction machines in good conditions to avoid excessive noise and where possible, conduct disturbing noise levels activities in convenient working hours so as to avoid disturbance of habitat of these birds					

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
Impacts on air pollution	- Undertake watering to attenuate dust near sensitive receptors. The duration and frequency of this should be set out in the Dust Management Plan and will consider water availability and any stakeholder grievances	- No of times water is sprayed	- Vehicle sign off records for watering trips - Field observation report	Monthly	- Contractor - Supervision by Supervision consultant Additional monitoring by REMA, RDB, District authorities	500,000
	- The Contractor will prepare an Air Quality and Dust Management Plan in the C-ESMP which will include collecting of baseline data on air parameters as well as regular and scheduled monitoring through tests.	- Air quality management plan in place - Number of air quality tests and results	- C-ESMP implementation report including air quality management - Copy Dust management plan - Air Quality tests reports/results			
	- Vehicles and machinery must be kept in good condition to prevent excessive smoke from exhausts.	- No of times vehicles/machinery are maintained - Condition of vehicles and machinery	- Proof on vehicle control - Vehicle maintenance reports			
	- Reduce dust by watering the access road surface regularly and especially near sensitive receptors such as schools, health centres, unless when raining	- No of times water is sprayed	- Field observation report - Vehicle sign off records for watering trips			
	- Locate construction plants away from the settlement and other environmentally sensitive areas	- Locations of construction plant	- Field observation report/C-ESMP implementation report			
	- Prevent the generation of air pollutants during the construction period by watering during crushing and screening of aggregates	- No of times water is sprayed - Air condition in areas of crushing aggregates	- Field observation report - Air quality tests			

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Workers who may unavoidably have to work in dusty workplaces should be provided with requisite PPE including nose and ear masks to protect them from excessive dust.	- No of workers wearing PPEs on site	- PPE issuance records			
	- Liaise with local communities to forewarn of potentially dusty activities.	- Community notices/sensitization meetings on dusty activities	- Sample notices issued/meetings attendance list			
	Since construction activities will potentially affect the operations of Nsheke Primary School, they should be scheduled during school holidays to avoid pupils' exposure to health risks, particularly from dust emissions and other construction-related disturbances	Construction activities occur in holidays	Site inspection reports Monthly report		Contractor Supervision consultant	
Noise and vibration effects	- Construction activities that generate disturbing noise levels are to take place during conventional working hours wherever possible	- Working hours for noisy activities	- Field inspection report	Monthly	- Contractor - Supervision by Supervision consultant - Additional monitoring by REMA, RDB, District authorities	500,000
	- Equipment producing high levels of noise should be screened when working near sensitive receptors such as settlement areas	- Number of screened noise producing equipment				
	- Site noisy plants such as rock crusher must be far from the settlement and noise sensitive areas	- Noise level measurement				
	- Safety procedures pertaining to noise and blasting, such as provision and wearing of PPE e.g. ear protection and safety devices should be provided for the workers who involve in noisy as well as risky operations.	- No of workers wearing PPEs on site	- Field inspection report			
	- No hooting near sensitive receptors such as schools and health centres.	- Workers sensitization on hooting policy - Community grievances on hooting	- Community reports/grievances records			
	Since noise from construction activities is likely to affect the school operation, construction works	Construction activities to be undertaken in	Site inspection reports Monthly report	Monthly	-Contractor	

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	nearby the school should be scheduled during school holidays to avoid pupils' exposure to health risks, particularly from noise emissions	school holidays			- Supervision by Supervision consultant -Additional monitoring by REMA, RDB, District authorities	
	- Avoid the use of explosives and where not possible, seek prior authorisation of the Minister in charge of internal security upon the recommendation of the competent authority. Requirements for granting the authorisation referred to in previous sentence are determined by an Order of the Minister in charge of internal security promote a systematic blasting schedule and plan. Contractor to prepare a safe blasting plan and procedures in line with the law including evacuation procedures. - Maintain vehicle and equipment according to manufacturers' specifications. - Install adequate noise prevention devices, e.g., mufflers on noise generating sources. - Switch off engines of vehicles and machinery while not in use. - Workers who may unavoidably have to work with noise generating equipment, e.g., earthmoving equipment should be provided with ear plugs and advised to put them on. - Siting noisy equipment as far away as possible from Noise Sensitive Receptors (NSRs), and use of barriers (e.g., acoustic sheds or partitions) to reduce the level of construction noise at receptors wherever practicable - Where practicable noisy equipment will be orientated to face away from the nearest NSRs	- Authorisation for use of explosives - Blasting plans/schedule prepared and shared with community	- Permits for explosive use - Blasting plans and procedures shared with community - Field observation - Blasting reports		- Contractor - Supervision by Supervision consultant - Additional monitoring by Minister in charge of internal security upon the recommendation of RMB	

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Working hours for significant noise generating construction work will be daytime only - Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units, will be used, where practicable - Where practicable, stationary equipment will be located in an acoustically treated enclosure - For machines with fitted enclosures, doors and door seals will be checked to ensure they are in good working order; also, that the doors close properly against the seals - Throttle settings will be reduced, and equipment and plant turned off, when not being used - Equipment will be regularly inspected and maintained to ensure it is in good working order. The condition of mufflers will also be checked; and - Fitting of mufflers or silencers of the type recommended by manufacturers					
Impact from Access Roads	The Contractor/s will make all the possible efforts to minimise the period of disturbance and control the movement of traffic by deployment of staff at locations where access roads intersect existing roads for controlling traffic. Wherever applicable/required the contractor will deploy trained flagmen/marshals to guide and control of the traffic. Any disturbance to residential properties and commercial area will also be kept minimum by providing access to at least for two wheelers. Construction materials should be stacked in a suitable place and away from the intersection of the access road with regular (existing) road so that it does not cause any obstruction to the traffic movement on existing roads. Contractor/s will ensure that effective public information campaigns are launched prior to the implementation of any traffic management	- Marshals available on site - Traffic managemet plan including diversion(alternative) roads in place and executed - No of campaigns conducted in local community on traffic management	- Field report - Minutes of the community meetings on traffic management	Monthly	Construction contractor Supervision consultant	300,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	In any case, the Engineer will provide guidance and assistance to the Contractor and supervise the preparation of the traffic management plan as is necessary and upon finalization will submit the plan to the client for approval Construction traffic shall not use the cut formation and finished subgrade without the prior permission of the Engineer. Any damage arising out of such use shall be made good by the Contractor at his own expense					
Impacts from quarry sites, borrow pits,	- Select quarry and borrow sites far from settlement and environmentally sensitive areas and get approval of site from supervising Engineer and RMB before exploiting	- Location of quarries/borrow pits - Permit/license and a restoration plan	- Field inspection report/ESMP implementation report - Acquired permits copies - an initial environmental examination (IEE)/ESIA copy - Field photos	Monthly	- Contractor - Supervision by Supervision consultant - Additional monitoring by REMA, RDB, District authorities	500,000
	- Do not locate temporal sites, quarry areas and borrow sites near forest area, rivers and streams	- perform an initial environmental examination (IEE).				
	- Prior to developing a material source, the contractor shall Prepare and get the approval for the management and rehabilitation plan for the borrow pits, quarries and dumpsites, seek a permit/license and a restoration plan to the relevant authorities and perform an initial environmental examination (IEE).					
	- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others a safety plan and communication strategy for protecting communities and properties around the quarry during the blasting period	- C-ESMP in place				
	- Rehabilitate all quarries and borrow sites to the satisfaction of the supervisor and Client, Temporal sites installations for offices and storage of equipment and access roads after the completion of construction works, decommission	- Area (Ha) of quarries, borrow pits and dumping sites rehabilitated.				

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	in line with the prepared rehabilitation plans.					
	- Joint Baseline survey of houses/developments around the quarries including photos	- No of houses within a certain set distance from the quarries and their condition	- Baseline report and photos of the developments			
Workers health including labour rights	- Provide education to personnel of the contractor about safety procedures and emergency response plans associated with their task	- No of trainings on OHS	- Minutes of the meetings conducted	Monthly/Quarterly	- Contractor - Supervision by Supervision consultant - Additional monitoring by public service Commission, District authorities	500,000
	- Provide safe water supply & appropriate waste disposal facilities including the provision of sanitary latrines in the Temporal sites installations for offices and storage of equipment and various sites where workers are working	- No of sanitary latrines on site	- Filed observation report/ESMP Implementation report			
	- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others a Workers Environmental, Health and Safety (EHS) plan being that of contractual agreement by the contractors in order to outline procedures for avoiding health and safety incidents and for emergency medical treatment.	- EHS plan in place	- C-ESMP report			
	- Ensure all workers on site have insurance in case they get injured.	- No of workers with health insurance	- Proof from RSSB on workers insured			
	- Provision and wearing of recommended quality Personal Protective Equipment (PPE) by workers on site at all times. Active replacement of worn out of PPE.	- No of workers with PPEs	- PPE issuance records			

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Sufficient training to all workers on site on safe methods pertaining to their area of work to avoid injuries.	- No of trainings conducted on workers safety and management	- Minutes of the meetings conducted			
	- Contractor to designate/hire a lead Safety Environment and Health Officer to enforce the Safety and Health management plan on Site and to monitor implementation for the duration of the construction work	- HSE staff availed	- HSE staff contract			
	- Contractor will develop a Human Resources Policy, which will outline worker rights to be included in all contracts including restrictions on working hours in line with applicable ILO standards, compensation including consideration of overtime, holidays etc.	- Human resources policy developed	- Policy copy			
	- Contractor will develop and implement a Workers Grievance Mechanism for the Project workforce including workers and subcontractors.	- Workers GRM set up	- GRM records			
	- Contractor will ensure that workers sign a <i>Code of Conduct</i> (as shown in Annex 3) and ensure that it is followed to regulate the performance and behaviour of all workers	- No of workers signed code of conduct	- Copies of the codes of conduct			
	- Pre-employment medical assessments will be put in place as a workforce risk management tool to screen individuals for risk factors that may limit their ability to perform a job safely and effectively.	- No of workers done medical assessment	- Medical report			
Risk of accidents from traffics and Community injury on/offsite	- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others a customized Traffic Management Plan covering aspect such as vehicle safety, driver and passenger behavior, use of drugs and alcohol, operating hours, rest periods, speed	- Traffic management plan in place	- Copies of the prepared plan	Monthly	- Contractor - Supervision consultant - Additional monitoring by	500,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	limits, community education on traffic safety and accident reporting and investigations				District authorities, traffic department	
	- Provide alternative pedestrian routes where these are interrupted	- Alternative pedestrian routes in place	- Field observation report			
	- Use clear, labeled properly and meaning full traffic signs and speed limits, especially at road crossing of the people and conjunction of animals	- No of sign posts available on site	- Field observation report			
	- Provide traffic awareness specially at schools, religious and other risky places on roads in use by both the community and the construction vehicles, as well as on site.	- No of awareness meetings conducted	- Minutes of the meetings held			
	- Minimum requirement of third-party Insurance for all vehicles in use by the contractor.	- No of vehicles Insured	- Proof from RSSB on vehicles insured			
	- Key design related safety measures to be considered include speed breakers, paths for pedestrians, etc. on roads in use by both the community and the construction vehicles, as well as on site.	- No of key design safety measures	- Photos of the design measures			
	- Establish a clear GRM mechanism for communities to lodge their grievances including a hot line for reporting of the same.	- GRM established	- GRM records			
	- Contractor to prepare and share with proponent a contingency/emergency response plan for accident response. - Contractor will extend the Worker Code of Conduct (as shown in Annex 3) to include guidelines on worker –community interactions and will provide training on the worker code of conduct to all employees including subcontractors and truck drivers as part of the induction process.	- No of awareness meetings conducted	- Minutes of the meetings held			

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Contractor will provide primary health care and first aid at construction site to avoid pressure on local healthcare infrastructures. -Contractor will develop and monitor implementation of a Community Health and Safety Management Plan (CHSMP) which will include the following measures: -Undertake a programme of stakeholder engagement and consultation to educate local communities including identified sensitive receptors of the risks of trespassing onto sites, the meaning of signs, and the dangers of playing on or near equipment or entering fenced areas. Special attention to be paid on residential areas, primary and secondary schools. Where the contractor accidentally interferes with populations' structures and assets, He/she should make the due compensation in coordination with local authorities and project proponent; Issuance of workers with badges or identification cards to differentiate between workers and other community members etc.					
	To effectively safeguard pupils at Nsheke Primary School, construction works near and within the school compound will be scheduled during school holidays to minimize exposure to traffic hazards and construction-related disturbances. In addition, to ensure the long-term safety and sustainability of the school in relation to the nearby canal, a protective fence will be constructed to prevent potential accidents, such as pupils falling into the canal.	Construction activities in school holidays Fence constructed	- Inspection report	Monthly	Contractor/supervision consultant	500,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
Increased risks of communicable diseases	- Ensure all workers including subcontractors receive education around transmission and symptoms of communicable diseases of concern and STDs.	- No of awareness meetings conducted - No of restored borrow pits/quarries - No of counselling sessions/health campaigns and distributed condoms - Location of quarries and borrowpits	- Minute of the meetings held - Photos - Counselling reports - Condom issuance/purchase records	Quarterly	- Contractor - Supervision by Supervising consultant and RWB - Additional monitoring by District authorities	5,000,000
	- Restore borrow pits and quarry areas to minimize breeding sites for mosquito					
	- Provide health education to the work force and community mainly focusing on the HIV transmission and prevention.					
	- Provide free counseling and distribute condoms & leaflets to workforce and vulnerable group of nearby communities.					
	- Do not induce malaria outbreak by creating temporary & permanent water holding areas which favor mosquito breeding					
	- Take care when selecting Temporal sites installations for offices and storage of equipment in such a way that it should not invite close interaction with local community.					
	- Contractor will put in place measures geared towards prevention of spread on Covid 19 between community members and the project workers. Such measures will be aligned to prevention protocol as per the prevailing ministry of health directives including (i) Ensuring social distance among workers, (ii) provision of face masks to workers and (iii) provision of hand washing dispensers and soap or alcohol-based sanitizers at work places.	- No of measures to prevent covid spread in place	- Purchase records of e.g. sanitisers - Photos of measures			
	To mitigate the risk of communicable disease transmission to Nsheke Primary School, construction activities will be undertaken during school holidays to minimize pupil-worker	Construction activities in school holidays	Inspection record	Monthly		

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	interaction.					
	Medical screening of workers prior to allocation of work sites, with regular updates	Screening reports	Screening reports	Monthly	Contractor and supervision consultant	
Conflict among workers and local people	- Implement a set of rules for the workplace, including the Code of Conduct (as shown in Annex 3). The standards should include, inter alia, the entry of persons outside the service.	- No of workers with signed code of conducts	- Signed code of conducts in place for all workers	Quarterly	- Contractor - Supervision consultant - Additional monitoring by District authorities	300,000
	- Explain to workers about the importance of keeping a good relationship with local communities; and the Temporal sites installations for offices and storage of equipment should be well fenced.	- No of worker's sensitization meetings held	- Minute of the meetings held			
	- As part of the C-ESMP contractor to prepare a labour management plan and labour influx plan to ensure labour issues well managed. Semi-skilled and unskilled labour will first be sought in the project's vicinity i.e., locals especially the unskilled will receive first priority to reduce on labor influx that would come with other negative repercussions.	- labour management plan and labour influx plan - No of locals hired versus other workers	- labour management plan and labour influx plan copies - Employment records			
Disruption of public utilities	- Coordination with relevant authorities to identify and map the location of existing underground utilities such as electricity and communication cables, prior to undertaking any work	- Public utilities to be affected mapped	- A list of all public utilities to be affected	Monthly	- Contractor - Supervision consultant - Additional monitoring by District	500,000
	- Plan for immediate intervention by the service providers for any damages to utilities during project execution;					

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Replace (or compensate) for public and private physical asset damaged due to disruption. For each damaged utility, fix the damage to the satisfaction of the service provider. Reparation work shall be treated as an emergency and undertaken without undue delay; - Provide prior public information about the likely disruption of services; - Where practical, the contractor shall work carefully to avoid damages to the electricity and communication cables, and water lines if any. - Ensure immediate reinstatement of services	- Public utilities replaced - Prior notification for service disruption - Timelines between disruption and reinstatement	- list of public utilities replaced/ compensated - Photos		authorities	
Gender based Violence, Sexual Harassment and Sexual Exploitation	- Prepare and Conduct awareness program to all workers and the community and Nsheke School on the avoidance and related risks to GBV	- No of GBV awareness campaigns (sensitized meetings) conducted	- Minute of the meetings held	Monthly	- Contractor - Supervision consultant Additional monitoring by Gender Monitoring Office (GMO), Isange OSC& District authorities	700,000
	To mitigate risks of gender-based violence, sexual harassment, and sexual exploitation at Nsheke Primary School, construction activities near the school will be scheduled during school holidays.	GBV based GRM	- Reports			
	Employ a concrete GBV/SEA campaign within the school including a GBV focal person (teacher) accompanied by GBV sensitization and awareness creation	GBV campaigns	- Reports			
	- Contractor to prepare and Implement a GBV/SEA/SH prevention action plan that covers measures for prevention of SEA/SH, Response to SEA/SH	- GBV/SEA/SH prevention plan in place	- GBV prevention plan implementation report, Inspection report - Copies of signed codes			

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)	
	- The Contractor shall require his employees, sub-contractors, sub-consultants, and any personnel thereof engaged in construction works to individually sign and comply with a Code of Conduct (as shown in Annex 3) with specific provisions on protection from sexual exploitation and abuse.	- Signed code of conduct regarding SEA, SH, GBV plan in place - No of induction trainings held	of conduct - Training records				
	- All employees are required to attend an induction-training course prior to commencing work on site to ensure they are familiar with the GBV Code of Conduct.						
	- The contractor will mainstream Gender Inclusivity in hiring of workers	- No of women hired in construction works	- Report on women employed				
	- Female workers should be sensitized on their rights and encouraged to report any gender-based violence or threat.						
Child abuse and exploitation	- The contractor should be aware on labor Law and most importantly the Article on the Child Labor	- No of awareness meetings conducted	- Report/minute of meetings conducted	Monthly	- Contractor - Supervision consultant Additional monitoring by Gender Monitoring Office (GMO), District authorities	300,000	
	- All staff of the contractor (and sub-contractors) must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behavior.	- Labour management plan(LMP) in place - Zero record of child workers on site	- LMP implementation report - Employment records				
	- Children under the minimum legal working age will not be hired on site. Potential employment seekers at site will be required to provide identification document to verify age						
	Construction activities near Nsheke Primary School should be scheduled during school holidays to avoid the risk of child abuse and exploitation associated with the works.	Construction in holidays	Inspection report	Monthly	Contractor, supervisor, RWB		

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	Employ a concrete GBV/SEA campaign within the school including a GBV focal person (teacher) accompanied by GBV sensitization and awareness creation	Awareness campaigns	Reports	Monthly	RWB	
Creation of slopes and accumulation of earth materials during excavation works	- Construction activities should take place during the dry conditions. - Protective measures such as reinforcement of slopes and vegetation planting will be applied where necessary; - An appropriate dumping site for excessed excavated earth materials should be selected and recommended by local authorities; - Scarifying the site of topsoil combined with soil compaction all along the installed channels will result in reducing capacity of the ground to retain water and increase surface water run-off during periods of rainfall.	- Area(sqm) of slopes stabilised - Site for dumping excavated material - Area of reinforced slopes	- ESMP progress implementation report - Photos of site	Monthly	- Contractor - Supervision consultant - Additional monitoring by REMA	500,000
Poor waste management (solid and liquid wastes)	- The Contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which includes among others a solid and liquid waste management Plan - The Contractor is to improve solid waste management services through reducing the generation of solid waste, but also improving collection, sorting, handling and disposal in appropriate dumping site. - Contractor to sensitize workers on waste management and the C-ESMP.	- Waste management plan in place - No of dust bins available on site - Volumes of waste recycled - No of sensitization meetings conducted	- ESMP progress implementation report - Field inspection report - Waste records - Minutes of meetings held	Monthly	- Contractor - Supervision consultant - Additional monitoring by District authorities	3000000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Waste oil should be properly collected and stored in clearly labelled metallic drums with lids for reuse as well as provision of adsorption to prevent oil leakage.	- Area dedicated for storage of hazardous materials	- Field inspection report			
	- Contractor to hire a licensed solid waste handler for collection and disposal of all waste.	- No of solid waste handlers hired	- Waste handler contract			
	- Maintenance and servicing of vehicle, machinery and equipment must be carried out in a designated area (protected service bays) and where oils are completely restrained from reaching the ground. Such areas should be covered to avoid storm water from carrying away oils into the soil or water systems.	- Locations of servicing vehicles and machinery	- Photos - Vehicle maintenance records			
	- Oil, paints, fuels and other chemical materials should be stored in impervious site stores.	- Location and condition of storage sites for oils, paints etc	- Photos			
	- In case of any hazardous substance spills, immediate spill containment and clean up shall be initiated. Spill and containment plan to be developed	- Spill and containment plan to be developed	- Spill and containment plan copy			
Disruption of existing pattern of access	- Quick rehabilitation of disrupted existing patterns of access to facilitate movement of people and their belongings;	- No of access roads rehabilitated	- Field inspection report	Quarterly	- Contractor - Supervision consultant Additional monitoring by District authorities	500,000
	- Avail where possible temporally diversion ways for local population and passengers.	- diversion channel in place	- Field observation report - Photos			
	- Notify the community of any planned interruptions well in advance	- Community notices issued	- Copy of notices			
Cultural disruptions and protection of	- Deviation of the canal routing as an alternative way to avoid compensation and disruption of the canal alignment	- No of PAPs compensated for their affected graves	- Compensation report		Contractor & local authorities	500,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
archaeological and historical sites	- In case deviation is not possible, apply Cash compensation based on national expropriation law to relocate the graves prior to any works on ground - Enough time be given enough time to relocate the grave - The PAP will be assisted for burial ceremonies - In addition, Chance find procedures (as shown in Annex 6) shall also be used in case of any unexpected cultural heritage canal during construction phase				(Nyagatare District) & Supervision company, RWB	

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
Other Impacts from the temporal site installations	- Effective site management will improve efficient utilization and energy conservation on site - Maintenance of plant and equipment in serviceable and good working order to maximize their efficiency on fuel - The choice of machines intended for activities for which they have designed - Regular control of trucks Technical feasible water conservation measures, use of alternative water supplies, water consumption offsets to maintain total demand for water resources within the available supply, -Waste collection points will be established within the site to dispose temporarily solid wastes generated on site. The project will hire a licensed contractor to collect and dispose those wastes in the district landfill -Toilets will be constructed to facilitate the disposal of human wastes. The location of these toilets within the sites will consider area with deep water table and not near sensitive areas, - Masonry sewage treatment facilities will also be used to treat sewages -The restoration of these temporal site installations will be done basing on the existing site conditions prior to construction phase. Because these sites are not determined at the time of conducting this ESIA study, the initial environmental examination of these sites shall be conducted to record existing state of these site which will serve as baseline.	- No of trainings on energy and water use efficiency, regular checking of resource use efficiency	- Minute/Field report	Monthly	Contractor & Local authorities, supervision consultant, RWB, REG, WASAC	300,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
Impact on water quality, Possible contamination and competition over water	- At construction stage, the contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which included among other; Soil and Sedimentation Control Plan, Spoil Management Control Plan and Waste Management Plan. - Should the Client allow sourcing of water from the river for construction works, required permits must be sought and amounts should be pre-determined by the relevant authority to avoid conflict with the community and ensure no competition for water with the community. Should it suffice that the water is not sufficient for both parties, contractor should seek alternatives. - Community access to water sources should not be restricted. Should sites used by the community previously for water abstraction be affected, RWB and the Contractor is to work with the local community and authorities to identify clear alternative sites for community to continue abstracting water. - Store all raw materials away from the vicinity of water bodies located on the project area to avoid contamination in these areas. - General waste generated during this phase of the development must be stockpiled in one central area of the project site, away from existing reservoir and collected, transported and disposed of appropriately at the designated disposal site by relevant authorities - No hydrocarbon-contaminated water may be discharged into the river - Provide workers at the development site with sanitation facilities during this phase of the	- Masonry waste water treatment facility in place and operational - Sanitation facilities in place - Water use permit available	- Field report	Monthly	- RWB to issue the water use permit - Contractor - Supervision consultant - Local authorities	300,000

[illegible]

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
Operation Phase						
Impacts on environmental flow and transboundary issues	- Muvumba river is shared between Rwanda and Uganda. In order to comply with international best practices on the use of shared water resources, there should be a bilateral meeting aimed at the management of Mumba River	- Bilateral meeting between Uganda and Rwanda on the use of shared water resources	- Minute of the meeting	Once	RWB & Prime Minister's Office & MoE	0
	- Allocate enough amount of water for downstream water use and ecological need; the amount of water for downstream ecosystem should not be less than 30% of the natural flow at any time. Analysing the information/interpretation of data from the hydrology report of the Muvumba dam, it is clear that adequate quantity of water will be flowing downstream of the dam in the Muvumba river.	- Data on quantity of water released	- Report on flow measurement	Monthly	RAB& RWB	200,000
	- Ensure enhanced monitoring maintenance of the transmission and distribution pipelines upon commissioning to ensure minimal loss of water through leakages.	- No of times irrigation pipes are maintained	- Monitoring report			
Increased health impacts	- Remove vegetation from the margin of the reservoir and drainage structures	- No of community works done for mitigation the spread of malaria	- Reports on community works done	Quarterly	Local authorities, RAB, RWB	0
	- Design and construct irrigation canals and drainage structures in such a way that there could not be permanent water collection sites and formation of swamps					
	- Irrigation and drainage canals should be cleaned regularly					
	- Establish effective vector monitoring program around the reservoir and irrigation canals					
Deterioration of water quality	- Develop and promote Integrated Pest Management Plan prior to start of the operations of the irrigation and ensure its application including sensitization of farmers - Consider the strategic option of promoting	- IPM plan developed	- Copy of IPM plan	Prior to operation phase.	RAB& RWB	2000000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	organic agriculture in the schemes;					
	- -Collect and treat irrigation farm drainage water before discharging to the river	- No of awareness meetings done on the proper use of pesticides and fertilizers	- Field visit report/ESMP progress report	Quarterly	RAB& RWB	1000000
	- -Improve waste disposal system of the nearby settlement					
	- -Enhance extension and agronomic advisory services to ensure proper use of pesticides and fertilizers applied in the irrigation farm					
	- -Do not dispose fuel and lubricants into wet lands and streams	- No of waste handling facilities (dust bins, ...) on site				
	- Avoid dumping of solid and liquid wastes from the project Temporal sites installations for offices and storage of equipment into the rivers and wet lands					
	- Promote watershed management work to control soil erosion, nutrient wash and associated water quality deterioration and reservoir siltation	- Ha of land protected around the command area				
	- Apply physical/ biological treatment of inflowing run-off by using riparian vegetation buffer	- water treatment facility available at inlet				
Impacts on soil salinity decrease in soil fertility	- It will be necessary to enforce high levels of drain maintenance both on and off- command area;	- Number of trainings of farmers on how to regulate quantities of water in sustaining soil chemical properties for continuous fertility	- Minute of trainings conducted	Quarterly	RAB&RWB	500,000
	- Soil water levels and salinity will require very close monitoring to provide early warning of problems.					
	- Avoid over use of water in the irrigation field					
	- Avoid excessive application of fertilizers and pesticides					

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	- Drain water logging areas of the farm			Monthly		
	- Classify irrigation field according to soil salinity class and grow salt tolerant crops on saline plots					
	- Apply periodic leaching of saline soils					
	- Regular application of organic matter and lime shall be needed to maintain and improve soil properties.	- Amount(Kg) of fertilizers(Organic&Chemical) applied per month	- Report on the quantity of fertilizers used			
GHG emissions	- One way to reduce methane and nitrous oxide gas is to use Alternate Wetting and Drying (AWD) method.	- Number of GHG inventory done	- GHG inventory report	Once in month	RWB&REMA	800,000
Poor flood management in the command area	- One proposed solution consists of preventing the water from entering into the irrigation systems of command area, with the use of interceptor drains;	- Diversion channel in place	- ESMP progress implementation report	Monthly	RWB&RWB	200,000
	- Drain water for irrigation in pipes and use sprinkler for watering crops in command areas.					
	- Regularly monitor the performance of the irrigation scheme	- No of monitoring visits	- Monitoring records	Quarterly		
	- Prepare a crisis action plan/emergency action plan, sensitize the community on action and carry out periodic drills to test response measures and evacuation procedures.	- crisis action plan/emergency action plan prepared - no of sensitization meetings and emergency drills	- copies of plans - records of sensitization meetings and emergency drills - Photos			
	- RWB/RAB to update the dam emergency preparedness and response plan to cover irrigation component and areas, sensitize the community on action and carry out periodic drills to test response measures and evacuation procedures; The updated	- Dam emergency preparedness and response plan	- Updated Plan	At least 1 year prior to dam impoundment	RWB & RAB	

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	plan will be prepared during implementation and will be provided to the Panel and Bank for review not later than one year before the projected date of the initial filling of the reservoir ie at least 1 year prior to dam impoundment					
Siltation and clogging of irrigation infrastructure	- Improvement of watershed management conditions, especially promoting ecological agriculture	- Km of land protected along the main canal	- ESMP progress implementation report	Monthly	RWB&RAB	200,000
	- Creation of limited buffer zone all along the irrigation channels and grass planting for soil fixation.					
	- Improved farming methods including contour and terracing of farms among others	- Acreage of areas with contour/terracing - Community sensitization on farming methods	-			
Crop intensification and loss of traditional landraces	- Use improved varieties which are already grown in the region and have proved to be well adapted;	- Amount of improved seeds used - Set up of gene bank	- Report on the improved seeds used	Quarterly	RAB	0
	- Development and delivery of a preventive extension packages (farmer training in problem avoidance and management techniques);					
	- Prevention and control techniques for the major insects, weeds and disease problems in the area;					
	- Constitute a Gene bank for traditional landraces					
	- Provide easy access to inorganic fertilizers.					
	- Development and delivery of a preventive extension packages (farmer training in problem avoidance and management techniques);	- No of trainings done on Integrated Pest Management (IPM)	- Minute of the meetings held	Quarterly	RAB	200,000

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
Biotic constraints (weeds, insects and diseases)	- Prevention and control techniques for the major insects, weeds and disease problems in the command area.					
Introduction of invasive species	- All equipment brought from outside the project area for channel maintenance should be cleaned prior to being used on the project. - Introduction of a surveillance system to ensure any new species are quickly identified and maintained - Ensure use of clean and certified seed for crop production	- Status of maintenance equipment - No of surveillance trips	- Report on the status of maintenance equipment - Surveillance records	Quarterly	RAB&RWB	200,000
Conflict between water users	- Provide technical and logistical support for training water users on management of irrigation infrastructures and benefits sharing;	- No of trainings of WUAs on the management of water resources	- Minute of trainings conducted	Quarterly	RAB&RAB	500,000
		- Water abstraction permit	- Water abstraction permit			
	- Give responsibility to Grievances Redressing Committees (GRC) for helping and records of complaints and active participation in conflicts resolution.	- No of complaints resolved	- Report of complaints resolved	Monthly		
Diseases transmission in cattle and decrease of livestock productivity	- Increasing perimeter fencing would help to control different diseases especially tick- borne diseases;	- No of measures taken to reduce diseases transmission	- Report/disease surveillance reports - Vaccination records	Quarterly	RAB	200,000
	-Increasing the possibility of dip tanks and/or installation of individual or communal spray-races use against tick-borne diseases, would help greatly to reduce the losses incurred from mentioned diseases in livestock reared in the command area and vicinities;					

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)	
	-Regular disinfection of cows, goats and sheep using appropriate medicinal products dedicated to reared domestic animals;						
	-Initiate and effectively participate in a regional campaigns and tsetse flies control measures in order to eliminate Trypanosomiasis disease.						
	Initiate regular disease surveillance and monitoring						
Impact on biodiversity	- Develop a deliberate campaign for sensitization of the irrigation community on the importance of the grey crowned crane and need to preserve it should they sight any in their fields in the future. The plan will be developed one year prior to the operationalization of the irrigation scheme and integrated into the regular sensitization of the cooperatives and WUAs. - Establish collaboration with concerned conservation organizations/institutions in the area, in monitoring grey crowned crane precence in the project area proximity area as part of project monitoring to ensure effective measures are taken to support them when deem necessary.	No umber of campaigns delivered No of organizations collaborated	Reports	Quartely	RAB	500,000	
Operation subtotal cost							7,000,000
Decommissioning Phase							
Waste generation	Dispose solid wastes away from the site to approved disposal site by competent authority	No of PPEs availables for all workers	ESMP report	Monthly	Contractor and supervision consultant	300,000	
Air pollution	-Use of PPE such dust masks by demolition crew	No of workers wearing PPEs on site	Field inspection report		Contractor and supervision consultant	200,000	
	-Mobilize the ideal amount of equipment for the demolition works						

E&S impacts	Proposed mitigation measures	Monitoring indicator	Means of verification	Monitoring frequency	Institutional responsibility	Cost estimate (Rwf)
	-Ensure that the equipment mobilized are serviceable					
Occupational health and safety risks	-Provide workers with adequate and appropriate personal protective equipment (PPE).				Contractor and supervision consultant	200,000
	-Provide workers with adequate drinking water and breaks.	Clean drinking water available on site	Field inspection report			
	-Provide workers training on safety procedures and emergency response such as fire, oil and chemical spills, pipe bursts and other risks.	No of meetings on safety & health	Minute of the meetings held			
Decommissioning subtotal cost						700,000
GRAND TOTAL						25,900,000

7.2.3. Reporting

To ensure alignment with the African Development Bank's Integrated Safeguards System (AfDB ISS), this reporting framework outlines a structured and traceable procedure for Environmental and Social (E&S) reporting, tailored to an irrigation project. The framework ensures timely and quality data flow from contractors to AfDB through responsible intermediaries and includes provisions for Resettlement Action Plan (RAP) elements and independent audits.

The objective of reporting procedure is to establish a transparent, multi-tiered reporting procedure as shown in Table 9-3, that ensures:

- Compliance with AfDB ISS requirements.
- Integration of RAP monitoring results.
- Timely submission of accurate and verified reports.
- Feedback loops for continuous safeguards improvement.

Table 7-3: Reporting Procedure

Report Type	Responsible Party	Contents / Focus	Frequency	Enhanced By	Submitted To
Monthly E&S Progress Report	Contractor	Site-level activities, safeguards compliance, mitigation actions	Monthly	Supervision Consultant → Borrower (RAP inputs)	AfDB (via PIU)
RAP Monitoring	RWB (via PIU Safeguards Officer)	Livelihood restoration, grievances, compensation updates	Monthly	Integrated into contractor report	AfDB (with cover memo)
Consolidated Quarterly Report	RWB	Summary of E&S status, RAP progress, corrective actions	Quarterly	Compiled from monthly submissions	AfDB
Annual Independent E&S Audit	External Auditor (appointed by Borrower)	Overall compliance including adherence, stakeholder feedback	Annually	Reviewed by Borrower	AfDB and REMA
Corrective Action Plan (if any)	RWB, with inputs from Consultant and Auditor	Mitigation strategy for noncompliance, RAP delays, safeguards gaps	As needed (triggered by findings)	Cross-party review and sign-off	AfDB and REMA
E&S Completion Audit	RWB	Overall compliance including adherence, stakeholder feedback	Project completion	Reviewed by Borrower	AfDB

8. INSTITUTIONAL ARRANGEMENT FOR THE IMPLEMENTATION OF THE ESMP

To support the effective implementation of environmental and social mitigation measures, this section outlines the institutional arrangements and capacity assessment integral to the Environmental and Social Management Plan (ESMP). It identifies key actors, their respective roles, existing capabilities, and necessary capacity-building efforts to ensure compliance with AfDB ISS requirements.

8.1. Institutional Arrangements

To ensure effective implementation of Environmental and Social (E&S) mitigation and monitoring measures under the irrigation and livestock water use project, the following institutional roles are defined:

8.1.1. Contractor

The contractor serves as the primary actor on site, responsible for implementing all prescribed mitigation measures in line with the ESMP. They are tasked with ensuring that construction activities comply with environmental and social safeguards, preparing regular E&S reports, and collaborating with supervision consultants to adjust practices when non-compliance issues arise. The contractor's daily footprint shapes much of the safeguards reality on the ground.

8.1.2. Project Implementation Unit (PIU) Safeguards Team

This will play a crucial coordination and oversight role. This team consolidates site-level reports and prepares submissions to AfDB, ensuring that documentation reflects compliance with Bank policies and national regulations. Beyond reporting, the PIU safeguards team monitors systemic safeguard adherence and provides strategic support for grievance redress, stakeholder engagement, and training facilitation.

8.1.3. Supervision Consultant

The consultant on behalf of the client shall perform functions as the intermediary between contractor and client, ensuring that E&S requirements are met and continuously monitored. Their role involves reviewing contractors' reports, verifying the adequacy of mitigation actions, and facilitating integration of RAP components where relevant. The consultant also provides technical support to ensure environmental and social compliance throughout implementation.

8.1.4. Rwanda Environment Management Authority (REMA)

REMA will bring national-level regulatory power to the project. It is responsible for providing environmental enforcement and licensing, ensuring that all actors uphold Rwanda's environmental policies. It also oversees inspections beyond the immediate project zone, validating compliance through independent evaluations and follow-up on violations or complaints. In addition to its monitoring mandate, REMA will review and approve environmental audits conducted under the project to ensure they align with both national standards and the AfDB Integrated Safeguards System.

8.1.5. Rwanda Agriculture Board (RAB)

RAB holds a strategic role in community irrigation governance. RAB supports the creation and training of Water User Associations (WUAs), equipping local beneficiaries to manage irrigation schemes sustainably. Their involvement promotes long-term ownership and capacity development, linking infrastructure to social cohesion and livelihood restoration.

8.1.6. Independent Auditor

A third-party individual consulting firm will conduct an annual as well as completion Environmental and Social audit to objectively assess the project's compliance. This includes checking ESMP implementation quality, verifying grievance redress mechanisms, and evaluating adherence to AfDB's Integrated Safeguards System. Their impartial review strengthens accountability and transparency within the project lifecycle.

8.1.7. District Authorities

Nyagatare District will play a pivotal role in ensuring localized compliance and oversight. Specifically, they will be responsible for authorizing the clearance of agroforestry trees, in line with national biodiversity and land use guidelines. The District will also issue licenses for waste disposal sites within its jurisdiction, ensuring that site operations meet environmental and public health standards. In addition, the District will act as an intermediary for grievance redress, receiving complaints that have escalated from the local GRM committees and facilitating appropriate resolution measures in coordination with project stakeholders and REMA.

8.1.8. Stakeholders and Third Parties

These include Civil Society Organizations (CSOs), community leaders, and technical partners, play supportive roles in stakeholder engagement, grievance handling by grievance redress committees (GRCs), water users' associations (WUAs) and community monitoring. Their participation enriches the social fabric of ESMP implementation, fostering collaboration, trust, and meaningful feedback loops.

8.2. Institutional Capacity Assessment

Here's a structured overview of the Institutional Capacity Assessment (ICA) gaps in Table 10-1. This will support your ESIA/ESMP Implementation by highlighting areas where capacity strengthening is needed across various institutions:

Table 8-1: Identified Gaps

Institution/Actor	Identified Capacity Gap	Recommended Support
New Water User Associations (WUA)	Limited capacity in water resource governance and infrastructure operation	Training on water allocation, infrastructure maintenance, and participatory monitoring
Grievance Redress Committees (GRCs)	Lack of training on grievance handling procedures and documentation	Capacity building workshops on grievance protocols, GBV/SEA sensitivity, and escalation pathways.
Rwanda Water Resources Board (RWB)	Project Implementation Team (PIT or PIU)	Recruit train the new irrigation PIT/PIU on AfDB policies members

District Authorities	Limited knowledge of safeguards frameworks and project oversight roles	Multi-module training covering environmental & social safeguards, agroforestry clearance, GRM processes, and licensing roles
REMA	No identified gap	Not applicable
Contractor	Hazardous waste management handling procedures	REMA and RURA to train consultant safe handling procedures

Table 8-2: Capacity building plan

Topic	Training modules	Target	Duration	Modality	Responsible ⁶⁶	Cost (Frw)
Pre-construction phase						
Pre-compensation training on financial literacy	On how to manage money after being compensated.	Persons affected by the project	Three training sessions of 4 days each to cover all sectors of project intervention	Workshop	Safeguard staffs (Environmental safeguard specialist, Social safeguard specialist) Manager of saving and credit cooperatives	Cost already covered in RAP
Training on Environmental and social requirements as per national laws/regulations and requirements of AfDB	Training on AfDB Operational safeguards and their applicability to this project	Project affected People, Contractor and Supervision consultant	4 sessions of 2 hours each to cover all stakeholders	Workshop	Safeguard staffs (Environmental safeguard specialist, Social safeguard specialist)	1,000,000
Training on Environmental and social requirements as per national laws/regulations and requirements of AfDB	Training on AfDB Operational safeguards and their applicability to this project	New PIU staffs dedicated for the Additional financing (irrigation project)	Two days session	Workshop	RWB safeguard staffs and AfDP E&S Experts	1,000,000
-Training on grievance handling mechanisms -Specific training on handling grievances related to GBV and its forms	Roles of GRC in handling grievances Levels of GRCs, their compositions and their operationalization Procedures regarding handling SEA, SH,	Cell level GRC members	Three sessions of 2 days	Workshop	Safeguard staffs Staff from Isange One stop center ⁶⁷ District staff in charge of gender and family promotion	1,200,000

⁶⁶ Persons mentioned other than project safeguard staffs were mentioned but the responsibility for the training is still under safeguard staffs. They were considered as supporter but not responsible.

⁶⁷ structure for a comprehensive response to address gender-based violence and to complement the nation-wide efforts by the Ministry of Health, the National Police and the Ministry of Justice. By establishing Isange Centres countrywide the National Police, the Ministry of Health and the Ministry of Justice aim at improving the linkages of different ministries, referrals and care of gender-based violence victims/survivors at centralized and decentralized levels

	sexual harassment, etc.,					
Pre-construction subtotal cost						3,200,000
	Construction phase					
Training on labor and working conditions	Code of conduct at work place (as shown in Annex 3) Conflict resolution among workers GBV prevention and response Child labor prevention HIV prevention and other communicable diseases	Employees; Contractor and sub-contractors; Drivers Supervision firm; Cell level GRC members	Three sessions of 2 days	workshop	safeguard staffs	600,000
OHS training	Health and safety at workplace Possible Health, Safety and Environment (HSE) risks from construction works and their management, Community health and safety Incident investigation and reporting Method of dealing with emergency situations Understanding the OHS committee, its composition and role and the Ministerial	Employees; Supervision firm; District environmental officer; Contractor and sub-contractors	Three sessions of 5 days	Induction workshop	safeguard staffs	2,100,000

	order establishing this committee Monitoring and reporting on HSE performance					
Training on biodiversity management	Awareness on the management of gallery forest and the animal species (mainly baboons and weavers) during construction works	District environment Management officer; Project workers; Supervision firm	Three sessions of 2 days	workshop	Safeguard staffs	350,000
Training of Contractor of hazardous waste management procedures	Waste management including handling and procedure	Contractor	1 day	Workshop	REMA & RURA	1,000,000
Construction subtotal						4,050,000
Operation phase						
Training on protection of primary canal irrigation	Protecting buffer zone of the canal through Nature based solutions (NbS): by grassed vegetation, reeds, etc	Farmers including WUAs; District and sector agronomist	Two sessions of 2 days	workshop Field visit	Safeguard staffs	300,000
Training on environmental flow management	Environmental flow management and its role in maintaining ecological functions in Muvumba downstream area	WUA; District environmental officer; District irrigation officer	One session of 1 day	workshop	Safeguard staffs and RAB Irrigation Engineers	350,000
Operation subtotal cost						650,000
TOTAL COST						7,900,000

9. PUBLIC AND STAKEHOLDERS CONSULTATIONS

9.1. Introduction

Stakeholder consultation is a cornerstone of the Environmental and Social Impact Assessment (ESIA) process, ensuring that the voices of affected communities and interested parties are meaningfully integrated into project planning and implementation. In alignment with national legislation, the operational safeguard (OS10) of the African Development Bank (AfDB), and the Integrated Safeguards System (ISS) of the African Development Bank. This chapter outlines the stakeholder engagement activities conducted to date.

Therefore, prior to commencement of works and during ESIA scoping, sites visits and consultations were held with local communities living in Sectors covering the project, including potential Project Affected Persons (PAPs) and local leaders.

9.2. Objectives of stakeholder's consultations

The objectives of the consultation process are to: Identify and understand stakeholder priorities and concerns; Promote inclusive participation, particularly of vulnerable and marginalized groups; Inform project design and risk mitigation strategies; Foster transparency, trust, and social license to operate.

Specifically, this stakeholders' consultations process aimed to:

- Make the current study participatory and transparent; share the potential positive and negative environmental and social impacts and their proposed mitigation measures;
- Inform the PAPs about their rights and how they will be put in actions;
- Explain and take the compensation process transparent, but more details shall be emphasized;
- Determine the attitudes of PAPs towards project, and provide a platform for future consultation by:
 - ❖ Reducing conflicts through early identification of conflicting issues
 - ❖ Improving transparency and accountability of decision-making processes
 - ❖ Facilitating participation to increase public confidence in the ESIA process
 - ❖ Identifying stakeholders with whom further dialogue will be constructive in subsequent stages of the project

9.3. Summary of previous consultations undertaken in 2022 during project detailed design

Initial consultations were carried out in September 2022 during the project's feasibility and scoping phases, covering all seven sectors of the irrigation project. These consultations, held between 21st and 30th September, engaged a wide range of stakeholders, including local communities, livestock keepers, and cell and village authorities, to ensure transparency and participatory planning.

9.3.1 Previous Meeting: Discussions with District Authorities and Staffs

During the field mission, the Consultant team held a meeting on 26 September 2022 at the Nyagatare District Headquarters with senior officials, including the Director of Agriculture and Natural Resources, the District Agronomist, the Veterinary Officer, and Sector Executive Secretaries from the target irrigation command area.

The discussions focused on the project's anticipated benefits to be promoted, as well as potential negative impacts that should be minimized or mitigated. Participants emphasized the importance of joint collaboration to ensure the successful implementation of the project. Annexes 8a and 8b present photographs of the meetings with Nyagatare District officials.

During consultations, a range of potential adverse impacts on both human communities and the environment were highlighted for discussion with District senior officers. These included changes in Muvumba River flows and impacts on biodiversity, land and crop losses due to irrigation infrastructure, sedimentation in canals, crop intensification leading to loss of traditional varieties, biotic pressures (pests, weeds, diseases), soil fertility decline, contamination risks from agrochemicals, groundwater rise and salinization, poor flood management, spread of water-related diseases, waste management challenges, rehabilitation of borrow pits and quarries, and the risk of invasive species introduction.

Following these discussions, District officials emphasized their role as key stakeholders and confirmed their commitment to contribute resources, expertise, and coordination to support the project's successful and environmentally sustainable implementation. Annex 9 presents meeting minute held with District authorities during the detailed design phase of the project.

9.3.2 Previous Consultation held with local communities

During the discussions led by consultant team coupled with RWB safeguard team, communities and local authorities at sector and cell levels were informed about key project components such as irrigation canals, center pivots, and bridges, along with the anticipated benefits. These include year-round cultivation through irrigation (reducing reliance on rainfall), increased agricultural productivity, and enhanced employment opportunities.

However, potential social impacts were also highlighted, particularly the loss of land and houses in areas where open channels will be constructed. Communities were assured that, in such cases, fair compensation will be provided in line with the national expropriation law, as the project serves the public interest. In summary the following key points were presented to the participants, discussed, and clarified to ensure a common understanding

of the Project:

- **Project Presentation and Benefits:** Participants were introduced to the project and informed of its anticipated advantages, including improved wellbeing and socio-economic development for the district. Potential adverse impacts were also highlighted, along with proposed mitigation measures.
- **Compensation Modalities:** Communities were informed that compensation will be provided to project-affected persons for land and assets required for infrastructure such as site installations, intakes, main canals, reservoirs, livestock watering points, and dipping tanks.
- **Support During Implementation:** District representatives, local administrators, the Consultant's team, Grievance Redress Committees, and the local population were asked to support the Contractor during project execution and help resolve challenges that may arise.
- **Preparation for Compensation:** Affected persons were requested to prepare the necessary documentation (land titles, bank accounts, identification) to facilitate compensation. Local authorities were asked to assist those without land titles in obtaining them promptly.
- **Establishment of Grievance Redress Committees:** Communities were asked to elect Grievance Redress Committees members, after being explained on its role in the project implementation mainly to help address issues and constraints raised by project-affected persons during implementation.

Table 9-1 presents a summary of the key issues and concerns raised during the community consultations.

Table 9-1: The summary of key issues raised during previous consultation

Issues raised by participants	Responses provided
We now understand that our land will be acquired by the project, primarily for the construction of irrigation canals. What are the requirements and procedures we should be aware of so that we can prepare in advance?	The Consultant team together with experts from RWB and local authorities explained the processes of expropriation: Valuation will be continuing for all assets to be affected by the project; Collection of expropriation documents is still ongoing for the remaining PAP that are not yet consulted; In accordance with the expropriation Law and AfDB Policy, the project implementation will start after completion of compensation procedures.
What anticipated benefits does the project offer to stakeholders?	During the consultations, the following project benefits were explained and highlighted: Improved water access: The project will address seasonal water shortages by providing a reliable water supply during the dry season. Enhanced agricultural productivity: Approximately 10,240 hectares across seven sectors will be irrigated, supporting year-round cultivation.

Issues raised by participants	Responses provided
	Improved livestock production: Reliable livestock watering points will increase livestock productivity and farmers' incomes. Employment creation: The project will contribute to local economic development through job opportunities and wages paid to workers. Support to local businesses: Increased demand for services and supplies will generate additional income for local companies, thereby improving household livelihoods.
Community members emphasized the need for the project to ensure that farmers with land situated farther from the irrigation canals also have access to its benefits	Secondary and tertiary canals are planned within the command area. With the agreement of the District and local authorities, farmers may be allowed to connect to the installed irrigation network
Is the new irrigation project related to the previous irrigation projects already implemented in Nyagatare District?	The irrigation project is a standalone initiative; however, it is designed to complement and build upon the previous projects already implemented in Nyagatare District

The meetings were attended by 348 (52% women and 48% men) participants from five sectors of project intervention area covering phase 1 (Table 9-2). These engagements focused on understanding the socio-economic and environmental context of the Muvumba catchment, identifying potential risks and opportunities, and gathering input on irrigation project priorities for the whole project. Annex 10 presents the detailed minutes of the consultation meetings held with the community during the detailed design phase of the project.

Table 9-2: Stakeholders Presented During Public Participation

Sectors Covered	Number	Males	Females
Nyagatare	54	30	24
Karama	94	43	51
Tabagwe	0	0	0
Rukomo	132	65	67
Rwempasha	51	18	33
District	17	11	6
TOTAL	348	167	181

Key stakeholders included district authorities, sector agronomists, cooperative leaders, farmers and livestock representatives.

9.4. Recent 2025 stakeholder's consultations

In the course of updating the ESIA report, additional consultations were carried out between June 12 and July 05 2025 to inform stakeholders about the revised project scope and activities. Consultations with decision making bodies such as district authorities, public and private institutions including paddy rice operators as well as environmental experts from REMA were convened on the concept and nature of the proposed irrigation project in the

five sectors (Karama, Rwempasha, Nyagatare, Rukomo, and Tabagwe) of Nyagatare District. The importance of project implementation with fully public and stakeholders' participation, the roles to be played by key stakeholders as well as joint contributions from these actors to the success of the project have been emphasized.

In addition, the scope of the proposed project and possible means of maximizing local communities' social, economic and environmental benefits from the project implementation were underlined.

The consultations were organized with participation of the following key stakeholders:

- Nyagatare District's key Senior Officers;
- Rwanda Water Resources Board's Staff;
- Administrative Authorities at Sector and Cell levels;
- Leaders of the local Community Based Organizations;
- General community and Likely Project Affected Parties;
- Existing Water Users Associations;
- Rwanda Environmental Management Authority (REMA)

9.4.1 Meeting with Rwanda Agricultural Board Officials (RAB)

The workshop held from 12th to 15th May 2025 in Nyagatare District (as shown in Annex 11) focused on finalizing key documents and plans for the successful implementation of the Irrigation Project. It brought together technical teams from the Rwanda Water Resources Board (RWB) and the Rwanda Agriculture and Animal Resources Development Board (RAB), with RWB serving as the executing agency and RAB providing technical guidance and oversight on irrigation system design, agricultural productivity, and farmers' capacity building. The workshop reviewed the project scope, sustainability strategies, required environmental and social safeguards, instruments including the ESIA, RAP, SEP, and Gender Action Plan, and outlined the development of 3,073ha modern irrigation, construction of canals, booster pumping stations, and paddy field expansion. These efforts aim to improve food security, climate resilience, and access to water for both irrigation and livestock in Nyagatare District.

The workshop outcomes strongly link with prior stakeholder consultations for this project. Emphasis was placed on participatory irrigation management through Water User Associations (WUAs) and farmer cooperatives, in line with community feedback on sustainable water use, livelihood enhancement, and social inclusion. RAB's role was highlighted in supporting the establishment of these cooperatives, providing technical support for modern irrigation practices, and ensuring the long-term sustainability of the scheme. Overall, the workshop provided a clear framework for coordinated project implementation, reinforcing Rwanda's commitment to inclusive, community-driven, and environmentally responsible irrigation and livestock water management.

9.4.2 Consultations with Nyagatare District officials

The consultations, held on 28 July 2025, began with fruitful discussions with the District Environmental Officer of Nyagatare District. During the meeting, the project team presented the planned activities for the first phase of implementation, highlighting the socio-economic benefits such as improved irrigation, enhanced livestock water supply, and increased agricultural productivity. At the same time, potential environmental and social risks were thoroughly discussed. District officers were invited to provide their insights on strategies to minimize adverse impacts and ensure sustainable project outcomes. A photo illustrating the meeting is attached to this report as Annex 12.

The District officials acknowledged these potential challenges and expressed their full commitment to supporting the project. They pledged to provide technical guidance, and facilitate coordination with other ongoing development initiatives to guarantee the successful and sustainable implementation of the project. The minute of meeting is attached to this report as Annex 13.

9.4.3 Consultation with REMA & RAB: Joint field visit with Client Environmental and Social (ES) Staffs, ESIA Consultant (IBC Group), REMA, and RAB Representatives

A joint field mission was conducted on 03 July 2025 as part of the Environmental and Social Impact Assessment (ESIA) preparation for the Irrigation Project under the Muvumba Multipurpose Water Resources Development Program as highlighted by the Minute and Attendance List in Annex 14. The mission team, composed of the ESIA Consultant (IBC Group), Client ES staff, and representatives from REMA and RAB, visited the proposed irrigation sites to evaluate potential environmental and social impacts on the local community and surrounding ecosystems. During the site visit (photo in annex 15), the team assessed the existing Muvumba Perimeter 8 (P-8) irrigation scheme, traced the route of the proposed left main canal from the intake point along the scheme's belt road, and analyzed potential cumulative impacts on water availability. Environmental flow assessments confirmed that the dam design will ensure sufficient downstream water for the existing scheme, minimizing the risk of shortages. The team also inspected the acacia tree plantation along the Muvumba River and noted that the proposed canal alignment, located on an upper hillside area, would not interfere with the plantation.

The mission further observed that the hillside areas between the current wetland-based scheme and the planned irrigation system remain underutilized for agriculture. With the implementation of the new irrigation infrastructure, these lands will become more productive, increasing agricultural opportunities and the socio-economic value of the area. Overall, the field mission provided important insights into the integration of the proposed irrigation scheme with existing infrastructure and confirmed that the project is unlikely to negatively affect the Muvumba P-8 scheme. On the contrary, it is expected to generate positive environmental and social outcomes through improved land use and sustainable water management.

9.4.4 Consultation with Civil Society Organization

On 30th June 2025, a stakeholder consultation meeting (see photo in annex 16) was conducted at the head office of the Rwanda Rural Rehabilitation Initiative (RWARRI), following an official invitation letter and minute of the meeting (see Annex 17). RWARRI is a non-governmental organization committed to promoting and enhancing the social and economic well-being of rural communities across Rwanda.

The face-to-face consultation aimed to gather insights and perspectives on improving agricultural practices, particularly in Nyagatare District, where RWARRI is actively engaged in livelihood enhancement programs.

9.4.5. Consultation with Nsheke Primary School

On 29/08/2025, a face-to-face consultation was held at Nsheke Primary School with the Head Teacher by the consultant facilitated by the RWB staff and property valuer as shown in Annex 18. The team presented the Irrigation Project, detailing canal construction, livestock infrastructure, and compensation measures. The school will be partly affected on toilet facilities and fencing subject to compensation. Key concerns raised included latrine replacement, pupil safety during construction, and GBV risks due to labour influx. Commitments were made to build new toilets, assign a security guard, and conduct GBV awareness sessions. Inputs will inform ESIA and RAP mitigation planning prior to works commencement.

Further consultation was conducted on 30 October 2025 regarding the impacts of the project on Nsheke Primary School, which will be partially affected by the Right Bank Canal. The meeting, held at Nyagatare District, brought together district education officers, the District Valuation Officer, and the District Executive Secretary to discuss the extent of the impacts, including the loss of approximately 2,280 m² of school land, eight latrines, and several trees.

It was agreed that, although the affected land will not be compensated in cash since it is government-owned, the project will provide in-kind compensation measures. These include the construction of eight improved latrines to replace those that will be lost, the provision of nearby agricultural land to support the school feeding program, and the replanting of trees. The District further requested that the replacement toilets comply with current school construction standards. In addition, a protective fence will be installed along the canal to ensure pupil safety. The related costs for these restoration measures have also been estimated and agreed upon with the district. Annex 19 provides the detailed minute

Table 9-13: Summary of concerns raised and responses by Authorities and stakeholders

Issues/Concerns Raised	Response Provided
Will the installation of irrigation infrastructures lead to the loss of cultivable land and standing crops, and if so, what is the estimated extent and how will it be mitigated?	Yes, crops, houses, and land will be lost only where irrigation will be sited. Compensation will be provided to all PAPs in accordance with national expropriation law and donor's safeguard policy and Operational safeguard on land acquisition, restriction on access to land and land use and involuntary resettlement.
Will the project alter the downstream flow of the Muvumba River, and what impacts could this have on habitats and biodiversity?	Environmental flow will be maintained according to the dam design; therefore, no adverse impacts on the downstream ecosystem are anticipated.
Will the use of agrochemicals and pesticides contaminate soil, water, or harm human health?	Yes. the application of agrochemicals and pesticides may have potential risks on soil, water resources as well as human health. Where feasible organic alternatives will be applied. To prevent health effect from these substances, training and awareness programs will be conducted by project staffs for farmers on the safe handling, application, storage, and disposal

	of agrochemicals. In addition, buffer zones of 5m on each canal bank will be established along the main canal to minimize run off and contamination
Will irrigation and water storage increase the risk of waterborne diseases such as bilharzia and malaria?	Yes. Preventive health measures, including community sensitization and collaboration with health institutions, will be ensured.
Will sediment accumulation occur in canals due to erosion from upstream catchments?	Yes, there is a potential risk of sediment accumulation in canals due to soil erosion from upstream catchments, especially during heavy rains. To mitigate this, the project will implement catchment management measures around the dam catchment, planting trees within the dam buffer zone Sediment traps and check dams will be constructed at strategic points to reduce siltation before water enters the canal system. Regular desilting and canal maintenance will be carried out as part of the operation phase.
Could the project lead to the introduction of invasive species into local water bodies?	Yes but only locally adapted species will be introduced
How will local leaders and communities be involved in project execution and decision-making?	The project will consider locals and communities during its construction as well as operation phase. During construction, both will be engaged through public consultation meetings, to gather their views and concerns on ongoing construction works. Community led Grievance Redress Mechanism will also support the project to build strong relationship with the community through resolution of different grievances from the project. During operation, community will be engaged through involvement of district, RAB and water user association especially in making them aware of importance of protecting the canal to ensure sustainability of the scheme.
What are the compensation modalities and eligibility criteria for affected people?	Stakeholders were informed that compensation will be based on asset valuation, with a clear cut-off date and grievance redress mechanisms in place. It was also made clear that the donor consider three category of eligible persons to compensation apart from the one who have legal right to land or property as it is the only national legal requirement for compensation
How will the project ensure coordination with other development initiatives in the area?	Review meetings will be organized with local government institutions and other institutions such as MINECOFIN. Information sharing platforms will be used to keep all stakeholders informed of project activities and timelines
Will the project create employment opportunities for local people and support local socio-economic development?	Yes, as the irrigation will need different categories of labour, Priority will be given to local community during implementation.

Will new school latrines be constructed to replace those to be affected by canal construction?	Yes. The District authorities will collaborate with the project to construct replacement latrines in advance, ensuring that school operations continue without disruption.
The Head Teacher of Nsheke primary school raised concerns about potential traffic accidents that could disrupt learning. How will this be addressed?	To mitigate this issue, the contractor will ensure that a security guard is regularly stationed to guide pupils safely during construction activities, minimizing the risk of accidents and ensuring uninterrupted learning.

Table 9-24: Stakeholder Consultation Schedule and Attendance

Type of Stakeholders	Date of Meeting	Participants			Remarks
		Female	Male	Total	
Rwanda Agriculture and Animal resources Board (RAB)	12-15/05/2025	2	13	15	Annex 11
Nyagatare District officials	28/07/2025	0	1	1	Annex 13
REMA, RWB and RAB/CDAT	03/07/2025	0	5	5	Annex 14
Rwanda Rural Rehabilitation Initiative (RWARRI)	30/06/2025	0	1	1	Annex 17
Head teacher of Nsheke Primary School	29/08/2025	0	3	3	Annex 18
District different staff (District Executive Secretary, District Director of Education, District School Construction Engineer and District Valuation Officer)	30/10/2025	1	3	4	Annex 19
Local communities including PAPs	07/06/2025 18/06/2025 19/06/2025 01/07/2025 03/07/2025	216	317	533	Annex 20
Water User Association in Muvumba P8	02/07/2025	0	2	2	Annex 21
Rice farmers	02/07/2025	9	15	24	Annex 23

9.4.6 Consultations with Community members and PAPs

During the stakeholder consultation meetings conducted across various sectors of the Muvumba catchment, participants raised a range of concerns related to the design, implementation, and potential impacts of the Irrigation Project as highlighted by the Minute and Attendance List in Annex20. These concerns reflected the diverse interests and priorities of farmers, pastoralists, local leaders, women's groups, youth representatives, and vulnerable households.

The consultation team, comprising the ESIA consultants and technical experts from the Rwanda Water Resources Board (RWB), provided clarifications, technical explanations,

and policy guidance in response to each issue raised. The dialogue was conducted in an open and participatory manner, ensuring that all voices were heard and documented.

Community-wide discussions held across various sectors of the Muvumba catchment revealed a broad awareness and interest in the Irrigation Project. Participants including farmers, pastoralists, local leaders, youth representatives, women's groups, and vulnerable households recognized the project's potential to significantly improve agricultural productivity, reduce livestock mortality, and enhance access to clean and reliable water sources. Many welcomed the anticipated benefits, such as increased crop yields, improved food security, and the creation of local employment opportunities, particularly for women and youth. However, several concerns were raised related to project design and implementation. These included fears of waterborne diseases due to stagnant or poorly maintained irrigation canals, social disruptions from an influx of external laborers during construction, and the potential rise in gender-based violence (GBV) incidents.

In response, the consultation team comprising Environmental and Social Impact Assessment (ESIA) consultants and technical experts from the Rwanda Water Resources Board (RWB) engaged participants in open, participatory dialogue sessions to address each issue raised. The team explained how the ESIA process integrates robust public health safeguards, including requirements for proper water treatment and regular canal maintenance. Construction contractors will be obligated to implement comprehensive Environmental and Social Management Plans (ESMPs), covering community health, GBV prevention, and conflict mitigation. Community members were also informed about efforts to prioritize local hiring, ensure inclusive participation in training programs, and promote gender equity in access to project benefits. These transparent and inclusive engagements reassured the public and strengthened their confidence in the project's ability to balance infrastructure development with environmental protection and social wellbeing.

General community members and likely PAPs expressed mixed feelings about the project. While many were optimistic about improved water availability for farming and livestock, they raised concerns about potential displacement or disruption to land access and use. Some PAPs feared that their plots might be affected by the construction of canals or livestock watering facilities, especially without clear communication about compensation or land reallocation procedures. Others asked whether they would be consulted during site-specific planning and whether vulnerable households, such as female-headed families, would receive special consideration.

To address these concerns, the ESIA consultants outlined Rwanda's resettlement and compensation framework, clarifying that no displacement would occur without prior consent, valuation, and compensation in line with national laws. Community members were informed of grievance redress mechanisms and encouraged to continue voicing their feedback. The team emphasized that extensive baseline data collection and mapping were underway to minimize adverse impacts and ensure inclusive benefits. The consultative approach, which encouraged open dialogue and local knowledge sharing, helped build trust among participants and allowed for more nuanced understanding of on-the-ground realities. Consultation meetings with the community of Karama and Rwempasha sectors is illustrated in Fig. 9-1 and Fig. 9-2 below:



Figure 9-1:Public Consultation with local Administrative Authorities and community of Karama sector on July 3, 2025

The local populations owned the project and accepted to contribute as follows:

- Owning the project and allowing the Contractor to construct irrigation infrastructures in their own lands with compensation.
- Accomplish/execute excavation works where the canals and other infrastructures will be constructed and be paid for works done.
- Accept fair compensation for their affected lands and other assets where principal infrastructures such as temporal site installations, intakes, canals, reservoirs, cross drainages etc. will be constructed.
- Constitute required portfolio for the payment of affected lands and other assets (land title, bank account, identification information etc...).
- Take care and participate in the maintenance of placed irrigation infrastructures in their living administrative entities.



Figure 9-2Public meeting with local Administrative Authorities and community at Rwempasha Sector, Cyenjojo cell on July 1, 2025.

9.4.7 Discussion with Existing Water Users Associations (WUAs)

During the consultation meetings (as highlighted by the Minute and Attendance List in Annex21), representatives of existing Water Users Associations (WUAs), including the Chairman and the Manager (photo in annex 22), expressed both optimism and critical reflections regarding the Irrigation Project. While acknowledging the project's potential to improve water availability for both agriculture and livestock, they raised important concerns about its compatibility with the National Zero Grazing Policy. They highlighted that a significant number of livestock farmers in the area are in transition toward zero grazing systems, and they urged the project to consider appropriate infrastructure, such as household-level water connections or livestock troughs to support this shift. The WUA leaders also questioned whether their existing bylaws, local governance mechanisms, and water distribution systems would remain valid, or if they would be overhauled. Issues related to infrastructure maintenance, seasonal water allocation, and equitable access, especially during dry seasons, were also key points of discussion.

In response, the Rwanda Water Resources Board (RWB) officials and ESIA consultants clarified that while the current WUAs have played a pivotal role in water resource management, the project plans to establish new Water Users Associations that will be tailored to the upgraded irrigation systems. However, they emphasized that the new WUAs would build on the strengths of the existing structures by incorporating their experiences, leadership, and local knowledge. The project also includes dedicated components for institutional support, such as training on irrigation scheduling, infrastructure maintenance, and participatory conflict resolution. Furthermore, the team assured the participants that the new associations would be aligned with national policies, including the zero grazing directive, and that livestock water access points would be designed accordingly. WUA representatives appreciated the clarity and reaffirmed their readiness to collaborate, provided their voices continue to be heard and that a smooth, inclusive to help the new associations is ensured.

9.4.8 Discussion with Rice farmers

As part of the ongoing stakeholder engagement for the Irrigation Project, a dedicated meeting was held on 02 July 2025 with representatives of the Rice Farmers as shown in Annex23. The session aimed to listen to the perspectives of local farmers, understand their expectations, and address any concerns regarding the upcoming irrigation and livestock water infrastructure development. A total of 24 participants attended, including 9 women and 15 men, ensuring gender-inclusive representation within the discussion.

During the meeting, the ESIA Consultant and Rwanda Water Resources Board (RWB) experts provided an overview of the project's scope, including the construction of irrigation canals, water intakes, and livestock watering points. Farmers were informed about the anticipated benefits such as improved water availability during dry seasons, increased agricultural productivity, and enhanced livestock management opportunities. The team also highlighted potential environmental and social risks, alongside proposed mitigation measures, to ensure that the project implementation would align with sustainable land and water management practices.

The rice farmers' members actively shared their feedback and raised key concerns related to land acquisition, access to secondary and tertiary canals, and the potential for water use conflicts. They expressed strong interest in training opportunities on irrigation system maintenance, safe pesticide use, and livestock health management to maximize the project's benefits. Overall, the meeting provided an open platform for dialogue, with farmers

voicing both their support for the project and their expectations for fair compensation and active involvement in decision-making processes.

- Leaders of the local Community Based Organization;
- Existing Water Users Associations;
- General community;

Key concerns included:

- Equitable access to irrigation water and livestock water use points;
- Potential displacement or loss of land use rights;
- Risks of waterborne diseases and water quality degradation;
- Gender-based violence (GBV) and labor influx during construction;
- Maintenance responsibilities and sustainability of infrastructure;
- Inclusion of youth and women in project benefits and decision-making.

The responses given to the concerns are summarized in the Table 9-5

Table 9-35: Public Consultation with Communities of the project coverage

No.	Date	Venue of Meeting	Cells Targeted	Sector	Main stakeholder Groups attending	Male	Female	Total	Remarks
1	07/06/2025	Nyakagarama cell	Nyakagarama & Rurenge	Rukomo	Local Community (including PAPs) in the project area	36	43	79	Annex 20A (minute, translation and attendance list)
2	01/07/2025	Cyenjojo I	Cyenjojo cell	Rwempasha		62	26	88	Annex 20B(minute, and attendance list)
3	19/06/2025	Rutare	Rutare cell	Rwempasha		18	23	41	Annex 20C(minute, and attendance list)
4	18/06/2025	Nyabitekeri	Nyabitekeri	Tabagwe		38	12	50	Annex 20D(minute, and attendance list)
5	19/06/2025	Gitengure	Gitengure	Tabagwe		33	3	36	Annex 20E(minute, and attendance list)
6	19/06/2025	Nkoma	Nkoma	Tabagwe		30	20	50	Annex 20F(minute, and attendance list)
7	18/06/2025	Nkoma	Nyagatoma	Tabagwe		37	11	48	Annex 20G(minute, and attendance list)
8	03/07/2025	Bushara center village	Gikundamvura & Bushara cells	Karama		63	78	141	Annex 20H(minute,t and attendance list)
Total						317	216	533	

Table 9-46: Community Engagement Outcomes: Concerns and Responses

Issues/Concerns Raised in Community Meetings	Response Provided
Will our properties be compensated before canal construction start?	Yes, as per expropriation law, all affected properties will be compensated before any works start. In addition, PAPs have been communicated that they will be given 120 days to vacate the land as per the law.
Given the considerable width of the main canal, how will farmers be able to access their land located on the opposite side?	The project design incorporates the construction of access bridges at strategic locations to ensure farmers can safely and conveniently reach their land across the canal.
Will the existing irrigation canals of the Muvumba P-8 marsh land be removed?	No, because the new irrigation canals will not traverse the wetland, unlike the existing Muvumba P-8 scheme. The new canals will be constructed separately and will not interact with the existing P-8 infrastructure.
The project is beneficial to the community, but how will it ensure that the irrigation canals are protected from damage that could disrupt the scheme?	The project will establish a protected buffer zone of 5 meters on each side of the canal. In addition, people were communicated that community sensitization and awareness campaigns will be conducted to discourage encroachment and promote the protection of canal infrastructure.
Will the project support the community in resolving land title issues?	Yes. the project will collaborate with the district authorities to facilitate the processing and resolution of land title issues for affected community members
Will the local community be given employment opportunities during the construction phase?	Yes. The local community will be given priority during the recruitment process for construction-related jobs and inclusion of women will be given due attention
Will the land used for water troughs be compensated?	No. The water troughs will be constructed on land provided individually by each farmer. Therefore, each farmer will contribute a portion of their own land for the installation of their trough, and compensation is not applicable.
Will all community members have equal access to irrigation water?	Yes. Water distribution will be managed by the Water User Association, which will implement a fair and equitable schedule, consistent with practices in other established irrigation schemes.

Will landowners retain ownership of the remaining land after canal construction?	Yes. Except for the portions of land required for canal construction, all remaining land will continue to be owned by the respective landowners. The project aims to develop irrigated land while respecting and preserving existing land ownership rights.
Will the construction of additional irrigation canals cause a water shortage, considering that the existing Muvumba Marshland sources water from the Muvumba River?	No, assessment indicated that the construction of the additional irrigation canals will not affect the flow of the Muvumba River, ensuring that there will be no water shortage for the marshland or other users.
Will the land remaining between the existing M-8 irrigation canal and the new canal continue to be owned by the local community after construction?	Yes. The project will acquire only the land necessary for irrigation infrastructure. All remaining land will continue to be owned by the local community. The overall objective of the project is to enhance irrigation while supporting productive and sustainable use of community land.
When is compensation expected to be carried out?	Compensation will be completed prior to the commencement of project activities. The community will be adequately informed in advance about the process and timelines.
Will houses remaining after canal construction need to be relocated?	No, except for houses located within the designated buffer zone of the canal, which will require relocation. Houses outside this buffer area will remain in place, and no compensation for relocation will be provided.
What if the water troughs for livestock be individually allocated rather than communal? This approach will help prevent the spread of livestock diseases, improve management and maintenance of the water points, and safeguard both animal and community health. Incorporating this into the project design will ensure sustainable and safe water access for livestock while minimizing health risks for the surrounding community.	This is a great input! The project will ensure that troughs are designed for individual access to reduce disease risk and facilitate proper maintenance, promoting safe and sustainable livestock water use.
Will the dam reduce water flow to the existing weir used for Muvumba P-8 irrigation?	No. Hydrological assessments show that the dam's outflow will be sufficient for downstream irrigation and other uses, so water flow to the existing weir will not be affected.

During water filling in the dam, will there be any effect on the normal flow of the Muvumba River?	No. During the filling of the dam, the river flow will be maintained, with controlled and gradual water release to avoid any disruption, thereby ensuring that the normal flow of the Muvumba River continues uninterrupted.
The WUA Suggested training of cell and village leaders on water management to increase ownership	The project has planned targeted training activities to build capacity among leaders, enhancing water management, ownership, and maintenance of irrigation infrastructure.
What can be done improve ownership and supervision of livestock water points, the Water User Association proposed establishing a maintenance mechanism? What do you think of introducing user fees for livestock owners and collaborating with milk collection center leaders to collect contributions from farmers supplying milk, which would support regular maintenance and repair of the ponds/troughs?	The project will assess the establishment of an association or committee to oversee through use, following existing WUA practices to manage and supervise water use effectively.

9.5. Future Engagement - Linkage to the Stakeholder Engagement Plan (SEP)

The consultations described above are embedded within the broader Stakeholder Engagement Plan (SEP), which provides a structured and inclusive framework for stakeholder engagement throughout the entire project lifecycle. The SEP ensures that stakeholder identification and mapping remain dynamic and responsive to evolving project contexts. It promotes the use of culturally appropriate communication tools to facilitate meaningful participation across diverse groups, including vulnerable and marginalized populations. In addition, the SEP guarantees the establishment of accessible and functional Grievance Redress Mechanisms (GRMs) to address concerns in a timely and transparent manner. Through continuous feedback loops, the SEP supports adaptive management by integrating stakeholder input into project planning, implementation, and monitoring processes.

9.6.1. Community engagement during construction phase

The construction phase of irrigation project will pose significant risks and impacts to the community as mentioned in the impact chapter described above. Therefore, engaging the community during this phase is crucial for ensuring local ownership, reducing conflict, improving project sustainability and ensuring environmental and social safeguards are upheld.

The following approaches shall be used to engage the community during this phase:

❖ **Transparent Communication**

Regular updates about project progress will be shared to keep the community updated about the project. In case of any potential disruptions that may affect the community such as blasting, road and traffic movement, meetings, or notices shall be served prior to such disruptions;

1. Establish and operationalize Grievance Redress mechanism (GRM);
2. To ensure that community concerns and complaints are effectively raised and addressed, the elected Grievance Redress Committees (GRCs) will be made active, accessible, and encouraged to report any issues related to the project.
3. To strengthen their functionality, GRC members will receive training on how to accurately record, manage, and follow up on project-related grievances in a timely and transparent manner;
4. Accessible language: communication will be made in local language or translators as needed;
5. Inform communities about emergency procedures (e.g., in case of accidents or pollution);

❖ **Inclusive Participation**

1. Meetings with stakeholders: Meetings will be held with several categories of stakeholders such as community leaders, farmers, herders, women, youths and vulnerable groups.
2. Participatory monitoring: though it is the responsibility of the client, contractor and consultant, the project will collaborate with the community members in monitoring some safeguards matters such as livestock access points, water quality and provide information to effectively implement the project with community involvement
3. Gender and social inclusion: The project will actively promote the participation of women in decision-making processes related to water use. In addition, youth and other vulnerable groups will be meaningfully engaged to ensure that their needs, perspectives, and ideas are fully integrated into project planning and implementation. To support this, all project-related committees—including those similar to the Grievance Redress Committees (GRCs)—will be required to include representation from women and youth, ensuring their voices are effectively heard and their participation is impactful.

❖ **Respect for Livelihood and cultural practices**

It is evident that construction activities particularly during the installation of livestock troughs may occasionally interfere with cattle herders, affect livestock movement, or result in damage to crops. To minimize disruption to the community, the project will ensure that construction does not obstruct existing grazing areas or livestock water use routes.

In cases where crop damage occurs, fair compensation will be provided in accordance with the Rwandan Expropriation Law and the Bank's Resettlement Policy Framework. This approach aims to foster a positive relationship with the community and promote local ownership of the project.

Furthermore, to respect cultural heritage, the project will avoid disrupting sacred sites and community landmarks by adhering to the chance find procedures outlined in this ESIA.

❖ **Local employment and skills transfer**

To enhance effective community engagement during the construction phase, the project will prioritize the use of local labor wherever possible, ensure fair and safe working conditions, and promote skills transfer. This approach aims to build local capacity and create lasting benefits for the community beyond the project's completion.

9.6. Community engagement during operation phase

This section outlines key strategies for engaging communities during the operation phase of the project. Active community participation at this stage is critical to ensure the long-term sustainability of the project, proper use and maintenance of infrastructure, equitable access to resources, and continued local ownership. The approaches outlined below are designed to promote inclusive and efficient management of the project's operational activities:

❖ **Establish and support Water User Associations (WUAs)**

Water User Associations will serve as the cornerstone for community-based management of the irrigation infrastructure. These associations will be established and strengthened through targeted capacity building and financial support. Their responsibilities will include managing water distribution schedules, routine infrastructure maintenance, conflict resolution, and fee collection. Continuous training will be provided on key areas such as governance, record keeping, water scheduling, financial management, and equipment maintenance to ensure long-term functionality and accountability.

❖ **Involving the community in Operation and Maintenance**

Beneficiaries of the irrigation systems including farmers and livestock keepers will be trained to undertake routine operation and maintenance (O&M) of irrigation canals, water collection points, livestock water use facilities, and associated structures. In addition, local youth groups and community technicians will be equipped and empowered to perform first-line maintenance and conduct regular inspections. This approach not only guarantees timely interventions but also creates local employment opportunities and reinforces a sense of ownership and responsibility.

❖ **Enhance equitable access and social inclusion**

During the operation phase, deliberate efforts will be made to ensure that all segments of the community benefit fairly from water resources. Water use schedules will be designed based on an inclusive needs assessment, accommodating diverse uses such as crop irrigation, livestock water use, and domestic needs. The WUAs will play a key role in enforcing equitable water allocation while promoting the participation of women, youth, smallholder farmers, and vulnerable households. Special attention will be given to prevent elite capture and ensure that marginalized groups have a voice in decision-making.

❖ **Maintain regular communication and feedback Mechanisms**

Transparent and consistent communication is vital to build trust and encourage community involvement. Various tools such as community meetings, notice boards, mobile SMS alerts, and local radio broadcasts will be used to share key updates on water scheduling, planned maintenance, and any restrictions. A functioning grievance redress mechanism (GRM) will also be in place, allowing users to report issues, resolve disputes, and suggest improvements in a timely and inclusive manner.

Note: A standalone Stakeholder Engagement Plan (SEP) will be developed to guide stakeholder interactions throughout the project's lifecycle, including both construction and operation phases. The SEP will outline stakeholder mapping, stakeholder categories, their roles, preferred modes of engagement, and a clear schedule of engagement activities. It will ensure transparency, inclusivity, and responsiveness in all engagement processes, thereby enhancing the overall success and sustainability of the project.

9.7. Grievance Redress Mechanism

Effective grievance redress is a critical safeguard requirement in development projects, particularly those involving potential land acquisition, construction impacts, and changes to local livelihoods.

In alignment with the African Development Bank's Operational Safeguards particularly OS10 (Stakeholder Engagement and Information Disclosure) the Irrigation and Project has established a structured Grievance Redress Mechanism (GRM). This mechanism is intended to ensure that all complaints, concerns, and disputes related to the project are addressed promptly, transparently, and fairly.

The GRM provides a formal process through which Project Affected Persons (PAPs) and other community members can file grievances related to compensation, asset valuation, construction-related disturbances, or other project impacts. It ensures that such grievances are acknowledged, documented, and resolved within clearly defined timeframes at the lowest appropriate administrative level. The mechanism contributes to maintaining social harmony and project credibility by reducing the risk of unresolved conflicts that could delay implementation or lead to reputational damage.

9.7.1 Community GRM

The GRM is structured across four levels Cell, Sector, District, and the national level at the Rwanda Water Board (PIU-RWB) to allow for progressive grievance escalation when resolution is not achieved at lower levels. At each tier, designated Grievance Redress Committees (GRCs) are responsible for receiving, reviewing, and resolving complaints, with oversight from the Project's safeguards team. The following section details the composition and functioning of the GRM, reporting responsibilities, grievance logging and tracking procedures, and how this system supports the rights of PAPs in accordance with AfDB safeguard requirements.

The Grievance Redress committee was established through election by the Project affected people during the first consultation meeting held between the District officials, project representative and the project affected people. The elected committee is based at the cell level and is made up of six (6) members. Each GRC member is composed of President (1), Vice president (1), Secretary (1) and three Advisers (3). The main objective of the GRC is to ensure faster and better resolution of Project related complaints.

The project coverage at cell level encompasses 13 Cells (Bushara, gikoundamvura, Nyakagarama, Rukomo II, Rurenge, Cyenjojo, Rutare, Gitengure, Nkoma, Nyabitekera, Nyagatoma, Nsheke, and Barija) of five sectors of Rukomo, Tabagwe, Rwempasha, Nyagatare, and Karama. Therefore, 13 GRCs were established.

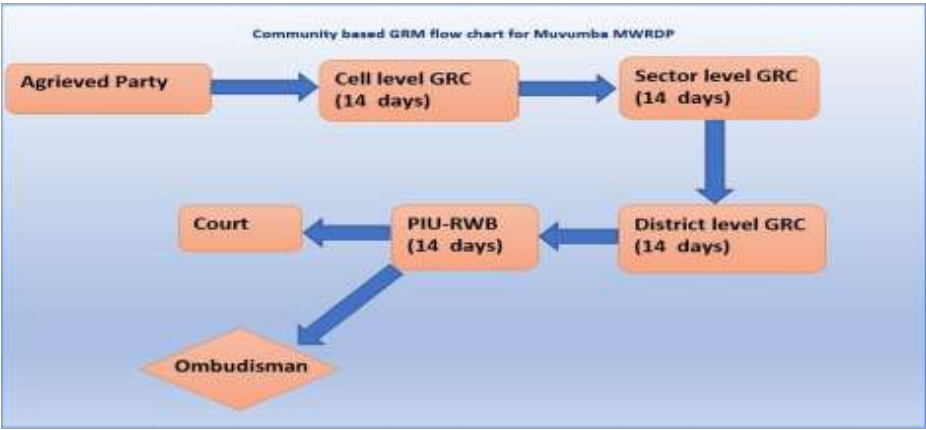


Figure 9-3: Chart of community GRM at different levels

The Community-Based Grievance Redress Mechanism (GRM) for the Muvumba MWRDP is structured to ensure timely and effective resolution of complaints raised by Project Affected Persons (PAPs). The process begins at the Cell level, where the Grievance Redress Committee (GRC) receives and addresses grievances within 14 days. During project implementation, this committee is required to meet with PAPs at least once every two weeks, and once per month during the monitoring phase. If the issue is not resolved at the Cell level, it is escalated to the Sector level GRC, which also has 14 days to respond. At this stage, the Sector Land Manager supports the committee in resolving concerns.

Should grievances remain unresolved at the Sector level, they are forwarded to the District level GRC, where the Director of the One Stop Center works alongside the committee to resolve them within another 14 days. If necessary, the matter can be further escalated to the Project Implementation Unit at Rwanda Water Board (PIU-RWB), where the Safeguards Specialist oversees grievance resolution. The PIU is responsible for collaborating with all lower-level committees and for monitoring each grievance to ensure it is resolved within the designated timeframe.

In cases where the aggrieved party is not satisfied with the PIU's resolution, the grievance can be taken to the Court or referred to the Office of the Ombudsman for independent review and final decision. This tiered structure ensures that PAPs have multiple opportunities for their voices to be heard, and that each concern is addressed thoroughly and fairly. The project's safeguards team plays a crucial coordinating role across all levels, ensuring transparency, accountability, and compliance with grievance resolution timelines.

9.7.2. Reporting mechanism

Cell Level Reporting:

At the Cell level, the Grievance Redress Committee (GRC) is responsible for recording all grievances in a standardized grievance logbook. Each grievance entry includes the complainant's name, nature of the complaint, date received, actions taken, and resolution status. On a monthly basis during implementation the Cell GRC compiles a summary report of all received and addressed grievances. This report is shared with the Sector GRC, either through physical submission or Email. In case of unresolved complaints, the details are forwarded immediately with full documentation to the Sector level for further handling.

Sector Level Reporting:

The Sector GRC maintains its own grievance log and collects Monthly reports from the Cell GRCs. It compiles a monthly consolidated report highlighting all grievances resolved at the Sector level and those received from the Cell level. The report includes follow-up actions, outcomes, and cases pending resolution. The Sector Land Manager ensures that this report is shared with the District Land Bureau and also acts as the technical liaison. Serious or unresolved grievances are escalated promptly to the district level, along with supporting documentation and response history.

District Level Reporting:

At the District level, the GRC led by the Director of the One Stop Center—receives reports from all Sector GRCs. A monthly district grievance report is prepared, including a summary of all grievances received, resolved, and escalated. Particular emphasis is placed on cases that required inter-departmental coordination or involved infrastructure or livelihood-related complaints. The District GRC submits this report to the PIU Safeguards Team at RWB. For escalated grievances, they attach all previous reports and actions taken to ensure continuity and accurate case handling at the national level.

RWB-PIU Reporting:

The PIU Safeguards Specialist at Rwanda Water Board maintains a centralized grievance database that compiles all reports received from District GRCs. A quarterly GRM report is generated, summarizing total grievances across all levels, categorizing them (e.g., compensation, access, environmental concerns), and noting trends or recurring issues. This report is shared with relevant stakeholders, including World Bank safeguards teams and project management. The PIU also ensures follow-up on unresolved cases and provides feedback to lower levels, especially

for learning and capacity-building purposes. If a case remains unresolved at this level, its referral to judicial or Ombudsman institutions is also documented.

9.7.3. Grievance Log

The Grievance Redress Mechanism Committee will ensure that each complaint has an individual reference number, and is appropriately recorded and tracked.

The log will contain record of the person responsible for an individual complaint received, and records dates for the following events:

1. Date of the received complaint
2. Name of the PAP complaining
3. Status of the complaint
4. Signatures of the PAP complaining
5. Signature of GRC
6. How and who addressed the complaint
7. Dates when the complaint was addressed.

In practice, grievances and disputes that are most received during the implementation of the Project include:

- Misidentification of assets or mistakes in valuing them; Dispute over the ownership of a given asset (two individuals claim to be the owner of the same asset) Disagreement over the value given to the affected assets. Successions, divorces, and other family issues, resulting in disputes between heirs and other family members, over ownership or ownership shares for a given asset. Issue of PAPs with no Bank accounts. Issue of PAPs that do not live on site, etc.
- The elected GRCs will receive different trainings by the Project on grievance redress mechanisms and trainings on social and environment safeguards policies.
- During the field mission, the team of consultant had fruitful Before closing the consultation meetings, the teams of consultant and experts from RWB asked participants to elect per Cell the Grievance Redress Committees (GRC) who will act as intermediary between the project managers and local population in solving raised complaints. Appendix IV contains the list of elected committees' members per Cell and their respective functions.

9.7.4. Grievance Redress Mechanism (GRM) for worker

In addition to the community-level grievance structures, the Irrigation Project will establish a dedicated Grievance Redress Mechanism (GRM) for workers employed directly by the contractor during project implementation. This internal mechanism is specifically designed to address grievances related to labor conditions, occupational health and safety, discrimination, wage disputes, harassment, contract violations, or any form of unfair treatment in the workplace. Establishing a worker-specific GRM reflects the project's compliance with the African Development Bank's Operational Safeguards (particularly OS1 on labor and working conditions) and Rwanda's national labor regulations.

The Workers' Grievance Redress Committee (WGRC) will be composed of five members to ensure fair representation and trust among the workforce. These include a President, Vice President, and a Women Representative, all elected directly by the workers. Additionally, the committee includes two Advisors, one of whom should be familiar with labor laws or experienced in worker representation. This structure allows the committee to handle a wide range of workplace concerns, promote gender inclusion, and ensure that workers are properly guided through transparent grievance procedures. The committee will function independently, with oversight from the contractor's Human Resources unit, and in coordination with the project's Environmental and Social Safeguards Officers.

The WGRC will maintain a confidential and accessible grievance submission system, which may include secure complaint boxes at the worksite, verbal submissions during designated office hours, or a dedicated phone line. Every grievance will be documented, assigned a unique reference number, and addressed within a target timeframe of 7 to 14 days. Once resolved, the decision will be formally communicated to the complainant. If the issue remains unresolved, it may be escalated to the contractor's senior management or, where appropriate, to the Rwanda Water Board's Project Implementation Unit (PIU). Strict confidentiality will be maintained throughout, and any form of retaliation against workers who submit complaints will be strictly prohibited.

To support the effective functioning of this mechanism, the project will provide specialized training to all WGRC members on grievance handling protocols, labor rights, gender sensitivity, and workplace health and safety standards. The contractor will also ensure that all workers are clearly informed about their rights and the GRM procedures during induction sessions, and through clearly displayed information materials at the worksite. By providing workers with a fair, safe, and responsive platform to raise concerns, the project aims to foster decent working conditions, reduce labor-related risks, and build trust within the workforce throughout the construction phase.

Figure 9-4: Composition and Roles of the Workers' Grievance Redress Committee (WGRC)

Committee Member	Role Description	Key Responsibilities
President	Lead authority of the WGRC; chairs grievance meetings and ensures timely, impartial handling of complaints.	- Chair all WGRC meetings - Ensure complaints are received and addressed promptly - Oversee grievance documentation and reporting - Liaise with HR and Environmental & Social Safeguards Officers - Ensure compliance with labor standards and project policies
Vice President	Assists the President and acts as lead in their absence; maintains continuity in	- Support the President in duties - Act as lead when President is unavailable - Organize meetings

	grievance handling.	- Follow up on resolution implementation - Coordinate among committee members
Women Representative	Represents female workers; promotes gender inclusion and addresses gender-specific grievances such as harassment or unequal treatment.	- Represent interests and concerns of female workers - Ensure gender-related grievances are addressed - Provide safe and confidential channel for female workers to raise concerns
Advisor 1	Provides expert guidance on labor law compliance, grievance procedures, and conflict resolution.	- Advise on labor law compliance - Support internal grievance procedures - Guide conflict resolution strategies, especially in complex/sensitive cases
Advisor 2	Acts as liaison between workers and contractor's management; contributes technical or legal perspectives.	- Facilitate communication between workers and management - Provide technical/legal insights - Support fair and informed grievance resolution

The Grievance Redress Mechanism (GRM) established under the Irrigation Project is a vital tool for ensuring fair, transparent, and timely resolution of worker-related complaints. By providing a structured platform that encourages inclusiveness, accountability, and confidentiality, the mechanism empowers workers to voice their concerns without fear of retaliation. The well-defined roles within the Workers' Grievance Redress Committee (WGRC) promote effective management of grievances, foster trust between labor and management, and contribute significantly to a safe, respectful, and productive work environment. Ultimately, the GRM strengthens project implementation by addressing social risks proactively and upholding workers' rights throughout the project lifecycle.

10. IMPLEMENTATION SCHEDULE AND BUDGET

Table 10-1: Implementation schedule of E&S activities for irrigation project

Phase	Planned E&S activities	Institutional responsibility	2025				2026				2027				2028				2029				2030			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Pre-construction	Preparation of a detailed Resettlement Action Plan (RAP) to guide land expropriation and based on clear criteria for eligibility	RWB Via Independent Party																								
	RWB in collaboration with local authorities will undertake fair expropriation/compensation of all affected population as per the National Expropriation/Compensation Law, and in observance of the AfDB's ISS policies, prior to the start of the works	RWB in collaboration with Nyagatare District																								
	Establishment a credible, independent and empowered local grievance and redress mechanism (GRM) to receive, facilitate and follow up on the resolution of affected people's grievances and concerns about the environmental and social performance of the project.	RWB & RAB																								
	Rwanda Water Board to prepare and implement Labor Management Procedure (LMP) including Capacity building to PIU staff on AfDB's policies	RWB																								
	Rwanda Water Board to prepare Pest Management Plan (PMP)	RWB																								
	Rwanda Water Board to prepare ESIA/ESMP	RWB																								
	Rwanda Water Board to prepare and implement stakeholders engagement plan (SEP)	RWB																								
	Recruitment of E&S Staffs	RWB																								
	Capacity building of STAFF/district	RWB																								
	Hiring contractor for construction & Supervision	RWB																								
	The contractor will prepare Specific Contractor's Environment and Social Management Plan (C-ESMP) which include among others a Vegetation Restoration Plan and Soil and Sedimentation Control Plan, Hazardous waste Management Plan, Spoil Management Control Plan and Waste Management Plan and Air Quality and Dust Management Plan.	Contractor																								
Construction	Preparation of ESIA/ESMPs for Temporal campsites, burrow pits and quarry sites	Contractor																								
	Construction of irrigation infrastructures	Contractor																								
	Contractor's ESMP Implementation (Traffic management plan, EHS, Waste management plan,	Contractor																								
	Operationalization of Grievance redress Mechanism (GRM)	GRCs & RWB																								
	Labor Management Procedure (LMP) Implementation (CoC, Recruitment, Empowerment, etc.,)	RWB																								
	Stakeholder's Engagement Plan (SEP) Implementation (Meetings, workshops, trainings, etc.,)	RWB & RAB																								

Decommissioning	Capacity building Related Cost	RWB	4,050,000	Capacity building cost
	Implementation C-ESMP implementation (Rehabilitation of leased land for temporal sites, borrow pits and quarry sites)	Contractor	7,200,000	Summation of ESMP (6,500,000Frw), ESMP Monitoring and Capacity Building Costs (700,000Frw) During Decommissioning Phase
	Operationalization of Grievance Redress Mechanism (GRM)	RWB		
	Project closing report and handover	RWB Via Independent Party		
	Project Completion E&S Performance Audit	RWB and RAB	180,000,000	New budget
Operation	Updating the emergency response and preparedness plan	RWB	68,450,000	Summation of ESMP (60,800,000Frw), ESMP Monitoring (7,000,000Frw) and Capacity Building Costs (650,000Frw) During Operation Phase
	RAB to implement Pest Management Plan (PMP) including farmers training on pest management, and agrochemical management	RAB		
	Establishment and training of WUAs	RAB		
#	GRAND TOTAL		<u>6 764 701 018</u> ~~6 763 701 018~~	ESIA implementation budget

11. CONCLUSION

An effective implementation of irrigation project which will irrigate about 9,900 hectares and deliver 3.94 Mm³ per year for water dedicated to livestock will not only enhance economic growth at the local District and five sectors concerned, but also will contribute to boost up the national and regional economy in general.

Nevertheless, as development project to be implemented in a densely populated country, it will likely generate adverse impacts to human community and environment. As outlined in the ESIA impacts will include acquisition of lands and destruction of individual assets for irrigation infrastructures construction, changes in hydrological regime downstream the constructed dam and its ecological consequences, water pollution by residues of fertilizers and pesticides and its negative effects to biological living organisms, biotic constraints (weeds, insects and diseases) and decline in soil fertility, increased risk of malaria, bilharzia and other waterborne diseases due to reserved water etc.

With reference to the potential adverse impacts and risks to be encountered in the implementation of the irrigation project, the present ESIA study proposes adequate preventive and mitigation measures to offset these adverse impacts in return. Moreover, in the present ESIA report, all the identified potential positive and negative impacts have been highlighted and responsibilities to implement the proposed mitigation measures as well as monitoring the execution of project's activities have been mentioned.

Therefore, the implementation of the Environmental and Social Management Plan (ESMP) consigned in the present report, conducting regular inspections and audits, plus continuous monitoring of project's activities implementation, all these will constitute favorable conditions for the success of the project through the complete achievement of its objectives.

The envisaged total benefits of irrigation project during its operational phase will far outweigh the sum total of adverse impacts highlighted during the other phases of project implementation. The implementation of irrigation project's activities will not pose irreversible damages to the socio-environment and there is no adverse impact for which remediation is not feasible. Thus, we assume that the socioeconomic returns as a result of all planned activities efficiently executed worth to the investment. The total implementation cost for this ESIA is equivalent to 6 764 701 018 ~~6 763 701 018~~ **Frw.**

RWB is in charge of implementing the commitments contained in this ESIA. This responsibility will be implemented through contractor and supervising engineer in some instances. Therefore, RWB, contractor and supervising consultant will hire full time Environment and Social safeguards experts to monitor the implementation of the ESMP. The Bid Documents to be prepared for the project will incorporate the Environmental and Social Technical Clauses (ESTCs) as shown in Annex 2.

The Project contract document should include provisions for the contractor preparing and implementing Construction Environment and Social Management Plan (C-EMSP) to outline in further detail soil and sedimentation control, dust management, labour management and Gender/VMG inclusivity strategy, Gender-based Violence Action Plan, COVID -19 Protocols etc. Monthly E&S reports shall be provided to AfDB on the implementation of the safeguards provisions, Annual audits shall also be prepared and submitted to AfDB to track Project

Environment and Social Compliance. At the end of the completion of the construction, an ESMP Completion report is to be done.

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13. APPENDICES

Annex 1: ToRs for Updating Environmental and Social Impact Assessment (ESIA)

A1.1 Objective of the consultancy

The objective of this consultancy service is to prepare an updated Environmental and Social Impact Assessment (ESIA) to ensure adverse environmental and social impacts associated to the designs, construction and commissioning of the irrigation system are avoided or minimized and the positive ones enhanced.

A1.2 Consultancy requirements

The ESIA will be prepared in accordance with the requirements of

- (i) Law N°48/2018 of 13/08/2018 on environment,
- (ii) Ministerial order N°003/MoE/25 of 19/08/2025 establishing the list of projects that must undergo environmental impact assessment, instructions, requirements and procedures to conduct environmental impact assessment
- (iii) AfDB Integrated Safeguard System, 2023
- (iv) The Good International Industrial Practices (GIIP) of the Project's sector,
- (v) Other relevant legislations

A1.3 Scope of Work

The ESIA study will be carried out for the selected areas for development of irrigation system on the area equivalent to 3,073ha located in Karama, Tabagwe, Rwempasha, Nyagatare and Rukomo sectors of Nyagatare District. The ESIA must be conducted in accordance with requirements of EIA Regulations of the Republic of Rwanda and the AfDB ISS requirements. The Consultant will liaise, collaborate and interact with the RWB Single Project Implementation Unit (SPIU), particularly the Environment and Social Specialists dedicated to the project. The proposed ESIA will incorporate all practical and cost-effective measures for avoiding or minimizing negative environmental and social impacts, enhancing environmental and social benefits and ensuring sound environmental and social management. The ESIA report including an Environmental and Social Management Plan (ESMP) will be submitted for review by RDB according to national EIA Guidelines and Regulations of 2006 and will also need to be reviewed and cleared by the African Development Bank (AfDB).

1.4 Consultant Tasks for ESIA update

This task will be undertaken in line with the detailed engineering designs carried out in collaboration with RWB and the opinions from consultations with beneficiary communities. Further details of the activities and deliverables expected from the ESIA team are set out below.

Task 1: Inception phase

The objective of the Inception Phase is to establish a common understanding between the consultants' team and the client on the objectives of the assignment and the proposed methodology to achieve them. The inception process also enables the consultant team to familiarize themselves with the project area and with the available documentation. Further details of the activities and deliverables expected are set out below:

- Review the national and AfDB policy, legal and institutional framework and other relevant project documents in order to establish the alignment and compliance of this assignment to the existing legislation and regulation;
- Conduct a project site reconnaissance and describe environmental baseline and socio-economic conditions of the project areas,
- Describe the project activities and specify the boundaries of the area of assessment;
- Prepare a schedule of consultation sessions needed to update the ESIA including a list relevant stakeholder to consult.

Task 2: Updating the ESIA

The scope of the ESIA should include but not be limited to the following:

1. Predict the anticipated environmental and social risks and impacts, including risks related to labor influx, gender-based violence, sexual exploitation and abuse (SEA), sexual harassment in the work place.
2. Updated environment and social economic baseline information of the project area including biodiversity in the area
3. Elaborate on a Consultation/Stakeholder Engagement strategy before and during works. (The strategy could consist of recurrent consultations and/or a public information focal point/office/tent where citizens can go if they have inquiries).
4. Establish a grievance redress mechanism (GRM) for the project
5. Recommend feasible and cost-effective measures to prevent, reduce or mitigate negative impacts and enhance positive impacts of the project.
6. Estimate the impacts and costs of those mitigation measures, and of the institutional and training requirements to implement them.
7. Updated/ clear details on the project influence area (site, direct influence area, indirect/wider affected area), including associated facilities.
8. Prepare an environmental and social impact assessment report to include an Environmental and Social Management Plan (ESMP) including proposed work programs, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measures. The ESMP should clearly present the social risks and impacts whose mitigation and management are the responsibility of the Project Company (examples include mitigation and management of risks related to Labor Influx, GBV, SEA, material sites and workers camps)
9. Clearly outline the environmental and social clauses/covenants to be included in bidding documents.
10. Explain how the project would comply with the requirements (including consultation) of the OP 4.01 and the environmental and social requirements of other applicable Safeguard policies (e.g., Involuntary Resettlement (OP 4.12).

The consultant will undertake tasks required to assess the environmental and social impacts associated with construction and operation of irrigation system but not limited to:

- Physical environment and Site conditions: characterization and assessment of soil and vegetation attributes; topography, landforms, geology, climate and meteorology, water and air quality, hydrology, etc.
- Biodiversity survey: This should provide detail on the known and expected occurrence of species with an emphasis on native species. This is necessary to inform rehabilitation interventions that could safeguard or enhance habitat for species of conservation concern;
- Cultural environment: including present and projected, where appropriate (e.g. cultural properties, graves, religious, historical, sacred sites etc.) which might be affected during construction;
- Occupational Safety & Health concerns: The Consultants shall analyse and describe all occupational health and safety concerns, and community safety and health that are likely to arise as a result of construction and operations of the proposed facility. The Consultants shall make recommendations on corrective and remedial measures to be implemented under the environmental and social management plan. The Consultant will include emergency/disaster preparedness and response plans and a safety plan for the project;
- Legislative and Regulatory Framework: The Consultants shall identify and describe all pertinent national regulations and standards governing the environmental and social quality; construction standards; solid and liquid waste management; worker and population health and safety; protection of sensitive areas; land use control at the national and local levels; involuntary resettlement and expropriation; disclosure and public information; and ecological issues, etc. The Consultants will then determine their relevance to the project and state compliance issues;
- Assessment of the negative environmental and social impacts associated with outsourcing of proposed construction materials and propose mitigation measures and alternatives,
- Labour management: assessment of labour related issues at construction sites including occupational health and safety, child labour and general wellbeing of employees/workers and propose mitigation measures;
- Gender: assessment of gender based violence and sexual harassment and abuse associated with construction of irrigation infrastructures both at site and in the surroundings and propose possible mitigation measures;
- Undertake the stakeholder consultations with the communities to be positively and negatively affected by the project.

- Development of an Environmental and Social Management Plan (ESMP) to mitigate negative impacts: The Consultants shall develop a comprehensive Environmental and Social Management Plan (ESMP) for the project. The plan should recommend a set of mitigation, monitoring and institutional measures to eliminate, minimize or reduce to acceptable levels of adverse environmental and social impacts and/or maximize the project benefits. The ESMP should clearly present costs associated with proposed mitigation and monitoring actions as well as the institutions responsible for the ESMP implementation. The Consultants will assess the institutional needs required to implement the ESMP recommendations and propose measures to address identified gaps, such as staffing and training requirements for proper ESMP implementation and other necessary support.
- Development of Environmental and Social Monitoring Plan: The Consultants shall propose a plan of action to monitor the implementation of the proposed mitigation measures during the construction, operation and maintenance phases. The consultants are required to give specific descriptions and technical details of monitoring measures, including the parameters to be measured, methods to be used, frequency of measurements, definition of thresholds that will signal the need for corrective actions, and monitoring and reporting procedures. The consultants will provide time frames and implementation mechanisms, staffing requirements and cost outlays for successful implementation of the monitoring plan.
- Capacity assessment: undertake an assessment of the capacity of the various actors involved in ESIA licensing as well as implementation, highlighting areas of concerns and need for capacity building. It should RWB/RAB's current systems and their capacity to manage the environmental and social aspects of the project, and to monitor and oversee the environmental and social performance of the Project. This should also cover other relevant parties and institutions. The section should recommend measures to close any capacity gap, to ensure that the capacity to meet the requirements of the AfDB's safeguard policies, such as staff recruitment, staff training, the development of procedures, and the use of consultants to supplement capacity. These measures will be summarized in an action plan, including a timeline and itemized costs for capacity strengthening measures.

A1.5 Structure of the Updated ESIA Report

The ESIA report structure will include the following main sections:

1. **Executive summary;** concisely discusses the purpose and need of the proposed action, significant findings and recommended actions, including the stakeholders' engagement, the cost for the measures, and the institutional arrangements for implementation.
2. **Introduction:** including objectives and methodology used in the preparation of the ESIA

3. **Policy, legal and institutional framework:** This section presents the analysis of the legal and institutional framework for the project within which the ESIA is carried out, consisting of
 - (i) the host country's applicable policy framework, national and local laws and regulations, and the respective institutional capabilities (including implementation) concerning E&S issues;
 - (ii) national environmental and social action plans or strategies and obligations of the country directly applicable to the project under relevant international and regional treaties and agreements,
 - (iii) applicable requirements under the OSs and the African Development Bank's Integrate Safeguards System (ISS) Guidance Notes;
 - (iv) the identification of differences between the Borrower's existing Environmental and Social Framework, and requirements relating to the project that may affect how the project is carried out in a manner consistent with the OSs;
 - (v) a description of how any deficiencies in the host framework can be addressed through administrative, legislative or regulatory change, institutional strengthening, and capacity building.
 - (vi) This section will further describe the roles and responsibilities of the key players
4. **Analysis of design alternatives:** the section shall evaluate a reasonable range of feasible project alternatives to meet the project's purpose and needs (eg: location, technology options or timing) and their E&S implications, including a no project alternative. Assesses the alternatives' feasibility of mitigating the E&S impacts, the capital and recurrent costs of alternative mitigation measures, and their suitability under local conditions, and the institutional, training, and monitoring requirements for the alternative mitigation measures. For each of the alternatives, quantifies the E&S impacts to the extent possible, and attaches economic values where feasible.
5. **Design measures:** Presents the basis for selecting the particular project design proposed, including for applying the mitigation hierarchy
6. **Project Description:** concisely describes the proposed project and its geographic, environmental, social and temporal context, including associated facilities, third parties, and any offsite investments that may be required (e.g. Dedicated pipelines, access roads, power supply, water supply, housing, etc), include a map of sufficient detail showing the project site and the area that may be affected by the project's direct, indirect, cumulative impacts

The consultant shall describe the proposed project in detail, its location, and components as well as its layout as per the designs. In summary the project description should include but not be limited to:

- a) History, purpose, context and expected economic benefits (local and national) of the proposed new bridge, including any proposed, reasonably defined, or ongoing development that might have a cumulative impact
- b) Describe the design, location, footprint, layout and size of the Project
- c) Identify and describe the project area of influence
- d) identify and describe each of its associated facilities to the extent that they can be reliably determined (with adequate justification) such as dedicated access roads, construction and worker camps, raw material and product storage facilities, water supply, expected dump and quarry sites

- e) describe expected activities during pre-construction, construction, and operation (to the extent known), as well as the estimated number of workers, and the volumes of materials to be transported
- f) include an indicative schedule for pre-construction and construction (to the extent known).
- g) Describe the zone of impact

7. Environmental and social baseline data: this should:

- a) describe relevant physical, biological, health, safety, security, social (including gender), cultural and socio-economic issues and conditions, and receptors of impact, including any changes in them anticipated before the project commences.
- b) Describe how climate change is affecting or likely to be affecting the project area and how this may influence the nature of project risks and impacts. Describes how the project may be affecting or contributing to climate change and its associated risks and impacts.
- c) Identify and characterize individuals and groups that are, due to circumstances, vulnerable, discriminated against, and underserved in, or excluded from, mainstream society. Disaggregated data on all such social groups should be provided to the extent that personal and group safety and data confidentiality and privacy are not compromised.
- d) Describe contextual risks (e.g. the political economy) that may affect the ability of the project to be carried out in a manner consistent with the OSs and other requirements such as international human rights obligations.
- e) Are informed by current and proposed development activities that are within the project area yet not directly connected to it but that may still have a cumulative effect on project impact.

See Annex 2 of the TOR for a detailed additional section on baseline.

8. Evaluation of potential adverse environmental and social risks and impacts (including cumulative impacts) of the proposed project activities and propose corresponding mitigation measures. This section shall include all relevant E&S risks and impacts of the project, including cumulative impacts specifically identified in the OSs, and any other E&S risks and impacts arising as a consequence of the project, including the risks and impacts identified in OS1, and other relevant OSs To the extent demonstrable, characterize the residual impacts in terms of their magnitude, extent, duration, reversibility and significance.

When describing impact, also Identify the receptors that may be affected, indicating their sensitivity and significance, quantify impacts to the extent possible, in terms of their magnitude, duration and consequences, including in terms of environmental costs and benefits and Distinguish impacts of pre-construction, construction and operation as well as positive and negative impacts, and their magnitude and significance among others.

9. Mitigation measures: Recommended feasible measures to prevent, reduce or mitigate significant negative impacts. Indicate the impacts and costs of those measures, and of the institutional and training requirements to implement them.

- a) Identify avoidance, minimization and mitigation measures and significant residual impacts that cannot be mitigated and, to the extent possible, assesses the acceptability of these residual impacts.

- b) Identify measures to enhance positive impacts and opportunities.
- c) Identify differentiated measures so that adverse impacts do not fall disproportionately on the vulnerable.
- d) Assess the feasibility of mitigating the E&S impacts, the capital and recurrent costs of proposed mitigation measures, and their suitability under local conditions, and the institutional, training, and monitoring requirements for the proposed mitigation measures.
- e) Specify issues that do not require further attention, providing the basis for this determination.

10. Environmental and Social Management Plan (ESMP) that includes (i) the measures to be taken during the implementation of this project to enhance the positive impacts, or to reduce them to acceptable levels, and (ii) the cost, processes and implementation arrangements needed to implement these measures (iii) Lines of responsibility for the actions (iv) The time frame in which these mitigation measures will be handled.

In addition to the above, the indicative content of an ESMP will include the following:

- a) Mitigation, compensation, and enhancement The ESMP identifies measures and actions, in accordance with the mitigation hierarchy, that avoid or reduce risks and adverse E&S impacts to acceptable levels, and those that enhance positive impacts. The ESMP will include compensatory measures, if applicable. Specifically, it: summarizes all risks and adverse E&S impacts (including those stemming from associated facilities, cumulative impacts, and those involving highly vulnerable rural minorities (HVRM) or involuntary resettlement); • describes, with technical details, each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g. continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate; • estimates any E&S impacts of these measures; • takes into account, and is consistent with, other mitigation plans required for the project (e.g. for involuntary resettlement, HVRM, or cultural heritage); and • describes, with technical details, each maximization measure.
- b) Implementation schedule and cost estimates: For all three aspects (mitigation-compensationmaximization; monitoring; and capacity development and training), the ESMP provides: (i) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (ii) the capital and recurrent cost estimates and sources of funds. These figures are part of the total project cost.

11. Environmental and Social Monitoring Plan: this describes the (i) specific description and technical details of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and a definition of thresholds that will signal the need for corrective actions; and (ii) monitoring and reporting procedures to ensure the early detection of conditions that necessitate particular mitigation measures and to furnish information on the progress and results of mitigation.

12. Capacity development and training:

- a) To support timely and effective implementation of E&S components and mitigation measures, the ESMP draws on the assessment of the existence, role, and capability of responsible parties on site or at the agency and ministry level. As relevant, it may also consider responsible third parties and stakeholders who may play a role in project implementation and monitoring.
- b) Specifically, to provide a specific description of institutional arrangements, identifying which party is responsible for carrying out the mitigation and monitoring measures (e.g. for operation, implementation support, enforcement, monitoring of implementation, remedial action, reporting, and staff training).
- c) To strengthen the E&S management capacity of the agencies responsible for implementation, the ESMP identifies the responsible entities on the basis of their prerogatives, and recommends strengthening these prerogatives and/or training their staff, and any other measure that may be necessary to support the ESMP implementation.

13. Stakeholder Engagement conducted by the consultant, summary of views from the stakeholders and how incorporated into the ESIA Report.

14. Grievance Redress Mechanism (GRM) for workers and communities according to the project-SEP and LMP,

15. Appendices:

- a) A list of the individuals or organizations that prepared or contributed to the updated ESIA
- b) References listing the written materials, both published and unpublished, that have been used,
- c) A record of meetings, consultations, and surveys with stakeholders, including those with affected people and other interested parties. The record specifies the means of stakeholder engagement that were used to obtain the views of affected people and other interested parties.
- d) Tables presenting the relevant data referred to or summarized in the main text.

A list of associated reports or sub plans i.e. C-ESMP and MSIPs,⁶⁸ detailed studies where done e.g. on ecology etc.

A1.6 Deliverables

The expected deliverables are as follow:

- 1. Inception report:** In the inception phase, the consultant will undertake consultative meetings, review and analysis of documents, and come up with an inception report. The report will describe in detail the approach, methodology and work plan to be used in executing the assignment. The inception report will also indicate the assumptions of the

⁶⁸ Including and as applicable Construction management, Traffic and access to construction site, Labour camps, Generic plans for the restoration of material sites (if applicable), Labour influx and labour rights, GBV and Sexual Exploitation and Harassment – SEA - (prevention and response) plans and responsibility for the same, Occupational Health and Safety, including accidents and the prevention and management of infectious diseases such as STDs and HIV, Community Health and Safety, Storage and disposal of hazardous and nonhazardous waste, including construction debris, Soil contamination, Surface and ground water contamination, Spill response, Blasting, Air emissions, Noise from equipment, operations (blasting and drilling), and traffic, Landslide prevention and slope stabilization, Storm water management, Emergency Response Plan, particularly during operations, Gender equity, Biodiversity protection and conservation, Cultural heritage, Traffic management and road safety, Site closure and restoration, chance find procedures

consultants, required documentation and inputs from the Client and any requirement that may have not been covered by the terms of reference but the Consultant deems necessary for the successfully accomplishment of the assignment. The consultant will convene an inception workshop for discussing the report to get feedback/comments after which the consultant will incorporate the feedback received and share with the client the final version of the inception report for approval. The inception phase is expected to be submitted in one week after contract signature

2. **Draft updated ESIA Report:** After field work, review of conceptual designs of the irrigation system and stakeholder consultations, the consultant will develop the draft ESIA in the format and outline prescribed in the final inception report. The consultant will present the draft ESIA to client and stakeholders for their comments and approval. The draft ESIA to be submitted within 4 weeks will also include the necessary tools that will be needed to operationalize the ESIA i.e. C-ESMP and its management plans.
3. **Final updated ESIA Report:** the client and AFDB will review the draft ESIA report for quality assurance and ensuring all comments on the draft report are well addressed to the client satisfaction. From the feedback of the stakeholders through the client, the consultant will then update the draft final report accordingly and develop the final ESIA report together with all the relevant tools. The final ESIA will require approval by the Client and clearance by the African Development Bank. The final report shall be submitted to the client within two weeks after addressing all comment provided by the client and the bank

All information should be in English. Where minutes need to be signed by local leadership, provide for copies in local language as well as English.

A1.7 Technical standards and requirements of the ESIA update

The ESIA must be prepared in line with government and the AfDB ISS requirements. The ESIA consultant will evaluate all the direct, indirect, cumulative potentially negative and positive environmental and social impacts associated with construction and commissioning of the proposed Muvumba downstream investment (irrigation project), and propose mitigation and enhancement measures.

In performing their duties, the consultants will submit all reports in English, both in word editable and in pdf formats, including maps at clearly readable scales, in both electronic and hard copy format. All major reports need to contain an executive summary. In addition to major reports, the consultant will also be requested to submit other documents such as photos, Shape files (GIS data), etc.

Annex 2: Environmental and social technical clauses (ESTCs)

Environmental and Social Technical Clauses (ESTCs)	Management practices by the Contractors and sub-contractors	Management practices by the Consultant	Cost (FRw)
ESTC 1: Solid Waste Management			
ESTC 1 :001 Management of domestic solid wastes	Avail solid waste bins, at least one bin for each category (e-wastes, chemicals, plastics, metals, glasses papers/wood and biodegradable wastes) and sort wastes at their sources accordingly; Ensure all solid wastes are handled by a licensed company involved in refuse management that will be hired by the contractor; Minimize the generation of wastes, segregate, reuse or recycle all the wastes, wherever practical; Avoid burning of solid waste; Do not allow ponding of water near waste collection/storage areas and construction camps; Discard all the storage containers that are capable of storing water, after use or store them in an inverted position.	Ensure the contractor has hired a local licensed company involved in waste collection and disposal; Inspection of the campsites and work sites to ensure there are no trashes	To be covered in the ESMP.
ESTC 1 :002 Management of excavated soil spoil	Consider the existing dumpsites which have been used as a dumping site for cut and excavated earth material from the Project for its capacity to handle the project soil spoil. Otherwise, look for new dumpsites. Selected dumpsites will not be located near river; streams; or any storm water runway. Preferably they will be located in areas of depression and of low land use value, where they cannot be washed into downstream ecosystems. Wherever possible, spoiled materials can be placed in low-lying parts of the topography or be used for filling exaction holes or road potholes and should be appropriately compacted. Prior to commencement of use of the dumping sites a plan of the management and rehabilitation of the dumpsite shall be prepared by the contractor and approved by the District Environmental Officer.	Conduct site surveys to identify the alternative sites for dumping Review and approve the management and rehabilitation plan for the dumpsite	To be covered in the ESMP.
ESTC 2 : Wastewater Management			
ESTC 2 :001 Sewage Management	Avail the adequate number of toilets and hand wash basins (one toilet for every ten persons with a minimum of a total of 10 toilets including at least 2 units at each active site (construction camp, borrow site, quarry	Define the location and number of toilets and hand	To be covered in the ESMP.

	site, dumpsite, etc) and separate latrines for males and females with total isolation by wall or by location. The sewage in the campsite will be handled using pit latrines and all along the work site by mobile toilets. Hand wash basins will also be provided along with toilets. Provision of adequate treatment and disposal for the sewage (septic tanks and soakaway pits)	wash basins and ensure safe disposal of the sewage. The toilets, septic tanks and soakaway pits will not be located in the storm water run way or flooding area.	
ESTC 2 :002 Management of Fuels and Hazardous Substances	Hazardous waste (including bitumen, oils, additives, grease, diesel, paints, etc) will be stored in appropriately labeled drums or similar sealed container, be placed in approved storage sites surrounded by concrete containment to avoid leaks to the environment Store all hazardous wastes appropriately in bunded areas away from water courses or provide absorbent and containment material (e.g., absorbent matting) where hazardous material are used and stored and personnel trained in the correct use. Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. Store hazardous materials above flood plain level. Drums will safely be transported to an approved chemical waste depot; Return the emptied container of hazardous material (e.g. bitumen drums, gas cylinders, etc) back to the supplier. However, if they are not empty prior to their return, they must be labeled with the name of the material they contained or contain and information on the supplier; Any spills should be cleaned-up within 24 hours;	Define the location for the waste storage sites away water courses and ensure not spills or leaks to the environment	To be covered in the ESMP.
ESTC 3: Water Resources Management			
ESTC 3-001 Avoidance of pollution to water resources	Strictly adhere with the management guidelines proposed in ESTC 1 and ESTC 2; Ensure waste substances do not enter waterways, storm water systems or underground water tables;	Ensure the contractor complies with the management	To be covered in the ESMP.

	Avail a water quality monitoring test kit for the water quality (Turbidity, pH, Electrical Conductivity (EC), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Chloride, Copper, Zinc, Cadmium, Lead, Grease and Oil, and Faecal coliforms) Monitor and report (monthly) the water quality characteristics in the runoff from the project site to the point of the drain discharges to the receiving water in the streams.	guidelines proposed for ESTC 3	
ESTC 3-002 Controlling storm water, erosion and siltation of water bodies	Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion Install temporary drainage works (channels and bunds) to avoid sediment and erosion from construction sites to the environment Divert runoff from undisturbed areas and install sediment catch basins, where appropriate, to capture sediment-laden run-off from site Stockpile materials away from drainage lines Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This shall be done in every exit of each construction vehicle to ensure the local roads are kept clean. Ensure that roads used by construction vehicles are swept regularly to remove sediment; Monitor and report the water quality characteristics in the runoff from the project site to the point of the drain discharges to the receiving water.	Ensure the contractor complies with the management guidelines proposed for ESTC 3	Part of site installation and construction works
ESTC 4: Drainage Management			
ESTC 4-001 Drainage Management and Safe disposal of the storm water	Implement the management guidelines related to provision of drainage proposed in ESTC 3-001 Ensure evacuation and safe disposal of the storm water from all project sites (excavation sites, road construction sites, campsites, borrow sites, quarry sites and dumpsites) to the recipient (road side drainage, ... river;	Ensure the contractor complies with the management guidelines proposed for ESTC 4-001	Part of the cost for site installation and drainages

	Establish local drainage line with appropriate trash and silt collector and screen for rainwater connecting to the existing established drainage lines; Rehabilitate road drainage structures immediately if damaged by contractors' road transports. Protect natural slopes of drainage channels to ensure adequate storm water drains.		
ESTC 4-002 Runoff control and Sediment Traps	Sediment traps/basins will be provided at the end or point of discharge of drains to reduce the storm water runoff velocity, allow settling of silt, sediments and suspended particles including trashes before discharging the storm water into a river, stream, or landscape	Ensure the contractor complies with the management guidelines proposed for ESTC 4-002	Part of the cost for installation of drainages
ESTC 5: Soil Quality Management			
ESTC 5-001 Avoidance of contamination of soil	Implement all waste management guidelines specified in ESTC 1 and ESTC 2 through good housekeeping of chemicals (grease, oil, bituminous, etc) and wastes to avoid chemical spillage and leaks or trashes that can pollute the soil.	Ensure the contractor complies with the management guidelines proposed for ESTC 5-001	Cost covered in ESTC 1 and ESTC 2
ESTC 5-002 Management of Construction material stockpiles	Limit the project activities and wastes within the project footprint (RoW, campsites, borrow sites, quarry sites and dumpsites) Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds	Ensure the contractor complies with the management guidelines proposed for ESTC 5-002	To be covered in the ESMP.
ESTC 6: Erosion and Sediment Control			

ESTC 6-001 Erosion from construction material stockpiles may contaminate the soils	Ensure evacuation and safe disposal of the storm water from all project sites (excavation sites, road construction sites, campsites, borrow sites, quarry sites and dumpsites) Locate stockpiles away from drainage lines and protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds Remove debris from drainage paths and sediment control structures	Conduct surveys and identify the storm water evacuation channels and disposal sites Ensure the contractor complies with the management guidelines proposed for ESC 6-001	Part of the cost for installation of drainages and excavation
ESTC 6-002 Cleared areas and slopes susceptible for erosion	Reinstate and protect cleared areas as soon as possible. Mulch to protect batter slopes before planting Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turfings/tree plantations Cover the loose sediments and water them if required Divert natural runoff around construction areas prior to any site disturbance Install erosion protective measures on site prior to construction, for example, sediment traps Control drainage through a site in protected channels or slope drains Install 'cut off drains' on large cut/fill batter slopes to control water runoff speed and hence erosion Observe the performance of drainage structures and erosion controls during rain and modify as required.	Carry out survey to identify areas susceptible to erosion Ensure the contractor complies with the management guidelines proposed for ESC-002	Part of the cost for installation of drainages and excavation
ESTC 7: Top Soil Management			
ESTC 7-001 Land clearing and earth works	Limit the project activities within the project footprint and avoid disturbance of soil outside the project site Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m. Remove unwanted materials from top soil like grass, roots of trees and similar others. The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. Locate topsoil stockpiles in areas outside drainage lines and protect from erosion.	Carry out survey to identify places where topsoil can be stored Ensure the contractor complies with the management guidelines proposed for ESTC 7-001	Covered elsewhere

	Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. Spread the topsoil to maintain the physico- chemical and biological activity of the soil. The stored topsoil will be utilized for covering all disturbed area and along the proposed plantation sites Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the binding of the soil layers, water penetration and revegetation		
ESTC 8: Topography and Landscaping			
ESTC 8-001 Land clearing and earth works	Undertake mitigation measures for erosion control/prevention specified in ESC-001 and 002 Undertake landscaping (filling of pits, holes and depressions) and greening through grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. Ensure the topography of the final surface of all raised lands (construction yards, approach roads, access roads, bridge end facilities, etc.) are conducive to enhance natural drainage of rainwater/flood water	Carry out survey of the area to identify the disturbed area for landscaping. Ensure the contractor complies with the management guidelines proposed for ESTC 8-001	To be covered in the ESMP.
ESTC 8-002 Greening in the road buffer zone, reinstated dumpsites, quarry and borrow site	Undertake greening through grass-turfing (complete land cover) and tree plantation Undertake greening through grass-turfing (complete land cover) and tree plantation (at least 1 tree per 5m spacing) for dumpsites, borrow sites and quarry sites under reinstatement Ensure three trees are planted wherever a tree is cut.	Undertake consultation with the District and REMA to identify which species to be planted in the road buffer zone. Ensure project compliance with the management guidelines for ESTC 8-002	To be covered in the ESMP.
ESTC 9: Construction Material Extraction			

ESTC 9-001 Sand extraction	Avoid extracting sand from the river bed in long continuous stretches; alternate patches of river bed will be left undisturbed to minimize the potentially negative impacts on the aquatic habitat. Not excavate deeper than 3 m at any single location. Not carry out sand extraction near chars that have sensitive Habitats Not carry out sand extraction during the night particularly near the chars Obtain approval from DSM before starting sand extraction from any location. Carry out sand extraction from sand bars to the extent possible. Maintain record of all sand extraction (quantities, location shown on map, timing, any sighting of key species) Provide silt fences, sediment barriers or other devices around the extraction areas to prevent migration of sediment rich water in to the river channels.	Carry out survey of the area prior to sand extraction and identify any sensitive receptors/habitats (e.g. bird colony) at or near the proposed sand extraction locations. Determine 'no-go' areas for sand extraction, based upon the above survey, Monitor the activity to ensure that the contractor complies with the management practices for ESTC 9-001..	Covered in the cost of supply of construction material
ESTC 9-002 Construction material from borrow pits and quarries	To consider existing dumpsite which is used as a disposal site for cut and excavated earth material from Project. The contractors shall conduct site investigations all around the sub-projects to ensure these sites have the required capacity to handle all earth material. The contractor will look for new dumpsites. Selected dumpsites will not be located near water bodies or any storm water runway. Preferably they will be located in areas of depression and of low land use value, where they cannot be washed into downstream ecosystems. Wherever possible, spoiled materials can be placed in low-lying parts of the topography or be used for filling exaction holes or road potholes and should be appropriately compacted. Existing borrow pits along the route will be used if any. New borrow pits (e.g stone, gravel exploitation) may have to be established where existing borrow pit material is not suitable or enough. Prior to commencement of use of the borrow pits, dumping sites and quarries an	Carry out survey of the area prior to establish a borrow or quarry site to identify any sensitive receptors/habitats (e.g. bird colony) at or near the proposed site. Determine 'no-go' areas based upon the above survey, Monitor the activity to ensure that the contractor complies	

	environmental and social management plan shall be prepared and approved by the the competency Authority, rehabilitation plan shall also be prepared and implemented after completion of construction works. As good environmental practices, it is proposed that existing borrow pits, quarries and dumping sites are given priority.	with the management practices for ESTC 9-002.	
ESTC 9-003 Blasting using explosive	Avoid carrying out any blasting during excavation or rock cut and other project work. Should unavoidable blasting (e.g. quarrying) the contractor will request and get approval from the competent authority. As per national regulations the blasting site should not be within a radius of 600 m of residential area and shall always take place during day's hours. · The methods and the means for the storage and the handling of the explosive should strictly adhere to national law, regulations and mining standards provided by the Rwanda Mines, Petroleum and Gas Board. · Recruit a person with a valid explosives manager's certificate as explosives manager. Ensure that activities that involve explosives, accessories or precursor substances are: - o managed by a certified explosives manager; - o carried out only by competent and certified persons; and - o carried out only if the licenses and permits required are in place. Ensure use or fitting high efficiency mufflers to noisy construction equipment and provide PPE protection to workers (masks, ear protection) exposed to the noise level above 85 dB to ensure compliance of the noise management measures, Monitor the vibration and noise level and their impacts to buildings and local people within a radius of 1 km	Assess the possibility of avoiding use of explosive, otherwise ensure the contractor has the permit and adheres with the explosive management practices (ESTC 9-003)	Covered in the cost of supply of construction material or other related civil work
ESTC 10: Air Quality Management			

ESTC 10-001 Management of machinery and vehicle exhaust emissions	Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. Proof or maintenance register shall be required by the equipment suppliers and contractors/ subcontractors Operate the vehicles in a fuel-efficient manner Service all vehicles regularly to minimize emissions Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites Limit the idling time of vehicles not more than 2 minutes.	Ensure the project machinery and vehicles compliance with the guidelines for the air quality management for machinery and vehicle's emissions (ESTC 10-001)	To be covered in the ESMP.
ESTC 10-002 Management of dust and particulate	Supply water and provide a mobile water tanker and suppress dust and particulate emissions at the stone crusher plants, excavation sites, borrow sites, etc. crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems Cover haul vehicles carrying dusty materials moving outside the construction site Impose speed limits on all vehicle movement at the worksite to reduce dust emissions Water construction materials prior to loading and transport Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site Restore disturbed areas as soon as practicable by vegetation/grass-turfing Store the cement in silos and minimize the emissions from silos by equipping them with filters. Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations; Avail the air quality monitoring kit for particulate matter (PM10, PM2.5) and monitor/report (daily) the PM10 and PM2.5 level at quarry sites, asphalt plants, borrow sites, excavation and construction sites	Ensure compliance of the project activities with the guidelines for the air quality management for dust emissions (ESTC 10-002)	To be covered in the ESMP.
ESTC 11: Noise and Vibration Management			

ESTC 11-001 Traffic vehicles Noise and vibration management	Maintain all vehicles in good working in accordance with manufacturer's maintenance procedures Ensure project drivers comply with the traffic codes concerning maximum speed limit, driving hours, etc. Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site; Avail a noise measurement device, monitor and report noise level at the noisy sensitive areas (centres, school, health centres, etc).For consistency purpose, monitor the noise level at the sites and compare the recorded values with the background noise level.	Ensure the project machinery and vehicles compliance with the guidelines for Noise and Vibration Management (ESTC 11-001)	To be covered in the ESMP.
ESTC 11-002 Management of Noise from machineries/equipm ent	Not carry out any blasting during excavation or any other activity. Should excavation be required (e.g. quarrying) the contractor will request and get approval from the competent authority. The blasting site should not be within a radius of 600 m of residential area and shall always take place during day's hours. Use the quietest available plant and equipment or modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines). Install acoustic enclosures around generators to reduce noise levels. Concentrate the project noisy activities during day's hours (7:00 am-6:00) and notify adjacent landholders prior to any typical noise events outside of daylight hours. Maintain all equipment in order to keep it in good working order in accordance with manufacturer's maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. Fit high efficiency mufflers to appropriate construction equipment and provide PPE protection to workers (masks, ear protection) exposed to the noise level above 85 dB To ensure compliance of the noise management measures, monitor the noise level at the sites and compared the recorded values with the background noise level	Ensure the project machinery/equipmen t compliance with the guidelines for Noise and Vibration Management (ESTC 11-002)	To be covered in the ESMP.

ESTC 11-003 Management of vibration impact on property during excavation, compaction, blasting	Undertake the field surveys to identify and record the status of buildings and properties that can be affected by the ground induced vibration from the project activities Compensate any damage (e.g. cracks in buildings) from the ground induced vibration at the satisfaction of the owners Undertake investigations of seismicity on the prospective sources of the material including quarries/borrow pits for embankment fills, pitching, rip rap, concrete aggregates and other construction materials; Lower vulnerability of infrastructure by enhancing prior measures such as the reinforcement of works Prepare an emergency response plan including response to earthquakes accidents (break, fall, fissures, landslip) that may occur during the construction works	Ensure all impacts from ground induced vibration from the project activities are compensated at the satisfaction of affected persons	To be part of the project civil works and contingent cost
ESTC 12: Protection of Flora			
ESTC 12-001 Vegetation clearance and revegetation	Before cutting any trees, count them and show them to Env. & Soc safeguard Specialist (s) and District forestry/EnvironmentaOfficer for assessment and approval; For every cut tree, replace it by planting 3 trees (native species); Reduce the disturbance to the surrounding vegetation especially those with protection status; Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. Wherever possible (where vegetation can grow), plant the vegetation on cuts and embankments Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction	Ensure compliance of the project activities with the guidelines for Flora Protection (ESTC 12-001)	To be covered in the ESMP.
ESTC 13: Protection of Fauna			
ESTC 13-001 Protection of animal habitat	Check the project site for the presence of sensitive habitats including active nests or eggs of migratory birds. In case active nests are identified, shift the work to the other sections and seek advice from or REMA Minimize the release of oil, oil wastes or any other harmful substances to the environment especially in water ways. Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching	Ensure compliance of the project activities with the guidelines for Fauna Protection (ESTC 13-001)	To be covered in the ESMP.
ESTC 14: Protection of Fisheries			

ESTC 14-001 Fishery Protection	Implement the management guidelines for Waste Management (ESTC 1 and ESTC 2) and Waste Resources Management and (ESTC 3) Minimize the release of oil, oil wastes or any other harmful substances to water ways. During abstraction of water in the nearby water bodies for suppressing dust or use in other construction activities, install and maintain aquatic lives/fish screens at the water intake	Ensure compliance of the project activities with the guidelines for Protection of fisheries (ESTC 14-001)	Cost covered in solid waste and wastewater management (ESTC 1 and ESTC 2)
ESTC 15: Road Transport and Road Traffic Management			
ESTC 15-001 Construction vehicular traffic	Prepare and submit a traffic management plan to the consultant for approval at least 30 days before commencing work on any project component involved in traffic diversion and management. Included in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges, temporary diversions, necessary barricades, warning signs / lights, and road signs. Avail traffic sign posts, warning tapes (at least 100 tapes) Provide road signs and warning tapes at strategic locations of the roads complying with the schedules of signs contained in the Rwanda Traffic Regulations. Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the following information in Kinyarwanda: Location: Village name Duration of construction period Period of proposed detour / alternative route Suggested detour route map - o Name and contact address/telephone number of the concerned personnel - o Name and contact address / telephone number of the Contractor - o Inconvenience is sincerely regretted.	Conduct surveys to identify the traffic accident hotspots and road deviation alternatives Review and approve the Contractor's Traffic Management Plan Ensure compliance of the project activities with the guidelines for the management of construction vehicular traffic (ESTC 15-001)	To be covered in the ESMP.

ESTC 15-002 Spillage of fuels and chemicals	Restrict the transport of oversized loads, uncovered, unsealed substances and overloaded trucks Enforce on-site speed limit by strategically position the traffic sign posts and humps at those accidents hot spots Clean up all spills of substances/material	Ensure compliance of the project activities with the guidelines for the management of Accidents and spillage of fuels and chemicals (ESTC 15-002)	To be covered in the ESMP.
ESTC 16: Wetland use activities			
ESTC 16-001 Earthworks and green infrastructure construction Activities in wetlands	Avoid as much as possible disruption of or other wetland (e.g. dumping or illegal discharge of pollutants); Respect the buffer zone regulation (avoid construction activities within 10 m of the nearby water bodies)	Ensure compliance of the project activities with the wetland and buffer zone protection guidelines	N/A
ESTC 17: Construction Camp Management			
ESTC 17-001 Siting and Location of construction camps	Submit to the consultant for approval a detailed layout plan for the installment of construction and construction camp showing the relative locations of all temporary buildings, including the management plan for the storm water, sewage and other wastes Construction camps will be small, will not include dormitories, only areas for eating, hygiene and sanitation, storage of belongings, etc. Construction camps and Construction camps will be installed as far as possible from the communities in order to avoid social conflicts; Local authorities responsible in the district for Environment health, social affairs and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.	Conduct surveys to identify the most suitable locations for dumpsites Review and approve the detailed layout plan for the installment of construction and construction camp showing the relative locations of all temporary buildings, including the management plan for the storm water,	Cost covered in the site installation

		sewage and other wastes	
ESTC 17-002 Water Supply and Sanitation Facilities	Provision of Safe and reliable water supply Hygienic sanitary facilities and sewerage system. Provision of the adequate number (one toilet for every ten persons) and separate latrines and bathing places for males and females with total isolation by wall or by location. Provision of adequate treatment and disposal for the sewage	Ensure compliance of the project activities with the guidelines for the management of Water Supply and Sanitation Facilities (ESTC 17-002)	Cost covered in the site installation & operation
ESTC 17-003 Stormwater management	Ensure harvesting of rainwater from the campsite building roof using water tanks (at least one tank of 5 m ³); Ensure safe drainage and disposal of all runoff generated from the campsite (soakaway pits or drainage to the side of the roads	Ensure compliance of the project activities with the guidelines for the management of the storm water (ESTC 17-002)	Cost covered in the site installation & operation
ESTC 17-004 Management solid of wastes	Implement the management guidelines for Waste Management ESTC 1)	Ensure compliance of the project activities with the guidelines for the management of wastes (ESTC 17-004)	Cost covered in the site installation & operation
ESTC 17-005 Management of Energy for cooking	Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them using biomass for cooking.	Ensure compliance of the project activities with the guidelines for the energy management (ESTC 17-005)	Cost covered in the site installation & operation

ESTC 17-006 Health and Hygiene	Provide a first aid kit and maintain a stock of medicines in the facility and appoint a full time designated first aider or nurse. Keep in contact with the ambulance to be used during an emergency. Initial health screening of the laborers coming from outside areas Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work Provide HIV awareness programming, including COVID 19, STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis Complement educational interventions with easy access to condoms at campsites as well as voluntary counseling and testing Install drainage facilities throughout the construction and construction camps and other project areas to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during the wet seasons. Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the project area containing messages on best hygienic practices	Ensure compliance of the project activities with the guidelines for the management of the storm water (ESTC 17-006)	Cost covered in the site installation & operation
ESTC 17-007 Safety	Post the campsite safety rules at the strategic places. Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors Provide appropriate security personnel (private security guards) and enclosures to prevent unauthorized entry into the camp area. Maintain a register to keep a track on a head count of persons present in the camp at any given time. Encourage use of flameproof material for the construction of labor housing / site offices. Also, ensure that these houses/rooms are of sound construction and capable of withstanding storms with strong winds and installed with lightning protection. Provide appropriate type of firefighting equipment suitable for the construction camps Display emergency contact numbers clearly and prominently at strategic places in camps.	Ensure compliance of the project activities with the guidelines for safety (ESTC 17-007)	Covered in the safety best practices

ESTC 17-008 Site Restoration	Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates if built. Maintain the noise levels within the national standards during demolition activities or international standards (noise residential level cannot be more than 80 dB) Contractor should connect with NGOs or the community to see potential use of good material that can be used by others. Dispose remaining debris at the designated waste disposal site. Handover the areas to land owner or district if agreement between both parties (contractor and land-owner) has been made and it will be signed and verified in a written report by the ESS that the area is clean of construction waste, hazardous waste (painting, diesel, oils, others). Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner.	Ensure compliance of the project activities with the guidelines for site restoration (ESTC 17-008)	Cost covered in the site decommissioning
ESTC 18: Cultural and Religious Issues			
ESTC 18-001 Construction activities near religious and cultural sites	Limit all construction activities within the footprints of the construction sites and avoid disturbance to cultural and religious sites, wherever possible Stop work immediately and notify the site manager if, during construction, an archaeological, grave or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by the DSM/PIU. Provide separate prayer facilities to the construction workers. Show appropriate behavior with all construction workers especially women and elderly people Allow the workers to participate in praying during construction time Resolve cultural issues in consultation with local leaders and supervision consultants Establish a mechanism that allows local people to raise grievances arising from the construction process. Ensure the local authorities responsible for health, religious and security are duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters	Ensure compliance of the project activities with the guidelines for Cultural and Religious Issues (ESTC 18-001)	To be covered in the ESMP.
ESTC 19: Environmental, Social, Health and Safety			

ESTC 19-001 Health and Safety Best practices	Hire 3 specialists: (1) Environmental Specialist; (2) The Social and Gender Risk Management Specialist; (3) The Safety, Health Specialist; Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes. Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating. Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration. Avail the adequate number of a complete set of PPEs such as overall, safety boots, helmets, masks, gloves, goggles, full-face eye shields, and ear protection. (every worker must have a complete set of PPEs) and ensure workers get training on PPEs use and maintenance. The application of prevention and control measures to occupational hazards should be based on comprehensive job safety or job hazard analysis. The results of these analyses should be prioritized as part of an action plan based on the likelihood and severity of the consequence of exposure to the identified hazards. Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters.	Ensure the contractor has an environment, health and safety manager to look after the health and safety of the workers Ensure the contractor complies with Worker Health and Safety	To be covered in the ESMP.
ESTC 19-002 Child and pregnant labor and Gender Based Violence (GBV)	The contractor and consultant will have GBV Specialists as part of the key staff of the team; Not hire children of less than 18 in accordance with the Law no 66/2018 regulating labor in Rwanda. Prepare a GBV action plan which will include but not limited to, the following activities: Action 1: Gather information to understand how violence directly impacts the project workers and communities around and the availability of services for victims and survivors of violence and exploitation in the project area	Inspect the work site and employee's records to check the contractor's compliance to child and pregnant labor (ESTC 19-002)	Covered elsewhere

	Action 2: Develop strategies and plans to address GBV, sexual exploitation and other abuse among the project participants (workers and communities). Consider interventions for the short term (six months to one year) and medium term (project duration) Action 3: Equip the project team (GBV specialist, ESS Specialists) to respond appropriately to support those seeking assistance Action 4: Include violence prevention and response activities in weekly, monthly, quarterly and annual work plans; Mandatory and repeated training and awareness raising (induction training and daily tool box talks to workers) about refraining from unacceptable conduct toward local community members, specifically women. Local people will also be sensitized against GBV and child labor before the start of the works and quarterly during the project implementation; Informing workers about national laws (e.g. Law 2 of N°59/2008 of 10/09/2008) that make sexual harassment and gender-based violence a punishable offence which is prosecuted; Introducing a Worker Code of Conduct (as shown in Annex 3) as part of the employment contract, and including sanctions for non-compliance (e.g., termination) including pursuing workers who have impregnated local women; During work, separate facilities for women & men, GBV-free zone signage. <i>In case of a grievance emanating from GBV, a special GBV task force will be established and will be in charge of receiving, assessing and handling all cases of sexual harassment and GBV.</i>		
ESTC 19-002 Child and pregnant labor and Gender Based Violence (GBV)	The contractor and consultant will have GBV Specialists as part of the key staff of the team; Not hire children of less than 18 in accordance with the Law no 66/2018 regulating labor in Rwanda. Prepare a GBV action plan which will include but not limited to, the following activities: Action 1: Gather information to understand how violence directly impacts the project workers and communities around and the availability of services for victims and survivors of violence and exploitation in the project area	Inspect the work site and employee's records to check the contractor's compliance to child and pregnant labor (ESTC 19-002)	Covered elsewhere

	Action 2: Develop strategies and plans to address GBV, sexual exploitation and other abuse among the project participants (workers and communities). Consider interventions for the short term (six months to one year) and medium term (project duration) Action 3: Equip the project team (GBV specialist, ESS Specialists) to respond appropriately to support those seeking assistance Action 4: Include violence prevention and response activities in weekly, monthly, quarterly and annual work plans; Mandatory and repeated training and awareness raising (induction training and daily tool box talks to workers) about refraining from unacceptable conduct toward local community members, specifically women. Local people will also be sensitized against GBV and child labor before the start of the works and quarterly during the project implementation; Informing workers about national laws (e.g. Law 2 of N°59/2008 of 10/09/2008) that make sexual harassment and gender-based violence a punishable offence which is prosecuted; Introducing a Worker Code of Conduct (as shown in Annex 3) as part of the employment contract, and including sanctions for non-compliance (e.g., termination) including pursuing workers who have impregnated local women; During work, separate facilities for women & men, GBV-free zone signage. <i>In case of a grievance emanating from GBV, a special GBV task force will be established and will be in charge of receiving, assessing and handling all cases of sexual harassment and GBV.</i>		
ESTC 19-003 First aid facilities and health care facilities	Avail at least 3 units of appropriately equipped first aid stations^[1] (one at campsite and two moving stations); Document and report occupational accidents, diseases, and incidents within 24 hours. Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures.	Inspect the work site to check the contractor's compliance to provision of First aid facilities and health care facilities (ESTC 19-003)	To be covered in the ESMP.

	Provide awareness to the construction drivers to strictly follow the driving rules		
ESTC 19-004 Campsite facilities	The Contractor shall implement the guidelines related to provision of water supply and sanitation facilities in the campsite (ESTC 19-002) including provision of safe and reliable water supply and hygienic sanitary facilities and those related to the storm water management (ESTC 19-003)	First aid facilities and health care facilities	Cost e covered in site installation
ESTC 19-005 Water and sanitation facilities at the construction sites	The contractor shall provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. Location of portable facilities shall be at least 6 m away from storm drain system and surface waters. These portable toilets shall be cleaned four times a day and all the sewerage shall be pumped from the collection tank once a day and shall be brought to the septic tank for further treatment or disposal. The contractor shall provide eating areas and drinking water to the construction workers at all the construction sites	Inspect the construction site to check the contractor's compliance to provision of potable water and sanitation facilities at the construction sites (ESTC 19-004)	To be covered in the ESMP.
ESTC 19-006 Health risks to workers and general public	Implement the guidelines for Waste Management (ESTC 1, ESTC 2), Water Resources Management (ESTC 3), Drainage Management (ESTC 4), Air Quality Management (ESTC 10), Noise and Vibration Management (ESTC 11) and Road Transport and Road Traffic Management (ESTC 15)	Ensure the compliance of the project activities to guidelines for the management of Health risks to workers and general public (ESTC 19-005)	Cost covered in site installation
ESTC 19-007 Trainings	Conduct regular training (induction, daily tool box) to all construction workers in environmental, basic sanitation and health care issues for more details). Train all construction workers in general health and safety matters, and on the specific hazards of their work. Training shall consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Implement malaria, COVID 19, HIV/AIDS and STI education campaigns targeting all workers hired, international and national, female and male,	Ensure workers get trainings on health and safety (ESTC 19-006)	Cost covered in ESH-001

	skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on an ongoing and regular basis. This shall be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing		
ESTC 20: Social impacts			
ESTC 20-001 Best practices for utility services, access to homes, businesses, agricultural fields or other natural livelihood assets, Noise, dust and other nuisances	Avoid the disturbance of utility services, access to homes, businesses, agricultural fields or other natural livelihood assets, Noise, dust and other nuisances Maintain any existing right of way across the whole or part of the construction site and public and private access to adjoining frontages in a safe condition and to a standard not less than that pertaining at the commencement of the contract. If requested by the consultant or the Contractor shall provide acceptable alternative means of passage or access to the satisfaction of the persons affected. Provide the access road to all buildings especially those accommodating business activities; Provide alternative temporary spaces for informal businesses (mobile credits selling stands, motorcycles parking sites); Engage with formal businesses owners in dialogue on potential periods of disruption; Conduct the construction works in phases so as to allow some businesses to continue; Provide temporary access bridges to the businesses during construction works; Provide appropriate information to potentially affected local communities prior to the beginning of any works in order to allay fears, complaints or potential risks due to lack of information or awareness about the project activities; Ensure provision of the disability accessibility including footpaths and access with railings and handrails; In case electricity and water supplies are to be disrupted, the PMU must inform affected households and businesses of the same at least 2 days in advance. Place wooden planks over constructed ditches which have not been reinstated to ensure access to the households along the construction route.	Inspect the construction site to enforce the best practices for utility services, access to homes, businesses, agricultural fields or other natural livelihood assets, Noise, dust and other nuisances (ESTC 20).	Cost covered in site installation and civil works

	Inform the street household businesses of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 2 weeks before start of the construction. Set up construction and traffic warning signs at the construction site. Provide safe and easy access to the household businesses putting clean and strong thick wood panels or steel plates over the open ditches. Avoid piling up materials and wastes within 20m from household businesses and shops. Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. Clean up construction areas at the end of the day, especially construction areas in front of business shops. Provide a night lighting system with luminously painted fence and night lamp.		
ESTC 20-002 Community health and safety risks due to lack of inadequate/ ineffective communication to local communities	Employ local casual labor and instruct them on environmental issues, safety and health before construction tasks are assigned. Communicate to migrant workers on local customs, practices and habits in order to avoid conflicts with local people. Maintain open communications channels with the local government and concerned communities; the contractor shall coordinate with local authorities (leaders of Cells or Villages, leaders of Sectors) for agreed schedules of construction operations in areas nearby sensitive places or during sensitive times (e.g. religious; sports events). A grievance mechanism/grievance redress committee will be set to mitigate or mediate for any project related issue to the community. The GRCs will be trained by the contractor on a quarterly basis (on training days, the contractor will provide transport allowances to the GRC members who attend the training). Copies of Kinyarwanda versions of these Environmental and Social Technical Clauses and of other relevant environmental protection documents shall be made available to local communities and to workers at the site. Project information will be disseminated to affected parties (e.g. local authorities, businesses and affected households, etc.) through community meetings before construction commencement. A contact address will be provided to the community.	Inspect the construction site to enforce the best practices Community health and safety risks due to lack of Inadequate/ineffective communication to local communities (ESTC 20).	To be covered in the ESMP.

	Community concerns and requested information are to be monitored as the project progresses. Inquiries must be responded to by telephone and written correspondence in a timely and accurate manner. Local resident's/community verifiers must be informed about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, demolition operations, as appropriate. Technical documents and drawings will be provided to local authorities, especially the sketch of construction areas and the ESMP of the construction site. Notification boards shall be erected at all construction sites providing information about the project, as well as contact information about the site managers, environmental staff, health and safety staff, telephone numbers and other contact information so that affected people could have a channel to voice their concerns and suggestions		

Annex 3: General Code of Conduct to be inserted in the ESMP, ESTC in the Tender documents.

This proposed project will comply with OS2 and OS4 and the Environmental, Social Health and Safety Guidelines of the WB (ESHS) and the Occupational Health and Safety (OHS) and Labor regulations of Rwanda. The following is a general Code of conduct to be inserted in the contract of contractors or sub contractors for civil works.

CODE OF CONDUCT FOR CONTRACTOR'S AND SUBCONTRACTOR'S PERSONNEL

We are the Contractor, *[enter name of Contractor]*. We have signed a contract with *[enter name of Employer]* for *[enter description of the Facilities]*. The Plant for the Facilities will be installed at *[enter the Site]*. Our contract requires us to implement measures to address environmental and social risks, related to the Installation Services i.e. services ancillary to the supply of the Plant for the Facilities, such as inland transportation, site preparation works/ associated civil works, installation, testing, precommissioning, commissioning, operations and maintenance etc. as the case may require.

This Code of Conduct is part of our measures to deal with environmental and social risks related to the Installation Services.

All personnel that we utilize in the execution of the Contract, including staff, labor and other employees of us and of each Subcontractor, and any other personnel assisting us in the execution of the Contract, are referred to as Contractor's personnel.

This Code of Conduct identifies the behavior that we require from the Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located).

Our workplace is an environment where unsafe, offensive, abusive or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

REQUIRED CONDUCT

Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located) shall:

1. carry out his/her duties competently and diligently;
2. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's and Subcontractor's personnel and any other person;
3. maintain a safe working environment including by:
 - a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
 - b. wearing required personal protective equipment;
 - c. using appropriate measures relating to chemical, physical and biological substances and agents; and
 - d. following applicable emergency operating procedures.
4. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;
5. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;

6. not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
7. not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;
8. not engage in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
9. not engage in any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage;
10. complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation and Abuse, and Sexual Harassment (SH);
11. report violations of this Code of Conduct; and
12. not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly. This can be done in either of the following ways:

1. Contact *[enter name of the Contractor's Social Expert with relevant experience in handling sexual exploitation, sexual abuse and sexual harassment cases, or if such person is not required under the Contract, another individual designated by the Contractor to handle these matters]* in writing at this address [] or by telephone at [] or in person at []; or
2. Call [] to reach the Contractor's hotline (if any) and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by the Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact *[enter name of Contractor's contact person(s) with relevant experience]* requesting an explanation.

Name of Contractor's Personnel: [insert name]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Contractor: _____

Signature: _____

Date: (day month year): _____

ATTACHMENT 1: Behaviors constituting SEA and behaviors constituting SH

ATTACHMENT 1 TO THE CODE OF CONDUCT FORM

BEHAVIORS CONSTITUTING SEXUAL EXPLOITATION AND ABUSE (SEA) AND BEHAVIORS CONSTITUTING SEXUAL HARASSMENT (SH)

The following non-exhaustive list is intended to illustrate types of prohibited behaviors.

(1) Examples of sexual exploitation and abuse include, but are not limited to:

- A Contractor's Personnel tells a member of the community that he/she can get them jobs related to the work site (e.g. cooking and cleaning) in exchange for sex.
- A Contractor's Personnel that is connecting electricity input to households says that he can connect women headed households to the grid in exchange for sex.
- A Contractor's Personnel rapes, or otherwise sexually assaults a member of the community.
- A Contractor's Personnel denies a person access to the Site unless he/she performs a sexual favor.
- A Contractor's Personnel tells a person applying for employment under the Contract that he/she will only hire him/her if he/she has sex with him/her.

(2) Examples of sexual harassment in a work context

- A Contractor's Personnel comment on the appearance of another Installation Services Personnel (either positive or negative) and sexual desirability.
- When a Contractor's Personnel complains about comments made by another Contractor's Personnel on his/her appearance, the other Contractor's Personnel comment that he/she is "asking for it" because of how he/she dresses.
- Unwelcome touching of a Contractor's Personnel or Employer's Personnel by another Contractor's Personnel.

- A Contractor's Personnel tells another Contractor's Personnel that he/she will get him/her a salary raise, or promotion if he/she sends him/her naked photographs of himself/herself.

Annex 4: Water quality analysis

Annex 4A: Water Analysis Average Results

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INES TESTING LABORATORIES

TEST REPORT

Report n° INES/WAQLAB/047/2025

ORIGINAL

I. Details of sample

Name of Customer: Rwanda Water Board

Address: KIGALI

Sample number: INES/TL/390/2025

Date of submission: 24/07/2025

II. Analysis of the sample

Condition of the sample: Good

Analysis completion date: 28/07/2025

Name of Laboratory : Water quality lab

Environmental Condition: Room temperature

Parameter tested	Unit	Results	Standards (RS 564:2023)
Physical chemical parameters			
pH		6.9	6.0 - 8.5
Electrical Conductivity (EC)	µS/cm	221.3	1000
Total Dissolved Solids (TDS)	mg/l	1305	-
Chloride (Cl ⁻)	mg/l	29.40	600
Salinity	‰	0.114	-
Nitrogen, Nitrates	mg/l	6.6	10
Total suspended solids (TSS)	mg/l	940	2100
Dissolved Oxygen (DO)	mg/l	7.01	3
Total manganese	mg/l	2.92	1000
Total mercury	µg/l	ND	2
Total arsenic	µg/l	ND	50
Sulphates	mg/l	78	600
Fluorides	mg/l	0.07	600
Lead	µg/l	9.02	-
Cadmium	µg/l	132	5
Biological oxygen demand BOD ₅	mg/l	5	-
Chemical oxygen demand COD	mg/l	11.5	-

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Total zinc	µg/l	40.38	2000
Total Hardness	mg/l	43	-
Magnesium (Mg)	mg/l	10.45	-
Phosphates	Mg/l	1.1	0.7

Bacteriological parameters			
Total coliform	cfu/100ml	1.69*10 ³	-
Fecal coliform	Cfu/100ml	2.32*10 ³	-

Responsible analyst UJENEZA Euphrosine 

Lab supervisor Dr. Nyirajana Jacqueline 

Vice chancellor
Father Dr. BARIBESHYA Jean Bosco 



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Annex 4B: Water Analysis Results for all Samples (1&2)

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INES TESTING LABORATORIES

TEST REPORT

Report n° INES/WAQLAB/047/2025

ORIGINAL

I. Details of sample

Name of Customer: Rwanda Water Board

Address: KIGALI

Sample number: INES/TL/390/2025

Date of submission: 24/07/2025

II. Analysis of the sample

Condition of the sample: Good

Analysis completion date: 28/07/2025

Name of Laboratory : Water quality lab

Environmental Condition: Room temperature

Parameter tested	Unit	Sample 1	Sample 2	Standards (RS 564:2023)
Physical chemical parameters				
pH		6.8	7.0	6.0 - 8.5
Electrical Conductivity (EC)	µS/cm	220	222.6	1000
Total Dissolved Solids (TDS)	mg/l	128	133	-
Chloride (Cl ⁻)	mg/l	29	29.8	600
Salinity	‰	0.113	0.115	-
Nitrogen, Nitrates	mg/l	6.5	6.7	10
Total suspended solids (TSS)	mg/l	930	950	2100
Dissolved Oxygen (DO)	mg/l	7.0	7.02	3
Total manganese	mg/l	2.8	3.0	1000
Total mercury	µg/l	ND	ND	2
Total arsenic	µg/l	ND	ND	50
Sulphates	mg/l	77	79	600
Fluorides	mg/l	0.06	0.08	600
Lead	µg/l	9.1	8.94	-
Cadmium	µg/l	13	13.4	5
Biological oxygen demand BOD5	mg/l	4.8	5.2	-
Chemical oxygen demand COD	mg/l	11	12	-

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	INES Testing Laboratory	Form no.: INES/TL/F-25
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Total zinc	µg/l	40.5	40.26	2000
Total Hardness	mg/l	42	44	-
Magnesium (Mg)	mg/l	10.4	10.5	-
Phosphates	Mg/l	1.0	1.2	0.7
Bacteriological parameters				
Total coliform	cfu/100ml	1.70×10^2	1.68×10^2	4×10^2
Fecal coliform	Cfu/100ml	2.35×10^1	2.79×10^1	4×10^2
Responsible analyst UJENEZA Euphrosine				
Lab supervisor Dr. Nyirajana Jacqueline				
Vice chancellor				
Father Dr. BARIBESHYA Jean Bosco				



Annex 5: Contingency Plan

The contingency plan is a course of action designed to help an organization respond effectively to a significant future event or situation that may or may not happen. It is a plan devised for an outcome other than in the usual plan. It is often used for risk management, for an exceptional risk that, though unlikely, would have catastrophic consequences.

The environmental Risk Management makes it possible to determine the accidents likely to occur within the framework of the construction works, to assess the consequences and then to propose the prevention or control measures for these potential accidents. These may arise from risk associated with the stored substances like oil spillage, risk associated with the installation of the Temporal sites installations for offices and storage of equipment, the risk associated with the worksite, risk associated with the operation of the infrastructures, risk associated with the climate, etc.

Identification and assessment of the risks of accidents

The aim here is to identify all the dangers to which personnel may be exposed during periods of work and operation. The proposed approach is based on the analysis of the tasks and work situations of the operators. For construction companies, it is similar to the approach necessarily implemented when drafting a Health and Safety Plan.

This work will consist of asking questions about the list of tasks necessary for carrying out the work, the list of operations for each task, the risk analysis of these operations, and determining preventive measures to act effectively on these risks.

On account of our project, the various risks to which staffs are exposed are recorded in the table below depending on the project phase:

Work phase

During this phase, the dangers likely to occur are related to the installation of life and technical bases (site office). The table below illustrates those risks.

Table 13-1: Identification and description of the risks associated with the installation of the site offices

Source of dangers	Danger	Risk	Nature of the risk	Prevention measures
Movement of site Vehicles	Speeding	Collision	Negation with required measures	- Hire only qualified staff - Limit the speed on the site to 30 km/ h
				- Make truckers aware of the code of conduct; - Install speed bumps in line with work zones and built-up areas. - Provide workers with harnesses;
Climbing (formwork)	Fall from height	Fractures	Very limited risk - "acceptable"	- Require respect for the wearing of harnesses; - Provide staff with PPE. - Provide workers with harnesses;
Formwork stripping	Fall from height/objects	Fractures, luxation	Very limited risk - "acceptable"	- Require respect for the wearing of harnesses; - Provide staff with PPE.
Electric installations	Stripped cables electric	Electrification electrocution	Very limited risk - "acceptable"	- Regularly check the electrical installations - Protect the electric cables in sheaths - Report electrical risk areas
	Short circuits	Fires Equipment losses	Very limited risk - "acceptable"	- Install suitable extinguishers - Train staff in the use of fire extinguishers - Report areas at risk of fire or electrocution. - Insure the equipment
Roof installation	Work at height	Fall from height	Very limited risk - "acceptable"	- Raise staff awareness of the risks - Establish a security procedure Provide workers with harnesses
Equipment	Uncontrolled handling of equipment	Abrasion/ amputation/ crushing	Immediate improvement required	- Train staff about the use of equipment - Protect the equipment

Source of dangers	Danger	Risk	Nature of the risk	Prevention measures
Cement mixer	Hauppauge	Fracture	Attention required	• Raise staff awareness of the risks; • Establish a security procedure
Reinforcement	Handling iron bars	Abrasions	Required actions	• Raise staff awareness of the risks; • Provide staff with PPE; • Ensure compliance with the wearing of PPE
Loading	Fall of objects	Crush / Fracture / Dislocation	Attention required	• Provide staff with PPE; • Establish a security procedure; • Raise staff awareness of the risks; • Monitor compliance with procedures
Unloading	Fall of objects	Crush / Fracture / Dislocation	Attention required	• Provide staff with PPE; • Establish a security procedure; • Raise staff awareness of the risks; • Monitor compliance with procedures

Contingency measures for risks of accidents:

The following measures will be implemented in case of accidents:

- ❖ Provide immediate first aid to provide quick support to the person in danger
- ❖ Mobilize (through Communicating immediately the nearby health center to provide or project provided) ambulance to facilitate in transport of the affected persons for further medical treatment or examination, or removal to hospital, as required.
- ❖ Treatment and Follow up on injured party

A7.1 Risks associated with stored substances

The stored substances are lubricating oils, diesel, and admixtures for different use at site.

A. Lubricating Oil Products

Lubricating oils are used for rotating parts. They are composed of severely refined mineral oils and additives whose content of polycyclic aliphatic hydrocarbons (carcinogen) in mineral oils is less than 3% or consisting of paraffinic hydrocarbons. These products are intended for the maintenance of vehicles on the site. They are used for ad hoc operations and are present on the operating site. They will be contained using local earth material and /or sand bags. Spill clean-up equipment specifically designed for other fuel and Oil products are to be located at the Temporal sites installations for storage of equipment, workshops and at other detached storages. Under normal conditions of use, lubricating oils present no risk of toxicity, ignition or explosion. However, eye or skin contact can cause irritation in some cases. Also, ingesting large amounts of oil will cause diarrhea and nausea. In addition, the dangers associated with accidental fuel oil spills include:

- ❖ Risks associated with flammability.
- ❖ Mildly toxic by ingestion, highly toxic if aspirated. Moderately toxic to aquatic organisms.
- ❖ Harmful to waterfowl Floats on water.

Spills or leaks of all light and medium oils, including fuel oil at storage facilities will be responded to by the following steps:

- a) Identifying the source of the leak or spill;
- b) Stopping flow if possible;
- c) Eliminating open flame ignition processes;
- d) Containing the spill;
- e) Notifying the Supervisor's Representatives
- f) Initiating Spill Response Plan.

Spilled diesel fuel can be covered by commercial sorbents or by sand straw or peat moss. If necessary, contaminated soil will be excavated. Digging sumps or trenches and pumping from below water table can recover diesel fuel saturated soil. Fuel spills on land will be responded to by the following procedures:

- ❖ Construction of earth berm down slope of the running or seeping fluid.
- ❖ Plastic taps may be placed at the base of the berm to allow the fuel pool on the plastic tarp for easy capture with absorbent pads,
- ❖ Pads may be squeezed into empty drums and re-used.
- ❖ Larger pools may be pumped back into the drums.
- ❖ Special care will be taken to prevent the fuel from entering the water body or water where it will have greater negative impact.;
- ❖ Contaminated soil and vegetation may have to be removed and disposed of at well designated dump site in each district.
- ❖ Fire Response methods for Diesel Fuel includes:
- ❖ CO₂, dry chemical, foam, or water spray.
- ❖ Water to cool tank surface.
- ❖ Diversion of the diesel to an open area and let it burn under control.
- ❖ Awareness of re-ignition if the fire is put before all diesel fuel is consumed
- ❖ Fuel spills on water will be contained immediately to restrict the extent of the floating fuel. The methods, which may be used to contain the fuel include:
- ❖ Booms deployed to contain the spill.
- ❖ Absorbent pads used to capture small spills on watercourse.
- ❖ A skimmer to recover oil contained by boom and then pumps the recovered fuel into empty fuel drums.

B. Diesel/Fuel

Diesel or gasoline is a fuel for a compression ignition engine. Physically, it is a light fuel oil and, by law, a fuel obtained from petroleum refining. Petroleum/Gasoline may be stored on-site for use by machinery and vehicles during construction. The gasoil presents the following dangers:

- ❖ Aspiration hazard, category 1;
- ❖ Skin corrosion / irritation, category 2;
- ❖ Acute toxicity (by inhalation), category 4;
- ❖ Carcinogenicity, category 2;
- ❖ Specific target organ toxicity - repeated exposure, category 2;
- ❖ Easily ignited by flame or spark; lighter than water (floats on water)

- ❖ Hazards for the aquatic organisms - Chronic hazard category

The initial response to petrol/gasoline spill will be:

- ❖ Stopping the flow at the source if possible.
- ❖ Eliminating all possible sources of ignition (e.g. extinguish cigarette, shutoff motors, generators)
- ❖ Evacuating danger area
- ❖ Carefully considering the hazards and merits of trying to contain the spill if it is safe to do so and obvious benefits of containment is apparent (e.g. contain if flowing towards a water course.) otherwise leave gasoline to spread and evaporate
- ❖ Meeting at the emergency assembly point
- ❖ Notifying the Supervising consultant.

In the event of fire, the response will be:

- ❖ Using CO₂, dry chemical, foam or water spray (fog);
- ❖ Using jet streams to wash away burning gasoline.
- ❖ Diverting the gasoline to an open area and let it burn under control.
- ❖ Using water to cool the tank surfaces.
- ❖ Being aware of re-ignition if the fire is put out before all the gasoline is consumed.
- ❖ Petrol/gasoline can be recovered in the following manner:
- ❖ Un-burnt gasoline can be soaked up by sand or pit moss or by commercial sorbents.
- ❖ If necessary, contaminated soil will be excavated,
- ❖ Gasoline entering the ground can be recovered digging sumps or trenches and pumping from below water table.
- ❖ Petrol/ gasoline can be disposed of in the following manner.
- ❖ Evaporation incineration under controlled manner.

C. Acid Spills

These occur mainly from vehicle batteries and other materials with acidic chemical properties. Spills of acid will be contained using sand bags and neutralization can be accomplished using either soda ash or lime. Both the sand bags and lime will be stored at equipment maintenance yards/service areas. Following neutralization, the area will be carefully flushed with water. Any water used for flushing a spill shall be contained, recovered and disposed of in an approved manner.

D. Admixtures

Admixtures are common chemicals in the manufacture of concrete. Added at low doses during the preparation of concrete (admixtures represent less than 5% of the mass of the concrete), these products improve certain characteristics of this material (waterproofing or setting time, for example). The different types of admixtures that exist will allow obtaining concrete with the specific characteristics you want to give it.

The main adjuvants are:

- ❖ setting accelerator;
- ❖ hardening accelerator;
- ❖ setting retarder;
- ❖ plasticizer;
- ❖ super-plasticizer;
- ❖ air trainer;
- ❖ pigment.

Table 13-2: Identification and description of risks associated with stored substances

Source of dangers/ Activity	Danger	Risk	Nature of the risk	Prevention measures
Fuel storage	Presence of heat source nearby	Fire	Required actions	• Provide the unloading site with suitable extinguishers; • Provide the site with a sandbox with accessories; • Prohibit heat sources on the dumping site; • Set up appropriate signals; • Train pump attendants in the handling of equipment
	Loss of containment of storage tanks	Spreading with risk ignition fuel of	Very limited risk - "acceptable"	• Build a sealed containment site around the vessel • Regularly monitor leaks
Cement storage	Fine dust	Respiratory infections	Required actions	• Provide staff with PPE; • Store in a container or warehouse; • Ensure health monitoring of

				exposed personnel; Require compliance with the wearing of PPE
Storage of used oils	Loss of containment of storage tanks	Spreading with risk ignition fuel of	Very limited risk "acceptable"	- Build a sealed containment site around the vessel; - Regularly monitor leaks; - Set up monitoring sheets for the supply and emptying of the tank
Storage of gas cylinders (acetylene, butane)	Inadequate exposure to heat sources	Explosion	Very limited risk - "acceptable"	- Build a sealed containment site around the vessel; - Regularly monitor leaks; - Set up monitoring sheets for the supply and emptying of the tank.
Storage and mixtures of	Accidental leak	Spreading with risk fuel poisoning	Very limited risk - "acceptable"	- Build a sealed containment site around the vessel; - Regularly monitor leaks; - Set up monitoring sheets for the supply and emptying of the tank
	Soil contamination		Very limited risk "acceptable"	- Build a sealed containment site around the vessel; - Regularly monitor leaks; - Set up monitoring sheets for the supply and emptying of the tank

A7.2. Risks Associated with the Worksite

Table 8-3 summarizes the risks associated with the worksite:

Table 13-3 Identification and description of risks associated with the worksite

Source of dangers/ Activity	Danger	Risk	Nature of the risk	Prevention measures
Topographic survey	Proximity to vehicle traffic	Collision	Immediate improvement required	Place work signs in survey areas Provide staff with PPE Limit speed in survey areas
	Survey in the brush	Reptile bite	Required actions	Provide staff with PPE
Geotechnical survey	Nearby roads direct collection of data	Collision	Immediate improvement required	Place work signs in survey areas Provide staff with PPE Limit speed in survey areas.
	Handling of fine dust	Respiratory infections	Required actions	Provide staff with PPE Ensure compliance with wearing of PPE Make staff aware of health risks.
Transport of staff to the site	Speeding	Collision	Immediate improvement required	Limit site speeds to 30 km / h Set up appropriate road works signs Follow up on signs
Construction machinery	Proximity to staff	Collision	Immediate improvement required	Limit site speeds to 30 km / h Set up appropriate road works signs Follow up on signs
Material transport	Crossing of agglomerations	Collision	Immediate improvement required	Limit site speeds to 30 km / h Set up appropriate road works signs Follow up on signals Install speed bumps when crossing built-up areas

Maintenance and repair	Spreading drain oils	Soil contamination	Attention required	Use the appropriate emptying equipment Train staff in safe emptying Make waterproof coverings for the floors of technical workshops Install a drain oil tank
	Short circuits	Fire / Loss of equipment	Very limited risk - "acceptable"	Set up fire extinguishers Train technical staff Insure the equipment Establish security procedures
Reinforcement	Handling iron bars	Abrasions	Attention required	Provide staff with PPE Ensure compliance with the wearing of PPE
Formwork and stripping	Fall of objects	Fractures	Very limited risk - "acceptable"	Establish a security procedure; Provide staff with PPE; Ensures compliance with the wearing of PPE Report work areas
Loading and unloading	Proximity to staff	Fractures	Very limited risk - "acceptable"	Report work areas Establish a security procedure Provide staff with PPE Ensures compliance with the wearing of PPE
Sealing	Storage	Spills	Very limited risk - "acceptable"	Ensure management
	Work at height	Fall from height	Very limited risk - "acceptable"	Ensure management
	Work posture	Musculoskeletal problems	Attention required	Ensure management
Food paint	Storage	Spills	Very limited risk - "acceptable"	Ensure management
		Fall from height	Attention required	Organize workshops
	Posture de travail	Musculoskeletal problems	Very limited	Respect of working hours Use appropriate scales

			risk - "acceptable"	
Pressure test	Implementation	Injuries or weakening of the frames linked to the explosion of pipes	Very limited risk - "acceptable"	Recognize buildings all along the water drinking network; Inform and conduct awareness to the staff and residents about the risks associated with pressure tests; Organize the site

The main Contingency measure is to provide first aid to the person in danger, and immediate mobilization of the ambulance to transfer the affected to nearby medical health center.

A7.3. Risks associated with damage to property or utilities

Table 13-4: Identification and description of risks associated with damage to property or utilities

Source of dangers/ Activity	Danger	Risk	Nature of the risk	Prevention measures
Excavations	Water pipes damaged Electrical poles disturbed	Loss of domestic water supply Loss of electricity	Highly significant	- Map all public utilities to be affected and estimate their values - Contingency measure: - Replace or compensate for damaged property at Contractors own cost
Excavations, heavy construction works	Deterioration/ impact on cultural heritage	Loss of value of cultural heritage	Highly significant	Apply the chance find procedures(as shown in Annex 6)

A74. Risks associated with climate risks

The irrigation could face risks of external hazards to the construction works and project operation phase. These are dangers linked to climatic phenomena. Though the area is not prone to landslides due to the topographic conditions, the area is exposed to flood events as the area is a wetland. flood events which may sometimes occurs in rain seasons could lead to damage of agricultural crops. Climatic phenomena could be at the origin of torrential rains, a source of flooding of plots and developed and existing villages. Flooding could cause loss of property (agricultural production), collapse of buildings.

Contingency measures:

- ❖ In case of flooding events, the response measures will mainly be focused on
- ❖ Event detection and assessing situation to determine emergency level
- ❖ Emergency level determination as Level 1 (non-emergency or slow developing situation), Emergency level 2 (rapidly developing and potential irrigation infrastructure failure) or Level 3 (Urgent and infrastructure collapse is imminent)
- ❖ Notification and Communication: communicating farmers of not using the wetland,
- ❖ Provide many communiqué to farmers and other passengers on the alternative access roads in order to prevent risk of death as a result of flooding events. Basically evacuation procedures triggered. Immediate evacuation should take priority over any other action should the stability of the irrigation infrastructure be threatened or situation assessed as level 2 or 3.
- ❖ Organize community works (known as Umuganda) to establish other possible drains to reduce the level of water in order to avoid drowning and loss of lives especially for farmers. Preferably, use experienced persons including civil engineering contractors, equipment and materials' suppliers and engineers available locally
- ❖ Increased monitoring of the situation
- ❖ Ideally a crisis action plan should be developed prior to start of the operation of the irrigation and should include the following:
- ❖ Contact names and telephone numbers (owner of the irrigation infrastructure, authorities downstream, police and emergency services and others) to call if the irrigation infrastructure is damaged, develops problems or is considered unstable, or flooding risk is imminent.
- ❖ Information on possible areas likely to be affected next to the irrigation infrastructure or downstream (estimated area of inundation) should the irrigation infrastructure fail or significant amounts of water require immediate release from gates, drains or outlets. A map to illustrate various levels of inundation (with estimates of timings for any flood wave) should be prepared and be available.
- ❖ A list of names, addresses and telephone numbers (keep this up to date) of inhabitants living immediately next to the irrigation infrastructure or downstream of the irrigation infrastructure and within the estimated area of inundation.
- ❖ The CAP should be periodically updated to consider changes in land use downstream and any changes to the catchment upstream.
- ❖ Plans for warning and emergency evacuation, including the provision of safe routes to

follow in case of flooding. Immediate evacuation should take priority over any other action should the flooding be considered level 2 or 3.

- ❖ Information on resources to use and procedures to follow for emergency repairs. This should include a list of civil engineering contractors, equipment and materials' suppliers and engineers available locally.

A7.5. Risks associated with lightning

Lightning is an electrical phenomenon produced by the electrical charges of certain clouds. This phenomenon can occur during stormy weather conditions. The current produced by lightning is electrical and causes the same effects as any other current flowing in an electrical conductor.

As a result, the following effects are possible:

- Thermal effects (release of heat);
- Rise in potential of the earth electrodes and ignition;
- Induction effects (electromagnetic field);
- Electrodynamics effects (appearance of forces that can lead to mechanical deformations or ruptures);
- Acoustic effects (thunder).

In general, a complete lightning strike lasts between 0.2 and 1 second and has an average of four partial discharges. The median value of the intensity of a lightning strike is around 25 kA. Between each (drive) discharge, a current of the order of a hundred or a thousand amperes continues to flow through the ionized channel. The risks presented by lightning therefore result from the associated lightning current.

Prevention and treatment measures:

The following measures are recommended for lightning prevention:

- (a) Provide earthworks for the buildings constructed;
- (b) Regularly check the electrical installations in the constructed buildings.

Annex 6: Chance Finds (Chance Find Procedures)

A6.1 Purpose of the chance finds procedure

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project design, construction, or operation. It is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

A6.2 Responsibility in the chance finds procedures

RWB as the implementation institution is responsible for siting and designing the project to Nyagatare District in order to avoid significant damage to cultural heritage. When the proposed location of a project is in areas where cultural heritage is expected to be found, either during construction or operations, the client will implement chance find procedures established through the Social and Environmental Assessment. The client will not disturb any chance finds further until an assessment by a competent specialist is made and actions consistent with the requirements of this Performance Standard are identified.

A6.3 Scope and induction/training

This procedure will be applicable to all activities conducted by the personnel, including contractors for the project that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

A6.4 Details on chance find procedures

If any person/worker under the project discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

- Stop all works in the vicinity of the finding, until a solution is found for the preservation of these artifacts, or advice from the relevant authorities is obtained especially the Institute of National Museums of Rwanda (INMR);
- Immediately notify the foreman. The foreman will then notify the site engineer and the Environment Officer of the contractor;
- Record details in Incident Report and take photos of the find;
- Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
- Preliminary evaluation of the findings by archaeologists. The archaeologist must make a

rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;

- Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the INMR, once completed. In case of significant find the INMR, will be informed immediately and in writing within 7 days from the find. The onsite archaeologist provides INMR with photos, other information as relevant for identification and assessment of the significance of heritage items. The INMR will investigate the fact and provide response in writing. Decisions on how to handle the finding shall be taken by the responsible authorities which is INMR. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
- Construction works could resume only after permission is granted from the responsible authorities.
- In case no response received, this will be considered as authorization to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photocopy of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports are kept.

A6.5 Additional information: Management options for archaeological site

Site avoidance: If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option); Mitigation: If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. Site Protection: It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site- specific.

A6.6 Management of replicable and non-replicable heritage

Different approaches for the finds apply to replicable and non-replicable heritage.

A6.6. 1 Replicable heritage

Where tangible cultural heritage that is replicable (Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be

transferred by appropriate measures. Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures) do not encounter critical, thereby mitigation measures will be applied.

The mitigation hierarchy is as follows:

- ✓ Avoidance;
- ✓ Minimization of adverse impacts and implementation of restoration measures, insitu;
- ✓ Restoration of the functionality of the cultural heritage, in a different location;
- ✓ Permanent removal of historical and archaeological artifacts and structures;
- ✓ Compensation of loss - where minimization of adverse impacts and restorationnot feasible.

A6.6.2 Non-replicable heritage

Most cultural heritage is best protected by in situ preservation, since removal is likelyto result in irreparable damage or even destruction of the cultural heritage. Non-replicable cultural heritage (Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site. Examples of non-replicable cultural heritage may include an ancient city or temple, or a site unique in the period that it represents) must not be removed unless all of the following conditions are met:

- ❖ There are no technically or financially feasible alternatives to removal;
- ❖ The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

A6.7 Human remains management options

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above.

There are two possible courses of action:

A6.7.1 Avoid: The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development of the project, and properly addressed by a comprehensive management plan.

A6.7.2 Exhume: Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain procedures may need to be followed before project 's development activities can recommence in the area of the discovery.

Annex 7: Community Health, Safety and Security Plan

A7.1. Community health, safety and security plan

This plan provides potential community health, safety and a security risk associated with the implementation of the irrigation project in Nyagatare District and helps to provide guidance that respond and mitigate the identified risks.

Under this plan, all applicable laws and standards stated in Legal and Institutional Framework shall apply. Table 9-1 summarizes the Community Health, Safety and Security Management Plan and shows the potential risks of the irrigation use project's activities, the proposed mitigation measures and the responsibilities.

Table 13-5: Summary of Community Health, Safety & Security Management Plan

Potential Risk	Mitigation Measures	Responsible
Increased pressure on health services and infrastructure. The influx of new workers from outside area to the project area will increase demand on existing health services	Health services of the new workers shall be provided especially the medical insurance "Mutuelle de santé" and provision of an appropriate sickbay and a qualified Nurse at working site. This will ease pressure on existing services which are left for the use by the rest of the community	Contractor and Monitoring by Supervising firm; Community Liaison and Sector's health Officer; RWB's staff
Spread of communicable diseases. The influx of new workers to the project area could bring with it an increase of communicable diseases, like Covid-19, HIV/Aids, STD and Tuberculosis.	Awareness campaigns for the prevention of communicable diseases through close collaboration with existing health Committees within the community and capacity building for those committees.	Contractor in collaboration with existing health centers. Monitoring by supervising Firm; Community Liaison and Sector's health Officer; RWB's staff
Respiratory diseases due to dust emission from transport, vehicles and machineries on roads	- Control speed limits; - Cover trucks transporting volatile construction materials; - Ensure haul trucks are not overloaded - Control of moisture content on haul road via sprinkling; monitoring to ensure all dust emission are within	Contractor. Monitoring by: Supervision Firm;

	national and international best practice limits.	Community Liaison and Sector's health Officer; RWB
Increased road accidents	• Prepare a Traffic Management Plan (see below) • Control speed limits; • Ensure haul trucks are not overloaded and are covered where necessary; • Placement of speed control signs • Awareness among local people especially children to avoid suspending themselves on the trucks	Contractor monitoring by supervision Firm; RWB; Traffic Police
Diffuse run-off from construction areas and other disturbed areas may contain elevated concentrations of suspended solids or pollutants.	Ditches will channel surface water runoff to the designated areas; Maximum reuse or recycle of process waste water; Water monitoring will be conducted; Access roads and ditches maintenance where necessary.	Contractor monitoring by RWB and District authorities
Noise level will be significant during construction.	Operating hours of the all activities only during the daily hours; Speed restrictions on site traffic.	Contractor monitoring by RWB and District authorities
Potential economic impact on household livelihoods	Local residents especially PAPs will be hired where possible; Implementation of a livelihood restoration program in the District (i.e.: avoid non-legal increase of food price in the project area)	Contractor monitoring by District and Sectors authorities
Loss of properties due to project activities	Ensure expropriation and compensation are carried out as per the ARAP and expropriation Law; All compensations and expropriation should be paid prior to commencement of works.	Contractor monitoring by District and Sectors authorities

A7.2. Traffic management plan

A7.2.1.1 Traffic issues and problems

Referring to the location of the selected site for irrigation project near the feeder roads, it is obvious that traffic issues may result especially during construction period. The following issues related to traffic can be identified such as lack of traffic discipline, poor pedestrian facilities and behavior, poor traffic operations, poor traffic management facilities, poor traffic signs placed and poor compliance for drivers.

(i) Lack of traffic discipline

- Y Trucks or construction machineries stop near intersections and in all lanes just in front of intersection without any consideration of traffic flow or stop in the middle of the road,
- Y Trucks and construction machineries drive at high speed in the project area and can cause serious accidents,
- Y Vehicles stop near intersections and in all lanes just in front of intersection without any consideration of traffic flow or stop in the middle of the road to pick up and/or drop passengers,
- Y Motorized vehicles are parked along roads, even if parking is forbidden.

(ii) Poor pedestrian facilities and behavior

- Y Pedestrians walk on the roadway because sidewalks are being upgraded, closed or occupied by unauthorized parking,
- Y Pedestrians cross the road under construction everywhere and any time even if trucks, construction machineries or vehicle are passing through. In roundabouts, pedestrians are waking anywhere and anytime when they want.

(iii) Poor Traffic Operation

- Y The flag-person directs traffic against traffic/safety signals,
- Y The flag-person uses sign posts which are not visible at distance or during darkness periods to direct traffic.
- Y Many obstructions such as construction materials, construction equipment, and construction wastes are occupied in road spaces.

(iv) Poor Traffic Management Facilities

- Y Road markings are non-existent or out of paint and lanes are not marked on the roadway,
- Y Very few or poorly road signs are installed on the road corridor and junctions.

(v) Poor Traffic Signals

- Y No truck, construction machineries and vehicle drivers follow traffic signal,

Y Some of the traffic signals are malfunctioning.

(vi) Poor Compliance by Drivers

Most people do not follow traffic rules properly because most drivers are not well- trained or are reluctant to abide by the traffic rules. Table 9-2 proposes counter measures for the traffic issues.

Table 13-6: Traffic Issues and Control Measures

Issues	Cause	Control Measures	Responsible
Lack of traffic discipline	Trucks or construction machineries stop near intersections	All trucks and machineries should not stop near intersection	Contractor
	Trucks and construction machineries drive at high speed	Speed limit sign posts should be installed and a flag-person to ensure compliance	Contractor
	Vehicles and construction machineries stop in the middle of the road	Vehicle should be prohibited to stop in the middle of road when not at duty	Contractor
	Motorized vehicles are parked along roads	A parking should be provided	Contractor
Poor pedestrian facilities and behavior	Pedestrians walk on the roadway	Ensure sidewalks are not occupied by unauthorized parking	Contractor
	Pedestrians cross the road under construction everywhere and any time even	Pedestrians should be guided when crossing the road under construction	Contractor
	Pedestrians are waking in roundabouts, anywhere and anytime when they want	Pedestrian should be stopped from walking in the round or guided when construction activities are being carried out	Contractor
Poor Traffic Operation	The flag-person directs traffic against traffic/safety signals	The flag-person should follow the safety signals provided	Contractor

Issues	Cause	Control Measures	Responsible
	The flag-person uses sign posts which are not visible at distance or during darkness periods to direct traffic	New and visible sign posts should be provided	Contractor
	Many obstructions such as construction materials, construction equipment, and construction wastes are occupied in road spaces.	All obstructions should be removed on the road space and corridor	Contractor
Poor traffic management facilities	Road markings are non-existent or out of paint and lanes are not marked on the roadway near project activities	Ensure all required sign posts are installed or marked on the roadway near project activities	Contractor
	Very few or poorly made road signs are installed on the road construction corridor and junctions.	Ensure worn out sign posts are removed and replaced by new ones	Contractor
Poor traffic Signals	No truck, construction machineries and vehicle drivers follow traffic signal	Ensure all drivers comply with traffic signs. Failure to comply sanctions should be provided	Contractor
	Some of the traffic signals are malfunctioning.	Ensure malfunctioning sign posts are replaced	Contractor
Poor compliance for drivers	Most people do not follow traffic rules properly most of drivers are not well- trained or are reluctant to abide by the traffic rules.	Toolbox meetings about traffic rules should be provided to all workers and drivers	Contractor
Influx of new workers in the area and possible community conflicts	Occurrence of communicable diseases among the community such as HIV/AIDS, etc	Prepare a labor Management Plan Prioritize locals for work	Contractor

A7.2.2 Road safety signs

Road safety signs to be used for construction of irrigation project are classified basing on the purpose and message intended as:

Regulatory signs: regulatory road sign are signs that are used to indicate or reinforce traffic laws, regulations or requirements which apply either at all times or at specified times or places upon a road, street or highway under use or construction the disregard of which may constitute a violation, or signs in general that regulate public. These include signs indicating: Stop, Do not enter, No parking, No hooting, Slow down, Students crossing, Speed Limit, Road closed, etc.

Warning signs: Warning sign is a type of sign which indicates a potential hazard, obstacle or condition requiring special attention. Some are traffic signs that indicate hazards on roads that may not be readily apparent to a driver. The warning signs usually contain a symbol and include signs indicating: Men at Work, Narrow Road, Humps ahead, Zebra crossing, etc.

Advisory signs: Advisory sign posts are often seen under a warning sign and typically placed at sharp curves, at exit ramps.

A7.2.3 Alternative roads

As of now there is no road along the proposed Primary canal route. Hence the belt road will be a new development; as such chances of disturbing access are quite less. Even then there can be few cases of disturbance to existing access of the local community. If no alternative to this road, the construction activities will block access of the local users and accidents may occur during its construction. To avoid any disturbance, road diversion as applicable may be needed to ensure safety of the nearby community.

Applicable measure to this impact:

Prior to construction works of the road, the RWB and contractor will consult local authorities of the sector and cell to see about any disturbance to local community and check whether any alternative road has to be provided (or can be used) at the time of construction. diversion bridge shall be established at the time of constructing new ones.

Traffic diversion plan will be established prior to construction phase and will consider the road with good conditions to keep facilitating the community's access. Wherever applicable, traffic movement will be diverted to one-way lane.

Annex 8a: Meeting in the office of District's senior officers



Annex 8b: Exchange with the Veterinary officer of Nyagatare District



Annex 9: Previous consultation meeting between consultant and District authorities

Annex 10: Previous consultation meeting with local communities

Annex 11: Consultation meeting held on 12-15th May 2025 with RAB officials

Annex-12: Meeting in the office of District's senior officers on 28/07/2025



Annex 13: Consultation Meeting with Nyagatare District officials

Annex 14: Joint visit with RAB and REMA officials during stakeholder consultation

Annex 15: A joint Field Visit with Client Environmental and Social (ES) Staff, ESIA Consultant (IBC Group), REMA, and RAB Representatives on 3 July,2025



Annex 16: Meeting with Civil Society Organization



Annex17: Consultation meeting with RWARRI

Annex 18: Consultation meeting on safeguard issues with Nsheke Primary School head teacher

Annex 19: Consultation meeting with District authority and District education officials about safeguard issues at Nsheke Primary school

Annex 20: Consultation meeting with local communities including PAPs

Annex 21: Meeting with water user association operating in Muvumba P8 on July 3, 2025.



Annex 23: Consultation meeting with rice farmers in Muvumba marshland