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REPUBLIC OF RWANDA



MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES

THIRD RURAL SECTOR SUPPORT PROJECT (RSSP 3)

**UPDATED ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT FOR MUKUNGULI
MARSHLAND IN KAMONYI AND RUHANGO DISTRICTS**

NOVEMBER 2016

EXECUTIVE SUMMARY

The Rural Sector Support Project (RSSP) planned to execute civil works related to the rehabilitation of two (2) diversion structures and construction of 2 new diversion structures and irrigation and drainage canals for expanding the Mukunguli irrigated rice scheme from existing 250 ha to 640 ha for rice production. The project will also develop access roads. In order to guide its development and operation in an environmentally friendly way, it is required to carry out an Environmental and social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) of the proposed irrigation scheme for rice production as directed by the Rwanda Organic Law on Environmental protection and World Bank safeguard policies, especially Environmental Assessment OP/BP 4.01.

The ESIA/ESMP study for the development of 250 ha Mukunguli marshland was conducted and cleared by the Bank in 2003 under RSSP1. However, due to the damages of river weirs constructed under RSSP1 by rains and the Government wish to expand the marshland from 282.5 ha to 640 ha, the update of the existing ESIA was found necessary to ensure that potential adverse impacts from both marshland parts are identified and mitigation measures are put in place before the construction works. This update was done by the Project Environmental Safeguards Team. The ESIA updating process begun in July 2016.

The main objective of the study was to update the existing ESIA report for Mukunguli marshland as per the new changes in the irrigated command area to ensure that the RSSP3 is implemented in an environmentally and socially sustainable manner and in full compliance with Rwanda's and the World Bank's environmental and social policies and regulations

The study identified and assessed the physical, biological and socioeconomic impacts of the project, interaction of these impacts, recommends mitigation measures and develops an Environmental Management and Monitoring Plan that will guide implementation of the project at Mukunguli site.

Potential key adverse impacts identified include loss of land and vegetation for canal and weir construction, soil contamination due to disposal of spoil soils, spread of waste during drains repair, water quality, natural habitat destruction or degradation, loss of biodiversity, and modification of flows for downstream users. Human Health can also be adversely affected as irrigation can support many waterborne diseases in both humans and animals such as malaria, yellow fever, cholera, typhoid, hepatitis, etc. However the above potentially adverse impacts identified are mostly short term and manageable in nature and expected to occur during the project implementation but can be improved through the identified and proposed mitigation measures.

The positive impacts identified considering the above activities include increased rice productivity, employment opportunities as well as increased household income. The acquisition of raw materials and as well as employment for this project activity can significantly reduce poverty within the project activities area.

In order to ensure that the proposed mitigation measures are implemented, an environmental management and monitoring plan has been developed to guide all activities of the project during all its phases.

This plan specifies the nature of the negative impacts, the proposed mitigation measures for the impact, the indicators during the execution of these mitigation measures, the time period, the responsibilities and the follow-up needed from concerned and specified parties. Some recommendations are also given so that the execution of the project becomes a success without harming or at least minimizing negative effect to the environment. The project would need to implement these recommendations for mitigating adverse impacts and prevent the potential ones.

Based on the nature and extent of the proposed project, the findings of the ESIA and the understanding of the significance level of disturbance of potential environmental impacts, it is the opinion of the ESIA project team that the proposed project can be implemented and adverse impacts be mitigated to an acceptable level.

ACRONYMS

AIDS:	Acquired Immunodeficiency Syndrome
CRS:	Catholic Relief Services
CWS:	Constructed Wetland System
DRESC:	Directorate of Rural Engineering (Genie rural)and Soil Conservation
DWS:	Directorate of Water and Sanitation
EDPRS:	Economic Development and Poverty Reduction Strategy
ESIA:	Environmental and Social Impact Assessment
ESMP:	Environmental and Social Management Plan
EO:	Environmental Officer
GEC:	Green Environment Conservation
GoR:	Government of Rwanda
HIV:	Human Immunodeficiency Virus and
IFAD:	International Fund for Agriculture Development
IPM :	Integrated Pest Management
LWH:	Land Husbandry, Water Harvesting and Hillside Irrigation
MDGs:	Millennium Development Goals
MINAGRI:	Ministry of Agriculture and Animal Resources
MINALOC:	Ministry of Local Government
MINECOFIN:	Ministry of Finance and Economic Planning
MINICOM:	Ministry of Trade and Industry
MININFRA:	Ministry of Infrastructure
MINIRENA:	Ministry of Natural Resources
NBSAP:	National Biodiversity Strategy and Action Plan
NCUR:	National Commission for Unity and Reconciliation
NEAP:	National Environment Action Plan
NGOs:	Non Government Organisations
OPEC:	Organisation for Petroleum Exporting Countries
RAP:	Resettlement Action Plan
REASON:	Rwanda Environment Awareness Services Organisation Network
REMA:	Rwanda Environmental Management Authority
RDB:	Rwanda Development Board
RNRA:	Rwanda Natural Resources Authority
RPF:	Resettlement Policy Framework
RSSP:	Rural Sector Support Project
SPAT:	Strategic Plan for Agriculture Transformation
SPIU:	Single Project Implementation Unit
UCRIDP:	Umutara Community Resource Infrastructure Development Project

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1.0 INTRODUCTION

1.1 Project background

The Government of Rwanda is pursuing a comprehensive Poverty reduction program which includes development and implementation of different sustainable development projects. In support of this programme, the GoR received funding from the International Development Association (IDA) towards the implementation of the Third Rural Sector Support Project (RSSP3) under the Ministry of Agriculture and Animal Resources (MINAGRI). The RSSP3 aims at promoting diversification of economic activities in rural areas as a way of increasing and stabilizing rural incomes.

The RSSP3 has three components, two technical components and one implementation support component.

Component 1: Marshlands and hillsides rehabilitation and development. The objective of this component is to expand irrigated area in cultivated marshlands and increase use of sustainable land management practices on associated hillsides to accelerate the pace of agricultural intensification.

Component 2: Strengthening commodity chains. The objective of this component is to support the commercialization of smallholder agriculture in targeted marshlands and hillside areas by intensifying production, promoting agricultural value addition, and expanding access to markets.

Component 3: Project coordination and support. The objective of this component is to ensure: (i) efficient execution of administrative, financial management, and procurement functions; (ii) coordination of Project activities among the various stakeholders; (iii) timely implementation and monitoring of environmental and land-use management frameworks mandated by World Bank safeguards policies; and (iv) establishment and operation of an effective monitoring and evaluation (M&E) system.

RSSP3 plans to carry out marshland rehabilitation works on 639.9 ha divided into two parts:

- i) Rehabilitating 282.5 ha of the upstream part of the marshland already developed under RSSP1 by constructing two (2) new diversion weirs to replace those destroyed by floods;
- ii) Developing 357.4 ha of the downstream part of the marshland not yet developed. Two (2) new diversion weirs and 13.6 km of irrigation canals will be built.
- iii) Developing access roads in the downstream part of the marshland.

In order to guide the marshland development and rehabilitation and its operation in an environmentally friendly manner, it was deemed necessary to update the existing Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) of the proposed Irrigation scheme for rice production as required by the Rwandan regulations, especially the Organic Law on Environmental protection and World Bank safeguard policies, especially Environmental Assessment OP/BP 4.01.

The first ESIA study for the development/rehabilitation of Mukunguli marshland (upstream part) was carried out by EXPERCO INTERNATIONAL under RSP1 support and cleared by the Bank in 2003.

Subsequent to the damages of river weirs by rains and the Government wish to expand the marshland from 282.5 ha to 640 ha, the update of the existing ESIA was found necessary to ensure that potential adverse impacts from both marshland parts are identified and mitigation measures are put in place before the construction works. This update was done by the Project Environmental Safeguards Team. The ESIA updating process begun in July 2016, and has culminated in the compilation of the present report.

1.2. Objectives of the study

1.2.1. General objective

The main objective of the study is to update the existing ESIA report for Mukunguli marshland as per the new changes in the irrigated command area to ensure that the RSP3 is implemented in an environmentally and socially sustainable manner and in full compliance with Rwanda's and the World Bank's environmental and social policies and regulations.

1.2.2. Specific objectives

The following are specific objectives of the present assignment:

- (i) Assess the potential environmental and social impacts of the RSP3 Project's proposed weirs and canals construction and development of irrigation infrastructure of Mukunguli marshland in Kamonyi and Ruhango Districts of the Southern Province;
- (ii) Update the proposed mitigation measures and address effectively the adverse impacts in compliance with national and World Bank regulations and policies;
- (iii) update the Environmental Management and Monitoring Plans that:
 - ✓ Identifies opportunities, and provides specific measures, for the conservation or restoration of ecological services (e.g. water retention, downstream flood mitigation, biodiversity) within and around the site;
 - ✓ Provides design and operations measures to minimize the risk of pollution and environmental health impacts;
 - ✓ Prescribes other mitigation measures needed to ensure long-term subproject sustainability (e.g. institutional capacity building for environmental management at all levels, public safety measures around reservoirs, domestic water sources, cattle watering facilities on hillsides), and
 - ✓ Outlines a monitoring program to track agricultural and environmental performance of the target watersheds and implementation of the mitigation measures for refinement of future management action, as required.

1.3. Scope of the study

The study consisted of collecting and analyzing available data using appropriate techniques and came up with realistic proposals and recommendations for the safe implementation of the proposed activities.

The study focused on the marshland and its surroundings that are likely to be impacted by the development/rehabilitation works.

The project impacts on landscape, air quality; microclimate; and water, sensitive ecosystems as well as the socio-economic components were assessed.

The study also covered both the direct and indirect impacts of the project activities and examined the impacts in terms of short term and long-term, cumulative impacts and impact interaction in Project Area. A set of mitigation and monitoring measures were formulated to provide viable and environmental friendly options to manage both the positive and the negative impacts and to mitigate adverse impacts of the development.

1.4 Methodology

The current study is an update of the existing ESIA/EMP report for Mukunguli marshland and was conducted using the following methodology:

1.4.1 Literature review

The review on the existing baseline information and literature material was done to get a deeper understanding of the project activity and its impact on Mukunguli site. The following are among the documents that were reviewed:

- ✓ Existing ESIA/EMP report for Mukunguli
- ✓ Feasibility and detailed designs reports for Mukunguli site
- ✓ National relevant legislations, policies and guidelines (including environmental, water and land policies and regulations);
- ✓ Existing reports on the socioeconomics of Kamonyi and Ruhango Districts
- ✓ World Bank Safeguards Policies and international conventions related to this project
- ✓ And other relevant documents (pedological maps, meteorological reports, etc.).

1.4.2 Site visits

The project environmental safeguards team surveyed the Mukunguli marshland and its surroundings including field observations at the site catchment, mapping desirable ecological conservation zones. These field visits ensured that the study took into consideration potential receptors of impact, any sensitive environment to the project, surrounding human activities and land uses, biophysical aspects (topography, visual aspects, noise, soils, potential water sources and aesthetic quality) and biological aspects. A photographic survey of the site and surrounding area was also performed for further analysis in this study. They were also used as data illustrators in the final study report.

1.4.3 Interactive discussions

Various discussions were held with the SPIU RSSP/LWH technical staff at the national level and District levels as well as other relevant staff of the key implementing partners of the Project including among others, Contractors, RDB, REMA and Kamonyi and Ruhango authorities. Interviews with farmers were also arranged to get the public opinion on the proposed activities development.

1.4.4 Impact Prediction and Evaluation

Various methods and techniques were applied in impact identification, prediction and evaluation. The ESIA identified and analyzed potential impacts linking these with specific project activities and phase. First, the task was to consider both positive and negative impacts of the project.

While considering the impacts, the study examined them in light of their characteristics i.e. nature (positive or negative), extent (spatial), occurrence (one-off, intermitted or constant), magnitude, whether reversible or irreversible, direct or indirect, probability of occurrence and significance with and without mitigation.

2. REVIEW OF POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Rwanda has sufficient legal instruments to ensure sustainable use of natural resources and environmental management. Most of the environmental legislation and policies in Rwanda were promulgated through the National Environment Action Plan (NEAP) process. The overall objective of NEAP is to integrate environmental concerns into the social and economic development process in the country. The NEAP therefore outlines a strategy and programme for addressing environmental issues and forms the basis for the current environmental policy in Rwanda.

The main thrust of NEAP is to identify environmental issues and problems, analyze their causes and recommend measures to resolve the issues for each sector. Creation of awareness at all levels of society of the environment and its relationship to socio-economic development and of the necessity for rational resource use among sectors of the country is a vital part of the overall objective. Public participation in the environmental decision-making process is an important element of the Rwandan policy. Amendment of existing legislation to enhance environmental quality is also a part of the NEAP process.

The protection and management of environment are among the pillars of Vision 2020, the development strategy for Rwanda. The environmental objective of the Government is that by 2020, it will have built a nation in which pressure on natural resources, particularly on land, water, biomass and biodiversity, has significantly been reduced and the process of environmental pollution and degradation has been reversed; a nation in which the management and protection of these resources and environment are more rational and well regulated in order to preserve and bequeath to future generations the basic wealth necessary for sustainable development in envisaged.

In this report section, the review of the legal, policy, institutional framework and development strategy were made in line with the environmental and social requirements for Rwanda. The review of relevant World Bank Safeguards/ Operational Policies applicable to the project as well as the international laws and conventions that bear significance to the implementation of this project was also done.

2.1. LEGAL FRAMEWORK

2.1.1. Constitution of the Republic of Rwanda

As the supreme law of the country, the constitution of the Republic of Rwanda of 2003, amended in 2015, stipulates that the state shall protect important natural resources, including land, water, wetlands, minerals, oil, fauna and flora on behalf of the people of Rwanda. This constitution entrusts the Government with the duty of ensuring that Rwandese enjoy a clean and healthy environment.

The Article 49 states that every citizen is entitled to a healthy and satisfying environment. Every person has the duty to protect, safeguard and promote the environment. The state shall protect the environment. The law determines the modalities for protecting, safeguarding and promoting the environment.

2.1.2. ESIA Guidelines for Rwanda

The Organic Law on environment protection made the Environmental and Social Impact Assessment (ESIA) mandatory for approval of major development projects, activities and programs in the Republic of Rwanda, irrigation projects inclusive. By mandate of the parliament of the Government of Rwanda, as conferred upon the Minister of Natural Resources, responsible for environment, in the Organic Law N° 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda, the following guidelines pertaining to the contents of Chapter 4, articles 67-70, concerning Environmental and Social Impact Assessment by the Rwanda Environment Management Authority (REMA) and as endowed with this power in Chapter 3, paragraph 1° of Article 65. Thus, these ESIA guidelines serve as a protocol for use by various stakeholders involved in the conduct of Environmental and Social Impact Assessment.

However, besides the legislation, guidance is needed of a more technical nature to streamline the conduct of ESIA and appraisal of ESIA reports. As such, the establishment of *“General Guidelines and Procedures for Environmental and Social Impact Assessment”*, which unifies the legal requirements with the practical conduct of ESIA, meets a need in the pursuit for sustainable development in Rwanda. The *“General Guidelines and Procedures for Environmental and Social Impact Assessment”* were prepared to contribute to improvement of ESIA practice in Rwanda and they aim to serve agencies and individuals taking part in the ESIA process. These guidelines were designed to ensure that participants in the ESIA process understand their roles and that laws and regulations be interpreted correctly and consistently.

Two main principles underlie these general guidelines:

- They comply with the legal and institutional frameworks on environmental protection in Rwanda and;
- They contribute to improvement of quality and efficiency of ESIA process in the country, and as such merge, step by step, with general global trends and practice of conducting ESIA.

These general guidelines were developed with the aim of providing information necessary when carrying out an environment impact assessment. It should be noted that the team carried out this ESIA study under the guidance of these general guidelines.

In addition to General Guidelines and Procedures for ESIA, the list of activities that require undertaking ESIA was established through the ministerial order No 004/2008 of 15/08/2008. Construction of public dams for water conservation, rain water harvesting for agricultural activities and artificial lakes is among activities that are subject to ESIA before being granted permission to start.

2.1.3. Law governing Land in Rwanda

Article 12 of the law N°43/2013 of 16/06/2013 governing land in Rwanda entrusts the state with ownership over land including lakes, rivers, natural forests, national parks, swamps/marshes, and touristic sites among others. The Article 29 of the same law gives the state control over swamps and/ or marshlands.

The law calls for inventory of the all swamps/marshlands and their boundaries, their structure, their use, how they can be organized. According to article 29 of the Land Law, swamp land belongs to the state. In order for the swamp to be efficiently managed and exploited, the Minister having Environment in his or her attributions must give an order that shall determine a list of swamps and their boundaries. Mukunguli is among the marshlands identified and delineated in 2008.

The law further requires that such a list shall clearly indicate the structure of the swamps, their use, how they can be organized so that they can be beneficial to Rwandan nationals on a sustainable basis. The ministerial order must also certify the modalities of how swamp land shall be managed, organized and exploited.

2.1.4. Environment Protection and Management Legislation

The Organic Law determining the modalities of protection, conservation and promotion of environment in Rwanda stipulates the general legal framework for Environment protection and management in Rwanda. This legislation focuses on avoiding and reducing disastrous consequences on Environment. The Ministry of Natural Resources (MINIRENA) is charged with the responsibility of propagating this organic law regarding environmental conservation.

Legislative and regulatory framework related to Environmental management is established by the Government of Rwanda in organic law N° 004/ 2005 of 08/04/2005. Chapter 4 of Title 3 provides for Environmental and Social Impact Assessment as a requirement for every proposed project that might affect the environment. Article 67, stipulates that: “Every project shall be subjected to Environmental and Social Impact Assessment, before obtaining authorization for its implementation. This applies to programmes and policies that may affect the environment. An order of the Minister having environment in his or her attributions shall determine the list of projects mentioned in this organic law”. Article 68 provides the guidelines for conducting Environmental and Social Impact Assessment. Article 69 stipulates that: “The Environmental and Social Impact Assessment shall be examined and approved by the Rwanda Environmental Management Authority or any other person given a written authorization by the Authority. The approval of ESIA reports is currently done by Rwanda Development Board (RDB).

The proponent pays a levy reduced from the operating cost of his or her project excluding the working capital. This tax is determined by the law establishing the National Fund for the Environment. The environment impact assessment shall be carried out at the expense of the proponent”.

Article 70 provides for “an order of the Minister having environment in his or her attributions establishes and revises the list of planned works, activities and projects, and of which the public administration shall not warrant the certificate, approve or authorize without an Environmental and Social Impact Assessment of the project. The Environmental and Social Impact Assessment shall describe direct and indirect consequences on the environment”.

Article 80 stipulates that: “Buildings, agricultural, industrial, commercial or artisan establishments, motor vehicles and other movable properties that are productive owned either by a person or by a public or a private association, shall be constructed, exploited and

used in conformity with existing technical standards approved or indicated by implementation of this organic law”.

Article 81, prohibits the following:

- Dumping or disposal of any solid, liquid waste or hazardous gaseous substances in a stream, river, lake and in their surroundings;
- Damaging the quality of air and of the surface or underground water;
- Non authorized bush burning;
- Smoking in public and in any other place where many people meet;
- Defecating or urinating in inappropriate place;
- Spitting, discarding mucus and other human waste in any place.

Further, Article 82 stipulates that: “It is prohibited to dump any substances, in any place, which may:

- Destroy sites and buildings of scientific, cultural, tourist or historic interest;
- Kill and destroy flora and fauna;
- Endanger the health of biodiversity;
- Damage the historical sites and touristic beauty at the lakes, rivers and streams”.

Article 83 stipulates that: “It is prohibited to dump in wetlands:

- Waste water, except after treatment in accordance with instructions that govern it;
- Any hazardous waste before its treatment. Any activity that may damage the quality of water is prohibited”.

Regarding constructions, article 87 stipulates clearly that: “It is prohibited to construct houses in wetlands (rivers, lakes, big or small swamps), in urban or rural areas, to build markets there, a sewage plant, a cemetery and any other buildings that may damage such a place in various ways. It further provides for all buildings to be constructed in a distance of at least twenty meters (20m) away from the bank of the swamp. If it is considered necessary, construction of buildings intended for the promotion of tourism may be authorized by the Minister having environment in his or her attributions”.

It is also prohibited to carry out any activities, except those related to research and science, in reserved swamps. The order of the Minister having environment in his or her attributions determines the list of plains in which construction is not permitted and the swamps that are reserved according to assessments of the experts.

Article 88 stipulates that: “it is prohibited to:

- Dump, make flow, dispose of and store any substance in a place where it may cause or facilitate water pollution on the national territory;
- Use natural resources in a degrading and illegal manner;
- Release into the atmosphere poisonous gases, smoke, waste, soot, dust and any other chemical substances in an illegal manner”.

Further, Article 89 stipules that: “In accordance with regulations provided for by International Conventions signed and ratified by Rwanda, it is prohibited to dump, eliminate, immerse any chemical substance in water and in any other place where it may:

- Threaten general public health and biological resources;
- Harm navigation, fishing and others;

- Deteriorate the beauty of a place which is potential for its aquatic tourist interest”.

It is in line with the above legal provisions and Article 95 which stipulates that: “Any one or association that does not carry out Environmental and Social Impact Assessment prior to launching any project that may have harmful effects on the environment is punished by suspension of his or her activities and closure of his or her association and without prejudice to be ordered to rehabilitate the damaged property, the environment, people and the property, for this reason that among others that SPIU RSSP/LWH is conducting/updating an ESIA for the proposed project in Mukunguli marshland.

2.2. POLICY FRAMEWORK FOR RWANDA

2.2.1. Vision 2020

One of the pillars of vision 2020 for the Republic of Rwanda is environmental protection and management. By 2020, the Government of the Republic of Rwanda envisages to have built a nation where stress on natural resources mainly land, water, forestry, biodiversity will have reasonably been decreased and the pollution process and environmental degradation reversed.

It is further stipulated that, the management and protection of these natural resources be given more attention in order to preserve and conserve for the future generations.

To achieve the objectives of Vision 2020, the Republic of Rwanda will ensure:

- The environment issue is integrated into all education, sensitization, and development policies and programmes as well as in all decision-making processes;
- The promotion of grassroots’ communities participation with more involvement of women and the youth in environment protection and management;
- That the precaution principle is set up to alleviate negative effects of socio-economic activities to our environment;
- A diversification of energy sources that will be made available to the population to decrease pressure on biomass;
- That the “ polluter-pays” principle as well as preventive and penal measures are set up to safeguard the environment;
- That a study on Environmental and Social Impact Assessment be conducted for any development project and programme;
- The planning of industrial sites establishment and control of their effects on environment and the population;
- The promotion of more environment friendly transport, stocking and industrial products and waste elimination technologies;
- Regulations relating to mine exploitation and mine discharge treatment are applied;
- Rehabilitation of former quarry sites;
- That the Bureau of Standards for local and imported products is strengthened;
- A statistic database on natural resources and environment and a quick alert system to mitigate anticipate natural disasters are set up and that a scheme for victims of a natural calamity is created;
- That Rwanda Environment Management Authority (REMA) is set up and supported,
- The cooperation with other countries and international institutions in the area of environment protection and management.

2.2.2. National Policy on Environment for Rwanda

The policy seeks to achieve its overall objective of the improvement of human wellbeing, the judicious utilization of natural resources and the protection and rational management of ecosystems for a sustainable and fair development through improved health and quality of life for every citizen and promotion of sustainable socio-economic development through a rational management and utilization of resources and environment, integrating environmental aspects into all the development policies, planning and in all activities carried out at the national, provincial and local level, with the full participation of the population, conservation, preserve and restoration of ecosystems and maintenance of ecological and systems functions.

The key principles mention among others that:

- It is every person's right to live in a safe and stable environment, but on the other hand, they must keep it healthy;
- The national economic growth must be based on rational use of resources and take into account environmental dimensions;
- Active and effective participation of the whole population for environment protection and management;
- A special emphasis must be laid on environmental education and sensitization programme at all levels with more involvement of women and the youth;
- Environmental impacts are to be analyzed while conducting studies of development projects.

Further, the policy proposes the elaboration or updating of master plans and special planning in urban areas with regard to population and land development aspects. In natural resources management (including land and water), the policy proposes:

- Ensure the preservation and protection of soils against any form of degradation;
- Ensure that a prior study of environmental impact which underlines costs and benefits from slopes and underlying ecosystems protection is conducted for any development projects and;
- Encourage programmes of rainwater collection, stocking and use.

The policy also proposes the following in regard to biodiversity, forests, wetlands management and other natural reserves and or ecosystems:

- Set up protection measures for slopes to avoid degradation of swamps;
- Promote the rehabilitation of ecosystems under degradation and restoring endangered species.
- On the issue of environmental education, information and research, the policy proposes among others to reinforce the human and institutional capacity building with regard to environment and to sensitize the population to protect the environment.

On health and sanitation, the policy proposes among others:

- Set up a system of waste collection, transport, disposal and elimination;
- Establish norms of zone protection between dumps, human buildings and water sources;
- Set up an appropriate canal and evacuation system for waste waters and rainwater in towns and resettlement sites "Umudugudu".

The National Policy on Environment for Rwanda harmonizes other policies like agriculture, energy policy. The policy further proposes that the Central Government will be concerned with conservation and protection policies while tourism and environmental management will be transferred to the District and Kigali City levels.

2.2.3. National Water Resources Management Policy

The overall goal of Rwandan water resources management policy is to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available Water Resources of Rwanda for significant socioeconomic development on sustainable basis.

The policy aims at fair and sustainable access to water, protection of the water resources and promotion of cooperation for management of river basins, etc. through reforestation on hillsides and water catchment areas. The policy underlines the fundamental principles that water is a natural endowment commonly owned by all the peoples of Rwanda and that every Rwandan citizen shall have access to sufficient water of acceptable quality, to satisfy basic human needs.

The policy also needs to adopt a holistic approach to the management of water resources and integrate other policies related to it including the forest, wetlands, agriculture and land. It is relevant to all project activities that will be undertaken in areas with water resources. This policy is therefore relevant to this project as most of the project activities will be undertaken within the water catchment areas of Mukunguli.

2.2.4 Policy on Land Resource

The Rwanda land policy, adopted in February 2004, seeks to establish a land tenure system that guarantees tenure security for all Rwandans and guides land reform initiatives that will establish good management and the rational use of land. It is equally relevant to all Rwandans - those with land and those without. This policy provides register and transfer of land and possibility of investments in land. It also highlights key principles of land use and land management calls for rational use and sound management of national land resources based on master plans. The policy advocates the protection of green areas, marshland, valley and protected areas in Rwanda. These protected areas are classified as such because of their multiple roles, namely ecological, economical, cultural, and social. These areas have been affected by various changes, one of which is the spatial reduction due to the resettlement of the population.

The policy promotes irrigating areas that are more or less flat and semi-arid to support agricultural production while discouraging overgrazing and pasture burning. On the use and management of hillsides and marshlands, the policy stipulates that marshlands meant for agriculture should be cultivated after adequate planning and Environmental and Social Impact Assessment.

2.2.5. Policy on Agriculture Sector

The main objective of this policy is to intensify and transform subsistence agriculture into market oriented agriculture. The use of contemporary inputs like improved seeds and fertilizers is envisaged.

This policy puts emphasis on marshland development for increased food production because the soil on hills is degraded by erosion and rendering it unproductive.

The policy promotes small scale irrigation infrastructure development in the selected marshlands while preventing environmental degradation and ensuring sustainable development. In order to achieve sustainable development in agricultural sector, the policy emphasizes the need to adopt Integrated Pest Management (IPM) practices.

The use of IPM practices is highly recommended in this Environmental and Social Impact Assessment study as this will guide on the best use of pesticides.

2.2.6. Marshland Development Master Plan

Rwanda has formulated a master plan for marshlands development which among other things provides for the protection of water catchments and soil conservation based on hydrology, pedology, environmental, agro economic and sociological studies. It will target to develop 40,000 ha of marshlands by 2020.

The plan also calls for development of a marshland to go hand in hand with the management of the hillsides associated with them. The master plan recognizes the role of Environmental assessment in planning for economic development especially in the agricultural sector.

2.2.7. National Biodiversity Strategy and Action Plan

This strategy defines the objectives and priorities for the conservation and sustainable management of biodiversity. The action plan includes hillsides, wetlands and protected areas as some of the areas that need to be conserved. The national biodiversity strategy and action plan approved in June 2000, defined the objectives and priorities for sustainable biodiversity conservation and management. Biodiversity includes wetlands, protected areas and the strategies are ranked as follows: Political and legal frameworks relating to environment unknown by the population and/or decentralized entities; ii) low level of awareness among people with regard to environment; iii) inadequate exploitation of forests; iv) erosion; v) exploiting quarry sites without restoring exploited parts; vi) insufficient knowledge on environment status; vii) weakness of decentralized structures in environment management; viii) absence of appropriate environment-friendly technologies.

The strategy on biodiversity aims at: improving conservation of protected areas and wetlands; sustainable use of biodiversity in natural ecosystems and agro-ecosystems; rational use of biotechnology; development and strengthening of policy, institutional, legal and human resources frameworks; and equitable sharing of benefits derived from the use of biological resources.

There is need to undertake an inventory of wetlands in the country which will allow planning for these ecosystems.

2.2.8. Policy on Health Sector

One of the objectives of this policy is to improve the quality of life and demand for services in the control of disease.

The policy identifies the most common illnesses in Rwanda and puts priority to addressing these diseases. Irrigation projects, envisaged for Mukunguli site, have a vital role to play in the increased incidences of malaria and schistosomiasis, especially in the irrigation canals and water reservoir.

2.2.9. National Poverty Reduction Strategy

The National Poverty Reduction Strategy promotes the transformation of subsistence agriculture into modernized agriculture, which is market oriented as one of the priority area. Other priority areas include human development which covers the actions of improving living conditions of the poor, economic infrastructure, governance, development of the private sector and the institutional reinforcement.

2.3. INSTITUTIONAL FRAMEWORK

2.3.1. Ministry of Natural Resources

The Ministry of Natural Resources (MINIRENA) is the ministry responsible for the environment. It has the following missions:

- Prepare and ensure the follow up and evaluation of policies, strategies as well as environment protection;
- Prepare draft bills and establish norms and practices for rational exploitation and efficient Land management, Environment protection, forest management and integrated Water Resources management and evaluate their implementation
- Promote research and exploit Rwandan underground natural resources and set up appropriate mechanisms for their extraction and valuation;
- Plan and follow up pure water distribution programme and basic health activities;
- Initiate incentive measures and support programmes to private sector and civil society so as to invest in land protection activities, Water Resources, Environment, Forest and Mining;
- Coordinate stakeholders' activities and mobilize necessary resources for land management and land use planning, Water Resources as well as Environment protection.
- Reinforce capacities of decentralized entities in matters of land management, Water Resources, Environment, Forest and Mining.

2.3.2. Rwanda Environment Management Authority

With regards to the management of the bio-physical environment throughout Rwanda, the overall responsibility now lies with the Rwanda Environment Management Authority (REMA). In November 2005, the Government of Rwanda approved the law establishing the Rwanda Environment Management Authority (REMA).

The functions of REMA are:

- To implement Government environmental policy and decisions of the Board of Directors.
- To advise the Government on legislative and other measures for the management of the environment or the implementation of relevant international conventions, treaties and agreements in the field of environment, as the case may deem necessary.
- To take stock and conduct comprehensive environmental audits and investigations, to prepare and publish biannual reports on the state of natural resources in Rwanda.

- To undertake research, investigations, surveys and such other relevant studies in the field of environment and disseminate the findings.
- To ensure monitoring and evaluation of development programs in order to control observance of proper safeguards in the planning and execution of all development projects, including those already in existence, that have or are likely to have significant impact on the environment.
- To participate in the set up of procedures and safeguards for the prevention of accidents and phenomena which may cause environmental degradation and propose remedial measures where accidents and those phenomena occur.
- To render advice and technical support, where possible, to entities engaged in natural resource management and environmental protection.
- To provide awards and grants aimed at facilitating research and capacity-building in matters of environmental protection.
- To publish and disseminate manuals, codes or guidelines relating to environmental management and prevention or abatement of environmental degradation.

REMA was initially responsible for reviewing and approving ESIA reports. However, this duty was now assigned to Rwanda Development Board (RDB) where a department of ESIA has been created and tasked with review and approvals of all ESIA studies.

2.3.3. Rwanda Development Board

This is a one stop institution bringing together several government bodies in Rwanda focused at promoting investment in Rwanda. RDB has created a department of ESIA responsible for reviewing all projects ESIA before approval; a duty that was previously undertaken by REMA.

With regard to Environmental safeguards, RDB plays the following roles:

- Review Project Briefs so as to advise on Terms of Reference,
- Provide information or advice to developers and ESIA Experts when consulted during ESIA process,
- Review ESIA reports and provide comments to the developers,
- Organizing public hearings,
- Issue certificate of approval

2.3.4. Rwanda Natural Resources Authority

Rwanda Natural Resources Authority (RNRA) is an authority under the Ministry of Natural Resources that heads the management and rational use of natural resources, including water. It plays a significant role in the management and protection of Environment through its department namely department of land and mapping, department of forests and critical ecosystems management, department of integrated water resources management and the department of mining and geology.

Particularly, RNRA is responsible for:

- ✓ implementing national policies, laws, strategies, regulations and government resolutions in matters relating to the promotion and protection of natural resources;
- ✓ Making follow up and to implement international conventions Rwanda ratified on matters relating to natural resources management
- ✓ advising the Government on appropriate mechanisms for conservation of natural resources and investments opportunities;

- ✓ registering land, issuing and keeping land authentic deeds and any other information relating to land;
- ✓ Ensuring proper geological data and their respective maps,
- ✓ providing technical advice on the land use;
- ✓ Making a follow up and supervising the activities relating to proper management, promotion, conservation and valuation of forests;
- ✓ Rehabilitating and conserving where a natural resource gets damaged in the country;
- ✓ Initiating research and study on water resources and to publicise the results therefore;
- ✓ Instituting regulations, guidelines and appropriate mechanisms for management, use and conservation of water resources and ensuring their implementation.

2.3.5. Local Governments

Local Governments (including Ruhango and Kamonyi District, the study area) under the General Guidelines and Procedure for ESIA are tasked to perform the following functions:

- At the request of RDB, review Project Briefs so as to advise on Terms of Reference,
- Provide information or advice to developers and ESIA Experts when consulted during ESIA process,
- At the request of RDB, review ESIA reports and provide comments to RDB,
- Assist RDB in organizing public hearings,
- Host public hearings,
- Host individual consultations,
- Gather written comments from public and transmit them to RDB.
- Participate in implementation and monitoring of Environmental and Social Management Plan

2.4. INTERNATIONAL ENVIRONMENTAL RELATED CONVENTIONS SIGNED BY RWANDA

Besides the law and regulation on ESIA at national level, Rwanda has approved and signed several international conventions which are in one or another way related to environmental management of feeder roads development projects:

- Convention on Biological Diversity aiming at conserving biodiversity, using it sustainably and fairly and equitably sharing benefits arising from genetic resources;
- The CARTAGENA protocol on Biosafety, which is a supplement to the Convention of Biodiversity signed in NAIROBI from May 15, to 26, 2000 and in NEW YORK from June 5, 2000 to June 4, 2001 as authorized to be ratified by Law n° 38/2003 of 29 December 2003;
- The KYOTO Protocol to the Framework Convention on Climate Change adopted at KYOTO on March 6, 1998 as authorised to be ratified by Law n° 36/ 2003 of 29 December 2003;
- The RAMSAR International Convention of February 2, 1971 on Wetlands of International importance, especially as waterfowl habitats as authorised to be ratified by Law n° 37/2003 of 29 December 2003;

- The STOCKHOLM Convention on persistent organic pollutants, signed in STOCKHOLM on 22 May 2001, has been approved by Presidential Order n° 78/01 of 8 July 2002;
- CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora): This is an international treaty aiming to prevent species from becoming endangered or extinct because of international trade. Any trade in protected plant and animal species should be sustainable, based on sound biological understanding and principles.

This shows the commitment of Rwanda to fulfil all the requirements at international level in terms of environmental protection toward sustainable development.

2.5. WORLD BANK SAFEGUARD POLICIES

The World Bank Group (WBG) includes two development institutions owned by 184 member countries – the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The operations of IDA and IBRD members are guided by a comprehensive set of environmental and social policies and procedures dealing with the Bank’s development objectives and goals, the instruments for pursuing them, and the project sponsor requirements for Bank-financed operations.

These policies and guidelines, known as Operation Policies (OPs), are set out in the Bank’s Operational Manual. The OPs are focused statements that follow from the Bank’s Articles of Agreement, general conditions, and Bank policies specifically approved by the Board. The Manual also addresses procedures, good practice and advice on implementation of policies.

Within the overall set of OPs, the Bank has identified ten key policies critical to ensuring that potentially adverse environmental and social impacts are identified, minimized and mitigated. These include:

- Environmental Assessment (OP 4.01);
- Physical Cultural Resources (OP 4.11);
- Disputed Areas (OP 7.60);
- Indigenous Peoples (OP 4.10);
- International Waterways (OP 7.50);
- Involuntary Resettlement (OP 4.12);
- Natural Habitats (OP 4.04);
- Forests (OP 4.36)
- Pest Management (OP 4.09) and;
- Safety of Dams (OP 4.37).

The Bank undertakes screening of each proposed project to determine the appropriate extent and type of Environmental Assessment (EA) to be undertaken.

The World Bank system assigns a project to one of three project categories, as defined below:

Category “A” Projects: An ESIA is always required for projects that are in this category. Impacts are expected to be ‘adverse, sensitive, irreversible and diverse with attributes such as pollutant discharges large enough to cause degradation of air, water, or soil; large-scale physical disturbance of the site or surroundings; extraction, consumption or conversion of substantial amounts of forests and other natural resources; measurable modification of hydrological cycles; use of hazardous materials in more than incidental quantities; and involuntary displacement of people and other significant social disturbances;

Category “B” Projects: Although an ESIA is not always required, some environmental analysis is necessary. Category B projects have impacts that are ‘less significant, not as sensitive, numerous, major or diverse. Few, if any, impacts are irreversible, and remedial measures can be more easily designed.’ Typical projects include rehabilitation, maintenance, or upgrades, rather than new construction and;

Category “C” Projects: No ESIA or other analysis is required. Category C projects result in negligible or minimal direct disturbance of the physical environment. Typical projects include education, family planning, health, and human resource development.

Based on the limited magnitude of its potential environmental impacts, the project has been categorized by the Bank as an Environmental Screening Category B – Partial Assessment. Environmental impacts of the proposed project activities in Mukunguli site are likely to be short term, site-specific, non-sensitive or irreversible, and in every case, mitigation measures can be designed to reduce the negative impacts.

The project sponsor is responsible for any environmental due diligence required by the Safeguard Policies, with general advice provided by Bank staff. Further details of the Bank’s environmental and social Safeguard Policies can be viewed at www.worldbank.org. We are also aware that the World Bank has an Inspection Panel that was established by the Executive Directors of the IBRD and IDA on September 22nd, 1993. Its primary purpose is to address the concerns of the people who may be affected by Bank projects and to ensure that the Bank adheres to its operational policies and procedures during the design, preparation and implementation phases of its projects.

Out of the above 10 safeguards policies, the RSSP3 shall trigger 7 policies. The Forests (OP 4.36), Disputed Areas (OP 7.60) and Indigenous Peoples (OP 4.10) are not triggered. The proposed irrigation project for Mukunguli site shall therefore be implemented in accordance with the requirements of the World Bank Safeguard Policies discussed below:

Environmental Assessment (OP 4.01)

This policy requires Environmental Assessment (EA) of projects proposed for World Bank financing to help ensure that they are environmentally sound and sustainable, and thus improve decision making. The EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. The EA process has thus taken into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and cultural property) and trans-boundary and global environmental aspects.

We have assessed and determined future potential environmental and social impacts during implementation of this project, and we have also clearly elaborated various mitigation, monitoring and institutional actions to be taken during the implementation of the project

activities. This is geared towards eliminating, reducing the adverse environmental and social impacts to acceptable standards. This ESIA report will therefore, upon clearance, be disclosed in the World Bank InfoShop and on the RRSP website, and will be made available to local communities in accessible locations.

Natural Habitats (OP 4.04)

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long term sustainable development. The World Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats. Natural habitats are land and water areas where (i) the ecosystems biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the areas primary ecological functions. Therefore, the natural habitats policy is triggered in certain cases because the proposed project within Mukunguli catchment area may have potential adverse impacts on the catchment area. These ecosystems do support varying degrees of natural complexities of flora and fauna.

Therefore, in regard to the above policy, this ESMP proposes various mitigation measures to eliminate and/ or reduce the likely advance impacts as a result of implementing this project.

Pest Management (OP 4.09)

This policy aims at the management of pests that affect either agriculture or public health. The World Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides.

Rural development and health sector projects have to avoid using harmful pesticides. A preferred solution is to use Integrated Pest Management (IPM) techniques of the existing Pest Management Plan of the project. In appraising a project that will involve pest management, the Bank assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and Environmentally sound pest management. As necessary, the Bank and the borrower incorporate in the project components to strengthen such capacity.

The Bank uses various means to assess pest management in the country and support integrated pest management (IPM) and the safe use of agricultural pesticides: economic and sector work, sectoral or project-specific environmental assessments, participatory IPM assessments, and investment projects and components aimed specifically at supporting the adoption and use of IPM.

For World Bank funded agriculture projects, pest populations are normally controlled through IPM approaches, such as biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest. The policy supports use of environmental methods for public health projects in controlling pests. Where environmental methods alone are not effective, the Bank may finance the use of pesticides for control of disease vectors.

The policy calls for assessment of the nature and degree of associated risks, taking into account the proposed use and the intended users for procurement of any pesticide in Bank financed projects. The policy sets criteria to apply for the selection and use of pesticides in Bank financed projects including must have negligible adverse human health effects, must be shown to be effective against the target species, and must have minimal effect on non target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies. Pesticides used in public health programs must be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well as for personnel applying them and the use must take into account the need to prevent the development of resistance in pests.

The policy requires that any pesticides it finances be manufactured, packaged, labelled, handled, stored, disposed of, and applied according to standards acceptable to the Bank. The Bank does not finance formulated products that fall in World Health Organisation (WHO) classes IA and IB, or formulations of products in Class II, if the country lacks restrictions on their distribution and use; are likely to be used by, or be accessible to, lay personnel, farmers, or others without training, equipment, and facilities to handle, store, and apply these products properly.

The policy requires putting in place a Pest Management Plan (PMP) and structure for adoption of IPM and safe use of pesticides. An updated PMP for RSSP 3 was prepared and disclosed in-country and at the World Bank InfoShop in April 2012.

Involuntary Resettlement (OP 4.12)

The objective of this policy to avoid where feasible, or minimize, exploring all viable alternative project designs, to avoid resettlement. This policy is active in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas (like marshlands). The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts.

This policy covers direct economic and social impacts that both result from Bank assisted investment projects, and are caused by (a) the involuntary taking of land resulting in (i) relocation or loss of shelter; (ii) loss of assets or access to assets, or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or (b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons. The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to project appraisal of proposed projects. The objective of this policy to avoid where feasible, or minimize, exploring all viable alternative project designs, to avoid resettlement.

The policy requires the displaced persons and their communities, and any host communities receiving them, are provided timely and relevant information, consulted on resettlement options, and offered opportunities to participate in planning, implementing, and monitoring resettlement. Appropriate and accessible grievance mechanisms are established for these groups.

In new resettlement sites or host communities, infrastructure and public services are provided as necessary to improve, restore, or maintain accessibility and levels of service for the displaced persons and host communities. The Resettlement Action Plan (RAP) was prepared for this project and publicly disclosed in Rwanda.

Physical Cultural Resources (OP/BP 4.11)

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.

Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

As this policy is triggered for RSSP, chance finds procedures should be incorporated into the ESMPs and civil works contracts.

The following wording is proposed:

If the Contractor discovers archaeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

- Stop the construction activities in the area of the chance 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 or the Institute of National Museum of Rwanda (INMR) take over;
- Notify the supervisory Project Environmental Officer and Project Engineer who in turn will notify the responsible local authorities and the INMR immediately (within 24 hours or less).

Responsible local authorities and the authorities of Institute of INMR would then be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the INMR. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage, namely the aesthetic, historic, scientific or research, social and economic values.

Decisions on how to handle the finding shall be taken by the responsible authorities and the INMR. This could include changes in the layout (such as when finding irremovable remains of cultural or archaeological importance) conservation, preservation, restoration and salvage.

Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities. Construction work may resume only after permission is given from the responsible local authorities or INMR concerning safeguard of the heritage.

Projects in International Waterways (OP 7.50)

Any river basins which qualify as international waterways for the purpose of the World Bank's Operational Policy for Projects on International Waterways (OP 7.50, the Borrower, or as requested, the World Bank notifies riparian nations of the respective river basins of the project, the details of which are provided in the notification.

The notification also confirms that the project will not have any adverse effects on the quantity or quality of the flow of the waters to any of the other riparian country. Riparian states have been officially notified about the proposed project and have provided their no-objection.

Safety of Dams (OP 4.37)

The World Bank distinguishes between small and large dams for application of its policy on safety of dams, OP 4.37, states:

- a) Small dams are normally less than 15 meters in height. This category includes, for example, farm ponds, local silt retention dams, and low embankment tanks.
- b) Large dams are 15 meters or more in height. Dams that are between 10 and 15 meters in height are treated as large dams if they present special design complexities (for example, an unusually large flood-handling requirement, location in a zone of high seismicity, foundations that are complex and difficult to prepare, or retention of toxic materials). Dams fewer than 10 meters in height are treated as large dams if they are expected to become large dams during the operation of the facility (eg. tailing dams).

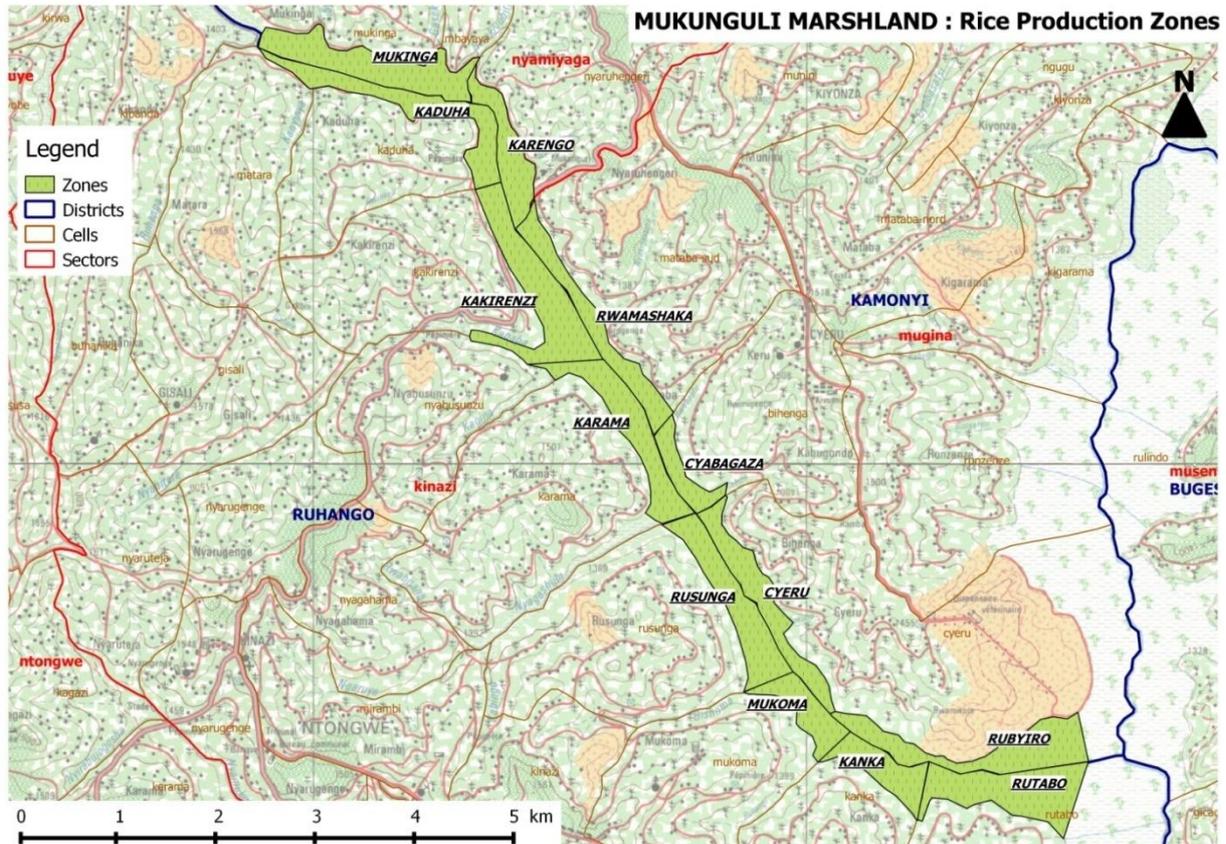
In the case of Mukunguli site, only river weirs and irrigation and drainage canals will be constructed. For this situation, only protection and safety measures will be required. The Dam Safety Policy is not triggered for Mukunguli site.

3. BASELINE INFORMATION

3.1. PHYSICAL ENVIRONMENT

3.1.1 Geographical Location

Mukunguli marshland is located in the Southern Province between Nyamiyaga and Mugina Sectors of Kamonyi District and Kinazi Sector of Ruhango District. It can be accessed from Kigali through RN01 until Rugobagoba. From there, a dirt road of 17 km on the left side of the RN01 leads to the marshland. The general map showing the marshland as well as sectors and cells covered is below presented.



Source: Feasibility study by SHERS Ingenieurs –Conseils sa (2015)

Figure 1: Geographical location of Mukunguli site

3.1.2 Climate

Basic climatic data are provided either at the reference climatic station, when available, or taken from Climwat (FAO) and IWMI databases on the basis of geographical coordinates of the studied area.

Table 1: Average monthly climatic data of the site

	Temp min.	Temp Max	Rainfall	Effective rainfall	Humidity	Wind	Sunshine	ETo	ETo
Month	°C	°C	mm	mm	%	m/s	hours	mm/day	mm/month
January	14	26.2	92.0	78.5	77	1.5	5.04	3.75	116.3
February	14.1	26.5	83.0	72.0	77	1.5	5.52	3.91	109.5
March	14.25	26.35	130.2	103.1	78	1.5	4.92	3.76	116.6
April	14.45	25.75	190.2	132.3	81	1.4	4.8	3.42	102.6
May	14.25	25.75	146.2	112.0	79	1.6	5.16	3.37	104.5
June	13.4	26.4	43.0	40.0	72	1.8	6.96	3.83	114.9
July	13	27	17.7	17.2	66	1.9	7.08	4.34	134.5
August	13.75	27.45	48.0	44.3	64	1.9	6.24	4.65	144.2
September	14.15	27.05	95.5	80.9	67	1.7	5.76	4.36	130.8
October	14.15	26.65	100.1	84.1	72	1.7	5.28	4.06	125.9
November	14.25	25.75	156.5	117.3	76	1.6	4.92	3.54	106.2
December	14.15	25.85	117.2	95.2	78	1.4	4.92	3.56	110.4
Average	14.0	26.4			73.9	1.6	5.6	3.9	118.0
Annual			1219.6	976.9					1 416.2

Source: Detail Design Study by SHER Ingenieurs- Conseils sa, 2015

The annual rainfall of the area is around 1,220mm. Rainfall maxima of 1500mm/month are usually observed in November (156.5mm), during the short wet season going from September through December and in April (190.2mm) during the long rainy season of February through June. The dry season extends from June to August, with July being the driest month. Mean annual temperature at the project site is 20.2°C, with mean annual maxima and minima of 26.4 and 14.0°C respectively.

The Mukunguli marshland gets its water from Mukunguli river and its tributaries. The water flows into Akanyaru river, tributary of Nyabarongo river.

3.1.3. Soils

The Mukunguli watershed is dominated by granite formations with local inclusion of quartzitic sandstone rocks. Granite is a rock characterized by 3 essential minerals: quartz crystalline grains; feldspars and micas. These essential minerals are generally associated with other secondary minerals.

The behaviour of these minerals to alteration processes is quite different from one to another. Feldspars are very sensitive to alteration and give clays. The mechanical alteration of micas gives smaller and smaller flakes. Quartzite grains resist to alteration and subsist in the alteration products generally mixed with clays and micas flakes. This alteration complex is known as granitic arena.

Marshland soils are composed of regolith deposited either by the river (alluviums) or by runoff (colluviums). Alluviums are generally clay or silt materials. They are deposited as sediments in marshland during long flooding episodes. Colluviums material are more coarse (silt and sand) and sediment all along the rain season at the piedmont zones.

Mukunguli soils were originally fibrist (organic soils with abundant fibbers). The marshland development for rice production has affected these soils and increased their mineralisation in the first 50 cm by modifying groundwater level, aeration and mixing up upper layers during seasonal ploughing. Organic soils are still present mainly in the downstream of the marshland under permanent flooding in the vicinity of the Akanyaru river. They are mainly fibrist or organic soils with abundant slightly decomposed fibbers. They are represented by MG034 (left riverside), MD010 (right riverside) and the pits (not described) located more downstream of the marshland, between MG034 and MD010 and Akanyaru river.

3.1.4. Land uses

Mukunguli marshland covers parts of Nyamiyaga and Mugina Sectors in Kamonyi District and Kinazi Sector in Ruhango District. The surface area that can be used for rice production is 521 ha subdivided into 10319 plots regrouped in 13 zones (SHERS, 2015). The total area cultivated into rice was 400 ha in season 2014 B and 300 ha in season 2015 A. Rice production in Mukunguli marshland is currently under the responsibility of Cooproriz ABAHUZABIKORWA. The uncultivated area for rice is either used the production of other seasonal crops or left unused due to floods.

The marshland is mostly used for rice production. However, other crops like banana, yam, elephant grass, bean, etc can be found in the marshland. The figure below illustrates various land uses within the marshland.



Figure 2: Land uses in Mukunguli marshland

3.2 BIOLOGICAL ENVIRONMENT

3.2.1. Flora

The original natural vegetation of the Mukunguli watershed was a savannah. The marshland itself was occupied by aquatic dense vegetation with papyrus and other cyperaceous species, phragmites, aquatic trees etc.). The vegetation of Mukunguli marshland is currently characterised by secondary succession growth due to human activities especially agriculture. These cultivated marshlands have changed from natural ecosystems to agroecosystems. The whole Mukunguli marshland is almost cultivated with rice. Other crops include weet potato, banana, nappier grass and vegetables, like cabbage. Aquatic vegetation, like papyrus species (*Cyperus latifolius*) were found at the marshland outlet, near Akanyaru river. No endangered plant species were observed in the studied area.

The original natural vegetation contributed to mitigate erosion reducing runoff and soil losses. In the marshland, aquatic vegetation played a key role as a buffer zone. In the upstream front, it was an excellent filter and stopped a maximum of solid particles brought by the runoff in particular sand and other coarser sediments. This protected the marshland against the siltation. The aquatic vegetation was also an excellent sponge and contributed to regulate hydrologic regime in the marshland and regulated the level of rivers located downstream (gentle variations between seasons and years). As a consequence, the destruction of aquatic vegetation due to agricultural activities affects negatively all the marshland and increased siltation observed these last 20 years and disturbed ecosystems in the downstream.

3.2.2 Fauna

In addition to domestic animals, different species of birds are found in the area. Fish species are available in Mukunguli and Akanyaru rivers. Hippopotamus were also reported in Akanyaru river. No endemic or endangered species were recorded in the area.

3.3 SOCIO- ECONOMIC ENVIRONMENT

3.3.1. Population

The 2012 Population and Housing Census revealed that the population of Kamonyi and Ruhango Districts was 340,501 and 319,885 inhabitants occupying the total area of 655 and 527 km² respectively. In both Districts, the females outnumber males. The female population of Kamonyi accounts for 54% females while that of Ruhango District is 52.1% of the District population. The average size of the household is 4.6 and 4.3 persons in Kamonyi and Ruhango District respectively. Mugina and Nyamiyaga Sectors of Kamonyi District have a total population of 39,056 and 38,839 covering 77.8 and 88.7 Km² respectively. The population density in Mugina and Nyamiyaga is 433 and 503 persons/ km² respectively. The population of Kinazi Sector is 43,658 people, including 20,926 males and 22,732 females. The 3 Sectors are the most populated in their respective Districts. The population in the 3 Sectors represents 18.4% of the total resident population of the 2 districts.

3.3.2. Socio-economic activities

a) Families using the marshland

The marshland area used for agriculture currently covers 521 ha and is subdivided into 10,319 plots used by small rice farmers, regrouped in 13 zones. Each family owns one plot and this would mean that the marshland is exploited by 10,319 families with 45,400 persons. This number is likely to increase after marshland extension since the additional land will be redistributed.

b) Size of the surveyed Household

A sample of 80 people was taken and a questionnaire was administered to people in the vicinity of the marshland. The information concerning size of the households was collected and results are summarized in Table below.

Table 2: Marshland ownership and Size of the surveyed Households

Land ownership				Size of the surveyed households			
S/N	Ownership	Frequency	%	S/N	Family size	Number of Respondents	(%)
1	Use marshland	80	100	1	Less than 3	20	25
2	Does not use marshland	0	0	2	Medium (3-5)	52	65
				3	Large (Above 5)	8	10
Total		80	100	Total		80	100

Source: Field survey and Analysis, August, 2016

The results from the survey revealed that all surveyed people (100%) possess plot in the marshland and use it for agricultural purpose. The findings also show that the majority of surveyed families (65%) are of medium size (3-5 people per household) while large families (above 5 people/HH) are represented by 10%.

c) Marital status of respondents

The marital status of the surveyed families is an important parameter to know the views of different categories of people about the project. The table below showed the marital status of the respondents.

Table 3: Marital Status of Respondents in the Household Surveyed

S/N	Marital status	Number of respondents	Percentage (%)
1	Married	60	75
2	Single	4	5
3	Widow	16	20
4	Divorced	0	0
	Total	80	100

Source: Field survey and Analysis, August 2016

The majority of families (75%) are married while the widow and single families represent 20% and 5% respectively.

c) Vulnerability of people in Mukunguli site

The vulnerability and social group for individuals in the community gives the idea of level of vulnerability. The following Table gives the detail on vulnerability within the study area.

Table 4: Vulnerability assessment in the vicinity of the marshland

<i>S/N</i>	<i>Social group</i>	<i>Frequency</i>	<i>%</i>
1	Living with disability	1	1.2
2	Orphans	2	2.5
3	Women headed household	6	7.5
4	Aged people (> 65 years old)	7	8.8
5	People in normal conditions	64	80
	Total	80	100

Source: Field survey and Analysis, August 2016

The majority of the project surveyed population (80%) are in normal condition followed by elderly people (8.8%) and women headed household (7.5%). Orphans and people living with disability represent 2.5 and 1.2% respectively.

d) Education of Respondents

The level of education among the population is very low as revealed by the data analysis reported in Table below.

Table 5: Level of Education of respondents

S/N	Level of education	Frequency (No)	Percentage (%)
1	Illiterate	16	20
2	Primary	52	65
3	Incomplete Secondary	7	8.8
4	Secondary	5	6.2
5	Incomplete Higher	0	0
6	Higher (Bachelors Degree)	0	0
7	Postgraduate	0	0
	Total	80	100

Source: Field survey and Analysis, August 2016

Among the respondents, 20% are illiterate; primary (elementary level) education represents 65% and 8.8% have incomplete secondary level. The proportion representing those who completed the secondary level represents 6.2%.

e) Economic activities

(i) Agriculture

Agriculture is the main sector of the economy with 78% and 83.2% of the population aged 16 and above in Kamonyi and Ruhango District respectively. The mean size of land cultivated per HH in Kamonyi is 0.53 ha while that of Ruhango is 0.45 ha; this is slightly below the national average 0.59 ha. In the marshland, the mean size is 5 Ares per household.

Cassava, Bean, Sweet potato, Maize, Rice, Soyabean and banana are the key crops in both districts. Cassava was the main cash crop; however, the importance of rice as cash crop increased as Cassava was recently constrained by the proliferation of cassava mosaic. Ruhango district has also a record in the production of some fruits, namely Avocado (9,459t/year), Citrus (313t/yr), Orange (100t/yr) and Onion. The marshland is mostly used for rice production.

In addition to cropping activities, some 67.1% of HH in Kamonyi and 92.8% in Ruhango raise some type of livestock, mostly cattle, goats and poultry.

(ii) Mining and quarrying

Kamonyi and Ruhango Districts have many sand and clay used for construction. However, their irrational exploitation affects the environment. There are also coltan and cassiterite. The sand exploitation is an important socio-economic activities in Mukunguli site. Most of the constructions in Kigali City and many other corners of the country are using Mukunguli sand because of its good quality.

(iii) Energy

The study areas are mostly using firewood as source of energy for cooking. The extension on the use of improved stoves "Rondereza" is underway. Currently, above 60% of the households are using improved stoves.

3.3.3 Rice production in Mukunguli

Rice was introduced in Mukunguli marshland from 1967 to 1972 by Chinese. The first rice perimeter cultivated had a surface area of 30Ha, and land preparation was done by local residents who were paid to work on their own land. The most significant changes that occurred over the last 48 years are: (i) The development of a rice

production scheme that is an example of success in terms of community mobilization and farmers ownership despite huge problems of flooding and the destruction of irrigation infrastructures since 2011, (ii) The creation of the Cooproriz ABAHUZABIKORWA that successfully took over the management of rice production after the dissolution of SOPRORIZ (joint venture between Government of Rwanda and Chinese Government); (iii) the creation in 2012 of Mukunguli Rice Promotion Investment Corporation (MRPIC), a company in which the Cooproriz ABAHUZABIKORWA has 38% of the shareholding. Rice production in Mukunguli marshland is currently under the responsibility of Cooproriz ABAHUZABIKORWA.

Rice production is the major economic activity in Mukunguli marshland. The marshland covers 640 ha spanning 13 km from north-west to south-east where it joins Akanyaru River. It is already developed on an area of 250 ha. The supply of water to the irrigation scheme comes from the Mukunguli River through two weirs. The downstream part of the marshland is cultivated on 400 ha but there are neither formal irrigation weirs nor an organized irrigation network. The marshland is subdivided into 10,319 plots used by small rice farmers, regrouped in 13 zones.

Flooding represents the highest risk for rice production in Mukunguli marshland. It is a consequence of erosion that occurs in the watershed that covers large areas from Rugobagoba (Kamonyi District) to Ruhango town. Despite these issues related to flooding and/or shortage of irrigation water, Mukunguli marshland presents a good potential for rice production: i) First of all, there are seven zones over 13 that manage to operate two rice production seasons per year (Mukingo, Karenga, Rwamashaka, Cyeru, Rubyiro, Rutabo, Kakirenzi); ii) Second, there are 4 zones where two seasons are done except on a few number of pockets where there is shortage of irrigation water or regular flooding (Cyabagaza, Rusunga, Karama, Kaduha); iii) Finally, the only zones where rice is cultivated only in Season B are Rukomo and Kanka.

(i) Crop calendar

Rice can be produced during 2 seasons per year in Mukunguli marshland (Season A: July –December; Season B: January-June): However, due to issues of flooding and shortage of irrigation water, the crop calendar can vary across the marshland from upstream to downstream where planting and harvesting period differ up to one month. The cooperative has put in place a system where planting dates differ from 15 days from one zone to the following one to enable equitable repartition of water resources.

Another coping strategy related to shortage of irrigation water consists in the choice of rice varieties to be cultivated. During Season A, farmers prefer to cultivate long cycle varieties such as TOx, Watt and Iron that can survive until rains come back in September-October. On the other hand when water is available in season B, short cycle varieties such as *Buryohe* and *Gakire* are preferred.

(ii) Rice varieties and seeds

Rice varieties currently used in Mukunguli are *Yun Yin*, *Iron*, *Facagro*, *Buryohe*, *Tox*, *Gakire*, *Watt* and *Rumbuka*. Seed multiplication and distribution is the responsibility of Coproriz ABAHUZABIKORWA, as a seed producer certified by Rwanda Agriculture Board (RAB). The cooperative supplies rice seeds to other rice producers cooperatives such as Coproriz Ntende (Gatsibo District); CODERCA (Ruhango District), KORIMU and CODARKA (Kamonyi District). Basic seeds are purchased from RAB at 400 Rwf/Kg and certified seeds produced by the cooperative are distributed the following year at 350 Rwf/Kg.

(iii) Fertilizers

The Coproriz ABAHUZABIKORWA has realized commendable achievements in promoting the use of inorganic fertilizers through improving mechanisms for accessing fertilizers loans and better distribution network. The use of fertilizers on rice is considered as a practice that is now well known for most of rice producers in Mukunguli marshland. Regarding yields, the maximum yield recorded in Mukunguli was 7.2 T/ha before the destruction of the irrigation infrastructures in 2011 whereas the average yield obtained in 2015A was 5.47 T/ha.

For the supply of fertilizers, the cooperative deals with “ENAS”, the private fertilizer company accredited for Kamonyi and Ruhango District by the Ministry of Agriculture and Animal Resources.

For season 2015A, some 60 MT of NPK and 30 MT of urea were distributed at a respective price of 410 Rwf/Kg for Urea and 550RwF/Kg for NPK 17.17.17.

(iv) Extension services.

Agricultural advisory services are provided to rice growers by the cooperative’s agronomist and 3 extension officers paid by the Mukunguli Rice Promotion Investment Corporation (MRPIC).

The cooperative has established a well structured extension system based on a team of 220 community extension volunteers (Abakangurambaga) and the contribution of the rice mill to training and basic equipment evaluated at 3 million Rwf per year.

(v) Water management

Water management is done through close collaboration between the rice growers' cooperative and "TUYITEHO Water User's Organization". Regarding water distribution in particular, they have established "8 barrages" made with wooden sticks and bags of sand that enable to divert water for irrigation. These barrages are located in the following places: i) Mukinga; ii) Kaduha; iii) Rwamashaka; iv) Karenga; v) Cyabagata; vii) karama; viii) Cyeru; ix) Mukoma. The exact location of the "weirs" is selected based on criteria such as: i) The potential to irrigate a large portion of the marshland; ii) The presence of clay soil where wooden sticks can be implanted; iii) Reduced risks of flooding. Where possible, one "weir" provides irrigation water to 2 neighboring zones.

The collection of the water fee is done by Coproriz ABAHUZABIKORWA and all amounts collected are thereafter transferred to the account of TUYITEHO Water Users' Organization in CAF ISONGA. The amount paid by farmers is 100 RWF /are/season. Most of payments are made in season B when water is available. Note also that the fee paid to the District is 1,000 Rwf/5 ares in Kamonyi District whereas it was fixed at 6,000 Rwf / 5 ares in Ruhango District.

(vi) Post harvest management

Post harvest management is generally well done in Mukunguli marshland. There is a drying area and a small hangar in each of the 13 zones .These facilities were constructed by the Rural Sector Support Project (RSSP) or by Coproriz ABAHUZABIKORWA. However, post harvest management is still constrained in some zones by the insufficient number of drying yards and sheds, and by few or poor post harvest equipment (winnowing, ...).

(vii) Access to markets

Focus Group Discussions and interviews with key stakeholders have confirmed that the Mukunguli Rice Promotion Investment Corporation (MRPIC) provides a reliable access to market for rice producers. The Cooperative Coproriz ABAHUZABIKORWA has signed a contract of exclusivity with MRPIC stipulating that all paddy rice produced in Mukunguli marshland has to be collected and supplied to MRPIC rice mill.

In order to avoid sales of paddy rice through informal channels, the cooperative agreed with MRPIC that farmers get back 20% of processed rice for their household consumption.

For the last season (2015A), the price paid to Coproriz ABAHUZABIKORWA was 247 Rwf/Kg for long grain paddy rice and 237 Rwf/Kg for short grain paddy rice. After deducting costs related to inputs and other services to members, the Cooperative paid to rice producers 225 Rwf/Kg for long grain paddy rice and 215 Rwf/Kg for short grain paddy rice. Net payments to farmers amounted 207 million Rwf. The total amount before deduction of the input loans and other contributions was 261 Million Rwf.

The key constraint is high competition from imported rice that can be sold at 500 Rwf/Kg. During field work, the consultant observed that MRPIC was preparing the collection of rice produced in season 2015B, whereas at the same time they still kept in their warehouses paddy rice previously collected in season 2015A.

(viii) Farmers' organizations

Coproriz ABAHUZABIKORWA and TUYITEHO Water Users' Organization are the two farmers' organizations operating in Mukunguli marshland. They are both well functioning and have proved to be relevant examples of good governance, complementarily, community mobilization and farmers ownership.

The Mukunguli Rice Producers' Cooperative (Coproriz ABAHUZABIKORWA) has 2,750 registered members. The Cooperative operates in two sectors of Kamonyi District (Nyamiyaga and Mugina) and Kinazi sector of Ruhango District. Mukunguli Marshland is divided in 13 zones (7 zones in Ruhango District and 6 zones in Kamonyi District), where farmers are organized in Self Help Groups (Amatsinda) composed by 100 plots of land as the lower level of organization within Coproriz ABAHUZABIKORWA.

Coproriz ABAHUZABIKORWA has well functioning organs (General Assembly, Executive Committee; Internal Audit Committee). It plays a key role for: (i) seed multiplication and distribution; (ii) Distribution of fertilizers and pesticides; (iii) extension and crop calendar organization; (iv) access to finance and access to markets.

TUYITEHO “Water User’s Organization” was established in September 2011 and officially registered in 2013. It is composed by all the 2,750 farmers who produce rice in Mukunguli marshland and is run by a Manager paid by RSSP, who is supported by a team of 5 persons in charge of irrigation.

TUYITEHO “Water User’s Organization” has realized commendable achievements in terms of coping with the issue of flooding and destruction of irrigation infrastructures. The rehabilitation/maintenance of the irrigation network costed more than 10 Million Rwf in 2014.

4 PROJECT DESCRIPTION

4.1 DESCRIPTION OF PROJECT ACTIVITIES

The perimeter of Mukunguli is located in Mugina and Nyamiyaga Sectors of Kamonyi District and Kinazi Sector in Ruhango District in Southern Province. The marshland almost covers 640 hathrough 13 km valley from north-west to south-east where it joins Akanyaru River as shown in Figure 3 below.

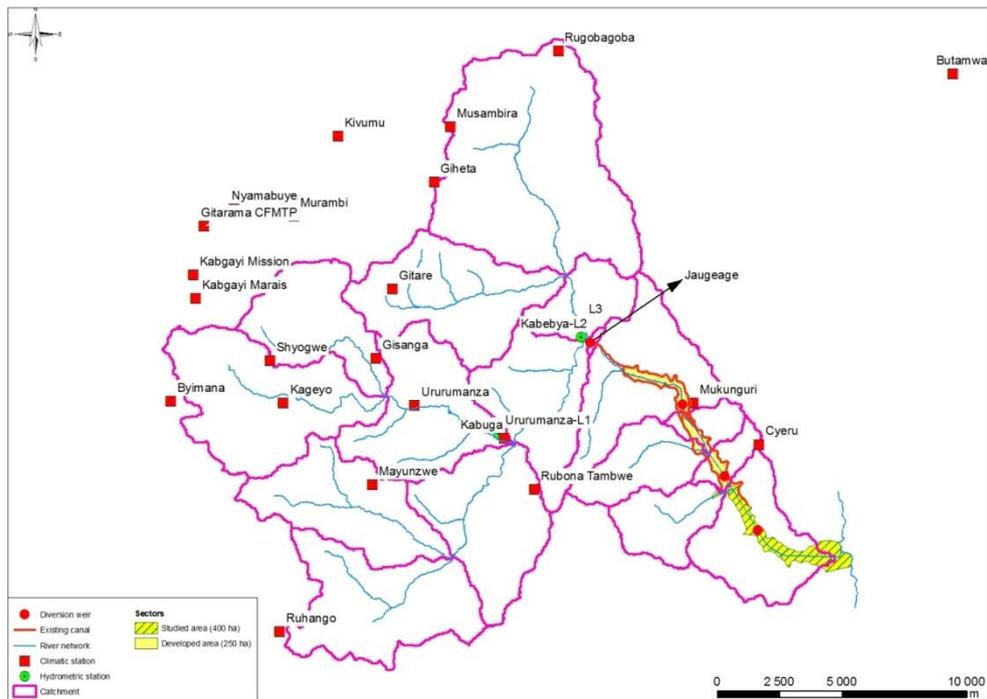


Figure 3. Geographical location of Mukunguli site

The marshland is crossed by Mukunguli river. This river has two main tributaries, namely Akabebya and Ururumanza. The Mukunguli river is a permanent water flow which goes into Akanyaru river. Tributaries are also permanent water courses.

The marshland is split into 2 parts: (i) the developed area of 250 ha in the upstream and (ii) undeveloped area of 400 ha downstream. The water supply to the developed irrigation scheme comes from the Mukunguli River through two existing weirs. The undeveloped part of the marshland is cultivated for rice production but there is neither a formal irrigation weir nor an organized irrigation network.

The two existing intake weirs in the developed marshland part are weir #1 upstream of the marshland (a little downstream of the confluence Akabebya and Ururumanza) and weir #2 in the marshland (some meters upstream of the road bridge allowing crossing the marshland). The two diversion weirs providing water to canals feeding the scheme are not operational since 2010 floods which destroyed and bypassed the structures probably due to under-designed overflow spillways' length and weak foundations on sandy soils. The riverbed has now moved 20 meters from its original alignment. The upstream weir has been completely destabilized and cannot be rehabilitated.

The downstream weir (near the cooperative office) is still in good conditions but it is now isolated and far from the active riverbed and is no longer connected to the irrigation network. The study proposes therefore to replace the diversion weirs by new structures which will be constructed upstream of the existing on sites providing good foundations conditions.

The downstream part of the marshland is characterized by its very high vulnerability to flooding and sediment deposits. This is due to the importance of the floods generated by the big watershed (221 km²) and the sand deposits in the river bed which rises above the natural grounds. When floods occur, the banks of the river are overtopped and destroyed. When this happens, a thick layer of sand is brought in the fields which cannot be cultivated anymore. Repairing the dykes of the river consumes important human and financial resources.

4.2 Project Components

The irrigation project works in Mukunguli marshland include:

- i. The rehabilitation of the two existing diversion weirs in the upstream part of the marshland (Weir #1 and Weir #2). These works will restore the water supply to the 282.5 ha of developed marshland. However, a detailed diagnosis of existing structures showed that given their condition, their design and implementation, it is not possible to make a simple rehabilitation of these two structures. That is why they are simply replaced. This solution is best suited technically for a similar cost;
- ii. The construction of two additional diversion weirs (Weir #3 and Weir #4). These structures will allow water supply to the downstream part of the marshland (357.4 ha). Both weirs feed two primary canals (one on each side of the main drainage channel). From the Weir #4, the right bank canal flows into an existing drainage channel. This channel will be used as a primary canal in the new development. Intakes are provided on these primary canals to deliver water to sectors through the existing longitudinal canals / drains. These canals are already used for the irrigation / drainage of the plots.
- iii. The construction of five overflow spillways on the main drainage channels downstream of Weir #4. Two overflow channels will be excavated on both sides of the main drainage channels. Their function is to collect water overflow and direct them in the downstream part of the marshland at the confluence with the Akanyaru River. The overflow spillway is placed where the capacity of the main drainage channel significantly decreases. Both aerial photographs and field visits have shown that it is in these zones that overflows occur with riverbanks failure. The overflow channel will be made by ground leveling in the buffer zone combined with the installation of a dyke on the marshland side.
- iv. The construction of two access roads in the downstream part of the marshland. These roads will help to facilitate the maintenance works on the main drainage channels and the sand exploitation in the river.

Access and feeder roads are expected to be developed from the existing structures on the hills around the marshland. Depending on the marshland's configuration and the topography of the terrain, these roads enable to walk along the developed area or to access to it at regular intervals.

Pedestrian paths and roads that cross the development site are systematically rehabilitated. Pedestrian paths are generally achieved by widening basins dikes up to 1.5 m.

Works on the roads consist of:

- the leveling of the platform: scarification, cleaning, compaction and terracing of the longitudinal triangular ditches - 0.30 m deep and 0.30 m wide.;
- possible landfills with defined profile;
- Compaction of the carriage way with 0.15 cm thick lateritic soil with a 4% lateral slope.

Run-off water from roads ditches is disposed of by using culverts and run-off canals. These structures collect water from both ditches of the road and channel it into a lateral drain crossing the irrigation canal with a run-off collector aqueduct.

The figures below show the typical profile of access and feeder roads whose carriage way width will be 5 m.

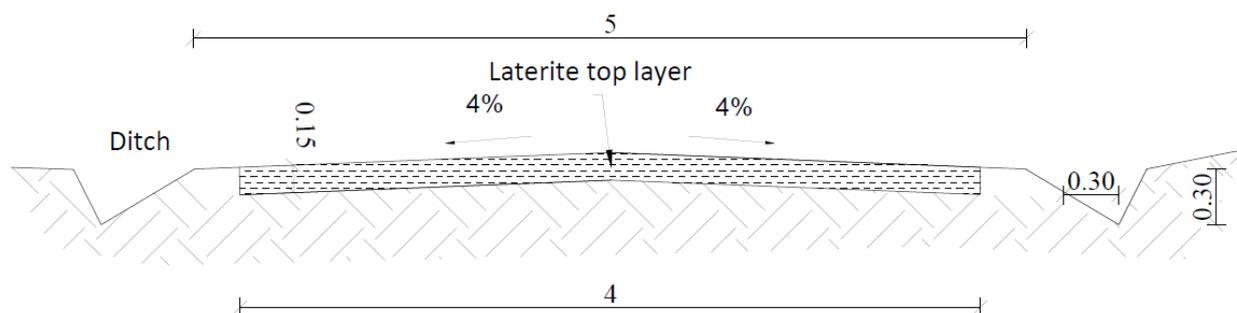


Figure 4: Access and feeder roads – Typical profile

The table below shows the proposed irrigated area by each of the planned structures in the marshland.

Table 6: Irrigated area by each of the planned structures

River Weir Number	Irrigable area (Ha)	Canals' Length (m)
1	77.4	
	45.7	
2	48.1	
	111.3	
3	42.8	3,618
	55.0	3,088
4	55.8	3,450
	33.7	910
	29.8	1,365
	140.3	4,339
Total	639.9	16,770

The proposed irrigation system for Mukunguli is simple in design and use. It is also easy to maintain and can be easy to replicate or adapt in other marshes in the region.

5. PROJECT NEED AND ANALYSIS OF ALTERNATIVES

5.1 No-Project Option

The project site has been earmarked for agriculture development and the land is currently used for informal seasonal cultivation in rice, sweet potato, vegetables, bean among other crops. The site is also facing with floods that seasonally damage crops.

Therefore, it is considered that the main reasonable alternative for the site is the development of the proposed project. If the proposed project is not implemented, the ongoing traditional agricultural practices in this marshland in terms of rice cultivation will continue with less and less production due to poor water drainage system or canal networks in the rice fields, floods, lack of access to agricultural inputs such as fertilizers, pesticides and other rice varieties among others improved extension services. As a result, food shortage and poverty will in the long run continue to be manifested in this area and hence more pressure on hillsides leading to accelerated erosion. An alternative type of infrastructural developments (rehabilitation of irrigation infrastructure for Mukunguli) would also serve to fulfill part of the urgent need for irrigation facility in Kamonyi and Ruhango District.

However, there are many significant and specific benefits that would not be accrued if the proposed developments were not to be implemented. Site and service schemes tend to stagnate and develop in a somewhat haphazard and unregulated manner with little regard for aesthetics. A site and service scheme would not receive the same level of investment and offer the same type of high-tech facilities as that of the intended project in terms of agriculture sector development. It is very unlikely that different and possibly fragmented types of schemes would achieve the same level of infrastructural development as that of the proposed project in terms of expanded irrigated area in cultivated Mukunguli marshland and increased use of sustainable land management practices on surrounding hillsides / catchment areas to accelerate the pace of agricultural intensification.

The component 2 of RSP3 (Strengthening commodity chains), would not be achieved if the project is not implemented. This component aims at supporting the commercialization of smallholder agriculture in Mukunguli marshland and hillside areas by intensifying production, promoting addition agricultural value, and expanding access to markets. In addition, many other benefits of the proposed project, such as provision of employment and numerous multiplier effects on the economy would not be realized if it were not implemented.

The proposed project is thought to be fully compatible with general development in the area and is likely to increase agricultural productivity. General and specific environmental impacts, which are anticipated as a result of the implementation of the project, are detailed in this report. On balance, it is considered that the proposed project will help to meet an urgent need for new irrigation infrastructures in Mukunguli marshland without significant net adverse impacts on the local and general environment, provided that appropriate mitigation measures as discussed in this report are incorporated. The proposed project is therefore regarded as one of the more viable alternatives for the site.

5.2. Selected Project Alternative

The project is proposed to be developed on land, which comprises existing and currently agricultural activities hence no environmentally sensitive areas are endangered. As such, no other sites of comparable size and location within a 5 km radius of the marshland that would be suitable for the type of the intended development have been identified, and therefore no alternative sites have been considered for the project. Several distinct advantages of the proposed sites include:

- i. The project is compatible with the on-going activities within Mukunguli marshland and the proposed project activities is generally rehabilitating and improving the already existing infrastructures such as irrigation networks and diversion Weirs in the area and expanding irrigated area;
- ii. The terrain and the size of the site, being Mukunguli marshland lend itself enough for the development;
- iii. The site is well serviced by a traffic artery, murrum roads link the project area to the main roads and makes the sites easily accessible;
- iv. The site has a good surface availability based on the available rivers of Mukunguli tributaries;
- v. Rice mill in the vicinity of the site was constructed and the current production does not satisfy the factory capacity;
- vi. Nearby communities offer a readily available pool of labour for employment during both the construction and operational phases of the project;
- vii. The site is already under agricultural development activities;
- viii. Location in the agricultural areas of Kamonyi and Ruhango Districts, meaning that the project will have little or no direct impact on natural fauna or flora, human settlements, etc. The project is located in an area where there are several agricultural activities on-going (within Mukunguli marshland and the surrounding area).

6. PUBLIC CONSULTATIONS AND PARTICIPATION

The Public participation and community consultations were made to explain the project and determine their thoughts, opinions and feedback on the impact of the project in the area. The presentation highlighted the project background, objectives, expected upcoming activities, socioeconomic information and environmental information as well as compensation procedures and payment modalities. The minutes of the consultation meetings are presented in Annexure 1. These stakeholders include both the local authorities, and the population.

6.1 Stakeholders

Involving stakeholders through participatory direct or indirect consultations is key to the successful implementation of the project. The stakeholders were those who have an interest in the project, and who will be involved in the further consultative process.

The main groups of stakeholders met are:

- Local authorities
- Local Community, mostly marshland Users
- Cooperative leaders

6.2 Findings from Public Consultation Meeting

a) Consultation with district authorities

District authorities were met on August 8th,2016 to explain the project background, objectives, planned activities, expected outcome/ benefits to farmers, district and the country, implementation schedule and their roles and responsibilities and how negative impacts will be mitigated. The procedures for valuation and compensation for affected properties as well as compensation payment modalities were also discussed. The officials contacted and met during public hearing are presented in Table 7.

Table 7 : Authorities Consulted in Ruhango and Kamonyi Districts

S.No	Names	Function
1	Tuyizere Thaddee	Vice Mayor, Kamonyi Economic Affairs
2	Twagirimana Epimaque	Vice Mayor, Ruhango Economic Affairs
3	Uwimana J Pierre	District Environmental Officer, Ruhango
4	Munyampirwa Francois	District Agronomist, Ruhango
5	Mutabazi Patrick	Executive Secretary, Kinazi

The local consulted authorities acknowledged the huge benefits that they expect from the rehabilitation and extension of the marshland for rice production and committed to support and participate in the project implementation and the valorization of the developed area as well as the maintenance of infrastructures put in place. The flooding in some portions of the marshland and sand mining are the main issues raised during the meeting. They requested the SPIU RSSP/LWH to design and put in place infrastructures resolving water issues in the marshland. Adequate measures for proper sand exploitation need to be taken.

b) Consultation with community leaders

The Project team also meets with the representatives of the Cooproriz ABAHUZABIKORWA, the cooperative using the marshland and opinion leaders within the area on August 8th, 2016. The list of attendance together with the minutes of the meeting is presented in Annexure 1. Explanations on the Project, its benefits and roles and responsibilities of Cooperative during and after development works were provided. Feedback from the Cooperatives leaders and opinion leaders were also obtained. The leaders welcomed the project and committed to work for the successful implementation of the project. The Cooperative leaders requested the Project to build post harvest infrastructures and strengthen the capacity of their members in rice cultivation and post harvest handling as well as cooperative organization.

c) Consultation with local community

The Project arranged consultation meetings with the local communities on 16th of August 2016 to create awareness on the project, obtain community' responses, feedback and concerns on the project and inform them about compensation procedures and payment modalities as well as their roles and responsibilities in the Project.

A total of 261 people attended the consultation meeting. The list of participants who attended the consultation meeting is available in Annexure 2.

After the presentation, the community was given opportunity to give their views, comments and queries. Different community problems were addressed during the meeting. The following table summarizes issues discussed and responses provided.

Table 8: Raised issues during public consultation and proposed responses

ISSUE RAISED	RESPONSE
Expected benefits likely to occur from the Project	<p>After explanation of the project, the following were listed as project benefits:</p> <ul style="list-style-type: none"> ✚ Availability of water in the whole marshland, ✚ Flood control ✚ Increased agricultural production which will enhance and promote food security. ✚ Increased income for different employed personnel that will contribute to the development of the project. ✚ Enforced technical capacity of farmers from different trainings offered. ✚ Job opportunities in different ✚ Improved wellbeing of project beneficiaries due to job opportunities creation, ✚ Increased number of business oriented in the project area ✚ Affording regional and international markets by selling our rice production. ✚ Provision of diversified rice products (rice straw, son de riz, etc) to feed domestic animals (cattle, poultry, etc). ✚ Easy access to the site and transport of the produce to

	<p>the market, etc. due to construction of access road.</p> <p>✚ Provided beautification of our area due to designed rice plots.</p>
<p>Expected risks and negative effects of the Project to the local community. The following were raised by the community:</p> <ul style="list-style-type: none"> ✓ Risk of HIV/AIDS pandemic spreading from migration/incursion of people due employment opportunities and social interactions; ✓ Pollution of Mukunguli and Akanyaru rivers by agrochemicals; 	<p>After explanation, the following responses were provided:</p> <ul style="list-style-type: none"> ✓ Regular sensitization on ways of HIV prevention will be provided; ✓ Guidance on the judicious use of chemicals in the cultivation and production of crops as well as farmers training in techniques of agrochemical applications (handling, labelling and application of agro-chemicals under field conditions) will be provided.
<p>Employment opportunities to be provided</p> <p>Land and properties incorporated thereon (houses, crops, trees) are likely to be lost due to development activities</p>	<p>The execution of works will require both unskilled and skilled workers. Priorities will be given to users of the marshland.</p> <p>Land will not be compensated because it belongs to government. Other assets (crops, trees, etc) that will adversely be affected will be compensated for. Just and fair compensation will be paid to owners through their respective bank accounts. This will be done in compliance with the expropriation law No 32/2015 of 31/08/2015 and Land law.</p> <p>All marshland users will be given plots for rice production after site development.</p>

The project received high degree of acceptability by consulted farmers in that the rehabilitation of the marshland will enable the marshland exploitation for 2 seasons per year and boost rice production as well as improve community livelihoods.

7.0. POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

A number of environmental issues, both positive and negative, were identified during the scoping process of the study and analyzed each to understand their magnitudes, extent and significance. Impacts that could occur are grouped and discussed below.

7.1. PROJECT POSITIVE IMPACTS

The RSSP3 study identifies many of the positive impacts of the proposed activities. These include poverty reduction, food security, hillside restoration, rural development, irrigation efficiency among others.

7.1.1 Impacts during Planning and Construction Phase

7.1.1.1 Physical Impacts

a) Command area Rehabilitation and Management

Soil erosion has been indirectly caused by degradation of catchments through inappropriate farming system and deforestation. The RSSP project component on hillside development through reforestation and terracing of the hillsides is to a great extent a sound practice for protecting the catchments/ command area.

b) Flood Control

The use of inadequate agricultural practices on catchments of Mukunguli marshland and existence of poor irrigation methods within the marshland contributed to hillside erosion, sedimentation and flooding in the marshland. The rehabilitation of river weirs, irrigation and drainage channels as well as construction of new irrigation infrastructures for marshland extension will control floods downstream by channelling and evacuating excess water during heavy rains. The protection of marshland catchments will also result in sediment control. Flood control effect of the project will free more land for farming as well as prevent destruction of food crops for those farmers exploiting floodplains during dry season and command area in the wet season.

c) Water Resources Conservation

The RSSP3 will invest in the protection of hillside through water harvesting, reforestation and terracing. This will reduce soil erosion and protect the hydrological systems from sedimentation, flooding and contamination. This will curb the rate of irrigation in the area and the country. Poor irrigation methods experienced in the marshland will be improved to ensure efficient water usage through improved drainage and irrigation canals.

7.1.1.2. Ecological Impacts

a) Ecosystems rehabilitation

For the protection and sustainability of rehabilitated or newly constructed infrastructures, it is compulsory to have 10 m buffer zone along Mukunguli river, which is the main drainage canal, and at least 5 m buffer zone of the main irrigation canal. The buffer zones will be planted with perennial grass and trees. The tree and grass planting in buffer zones and any other degraded area will improve the vegetation of these areas and this may improve the quality of existing habitats and ecosystems.

b) Environmental Protection

The project promotes intensification of agriculture. After the development of the marshland, the project will intensify rice production through the use of improved inputs that raise productivity. The project will reduce the pressure of farmers on more fragile lands, thus protecting them.

c) Birdlife Habitat

The rehabilitation of both river and canal buffer zones and afforestation of steep / marginal lands as well as growing rice will attract birdlife in the project area. This is a beneficial impact on the biological environment of the project area which will reintroduce the birds that were once thriving in the marshland.

7.1.1.3. Socioeconomic impacts

a) Rural employment

The construction of irrigation and drainage infrastructures and rice planting and management are labour intensive activities and for that reason, the labour needed in the project area will create much needed employment opportunity to the rural population. The rice mill of the site operates some few months in a year due to insufficient rice production. Workers are also employed when the production is available. With the marshland rehabilitation and expansion, the production will be increased and the mill is likely to operate throughout the year with permanent employment opportunities.

b) Poverty reduction

The irrigation project for rice production in Mugina, Nyamiyaga and Kinazi Sectors will promote increased productivity and commercialization of rice. Improvement in rice productivity will raise the income for the rural poor above the poverty line of less than a dollar a day. This is an indirect impact that will take a long process that will be felt after many years. The project will directly benefit an estimate of 4,000 families .

c) Market creation

The project will create market for farm inputs including seeds, fertilizers, pesticides and herbicides. This is a direct beneficial impact that would be felt after the project is operational and crops are harvested from the fields. Rice is more of a cash flow crop in Rwanda than a food crop for many. Production of rice will therefore provide many rural communities with a cash commodity for local and regional markets.

There is one rice mill within the area and Cooproriz ABAHUZABIKORWA, cooperative of rice farmers in Mukunguli, is one of the main shareholders. With marshland rehabilitation and expansion, paddy rice will be increased and the mill will be able to work throughout the year. The Rice from Mukunguli is traded across the country.

d) Capacity building of farmers

In the course of the implementation of the project, farmers will be sensitized and trained on operation and maintenance of irrigation infrastructures, the use of water and production of rice, appropriate application of fertilizer, IPM, etc., thus imparting skills to them for improved production as well as to access markets, which they will utilize even after the project's exit.

7.1.2 Impacts during the Operation Phase

a) Increased exploitable area and agricultural productivity

Mukunguli marshland has a developable area of 640ha but only less than 500 ha were productive. The productivity in the marshland was also low. The development of Mukunguli command area will increase the exploitable land area and improve soil fertility. In addition, due to the development and rehabilitation of irrigation infrastructures, water supply in the irrigation scheme will be sufficient and reliable to enable a fully twice crop growing season per year. The increase in exploitable area, improved soil fertility, reduced flooding as well as marshland irrigation will lead to increased productivity. This will also improve on rural livelihoods.

b) Increased farm incomes from crop output:

An increase in farm income as a result of increased marketed crop output is anticipated. This would additionally be due to better and reliable market access of rice produce that would fetch a good selling price as well as increased volumes of marketable output of rice. Most of the farmers indicated that as a result of increased incomes, farmers will be able to access inputs which they will use for rice intensification.

They also indicated that the proceeds could enable them to purchase more pieces of land elsewhere where they could grow other food crops that do not require irrigation, in order to utilize the irrigable land for commercial farming only.

c) Livestock Development

Major constraints hampering the development of the livestock sector include inadequacy of animal feeds both in quality and quantity, which arises due to pastures and water shortage among other issues (MINAGRI, 2008). The intensification of rice in Mukunguli will indirectly lead to the development of the livestock sub sector as a result of use of rice straw as quality fodder. This is likely to improve the low productivity of livestock on these farms. This will complement the government's initiative on one-cow one-family thus improving the welfare of the farmers within the project site, through provision of required nutrients at household level and income that may be used to purchase essential goods and services.

Availability of fodder for livestock will be an incentive for farmers to diversify and expand their livestock enterprises and enhance adoption rates of improved breeds which are early maturing and high yielder. Livestock development is envisaged to have a potential to contribute to poverty reduction through increased farm incomes. Livestock development projects often act as catalysts that enable farm households to join the market economy and thus to achieve a decent standard of living (ILRI, 2007). In addition to contributing to household level welfare, the increased milk production will have a positive effect on the national dairy sector.

d) Poverty Alleviation

The Rwandan Poverty Reduction Strategy Paper (PRSP, Rwanda, 2002) identifies five potentially competitive crops that will be targeted for expansion in addition to the traditional cash crops of coffee and tea. These are rice, maize, irish potato, cassava, banana and bean.

At the local level, the irrigation infrastructure project will promote increased agricultural productivity, and commercialization of rice agriculture from subsistence.

Improvement in crop productivity will raise the income for the rural poor above the poverty line of less than a dollar a day. This is an indirect impact that will take a long process that will be felt after many years.

e) Raising Rural Income

According to the socio-economic feasibility study by SHERS Ingenieurs- Conseils sa (2015), all surveyed households indicated that the implementation of the project will lead to expansion of the existing rice enterprises. This will improve rice production and generate income to beneficiaries within the entire command area, water catchment, command area catchment and the entire District.

f) Employment generation and poverty alleviation

The implementation of the project will result in the creation of more than 15,000 direct new employment opportunities for surrounding local communities and Rwanda in general. This will include opportunities for employment on weirs, canals and access roads construction as well as various aspects of infrastructure management and maintenance, land preparation for rice planting and rice management and trading.

g) Improved nutrition

The increase in rice production and farmers' income, thus making it possible for community members to acquire available food is bound to improve nutrition. This would imply that if the production is improved, there will be more food thus resulting in a decrease in prices hence making it affordable to all the members within the community to have access to food.

h) Increased public revenues

Operation of the project will provide increased revenue in terms of rates payable to Ruhango and Kamonyi Districts. Increased employment opportunities and other multiplier effects downstream in the economy will provide opportunities for increased revenue for RRA due to increased payments in the form of PAYE, VAT and corporate income tax from retailers and suppliers. The businesses operating on the site will also make substantial contributions in the form of corporate income tax. There will also be increased revenue to utility providers such as Energy, Water and Sanitation Authority (EWSA).

i) Market creation

The project will create market for the rice mill, farm inputs including seeds, compost and pesticides. The production of bean, maize and different kinds of fruits (mango, avocado, citrus, etc.) will provide many rural communities with a cash commodity for local markets.

7.2. PROJECT ADVERSE IMPACTS

7.2.1. Impact during the Design and Planning Phase

The design phase of this sub project involved identification of a suitable site for the infrastructure and undertaking of a detailed feasibility study. There are no adverse impacts expected during this stage, however, best practice was incorporated at this stage to ensure that the design takes into account the environmental issues to consider.

7.2.2. Impacts during Construction Phase

6.2.2.1. Physical Impacts

a) Oil spillage resulting in soil and water contamination

Heavy machinery will be used for the transportation of construction materials to the site, especially during the construction of the river weirs and access roads. This will require re-fuelling of construction equipment, maintenance works, repair works, which in effect result in oil spillage. Contamination of soils and run-off ending in the receiving bodies (marshland) shall cause water quality degradation, if no mitigation measures are implemented.

Mitigation Measure(s)

- It is proposed that the Developer or Project Manager inspects the contractor's equipment, to confirm having machines and automobiles in good condition, certified by the " National Automobile Inspection centre", in order to reduce on the likelihood of oil spillage.
- Re-fuelling, oil change, maintenance works, repair works will need to allocated a restricted area, far from the water stream and marshland and preferably positioned in an area that have no adverse effects if degraded. The area allocated for fuels shall need to have a cemented floor and a sand stock for use in the absorption of spilled oil.
- As for the river water quality contamination by oil spillage from generators, an oil interceptor should be installed at the stand-by generator. This will collect oil that would have been spilled hence avoiding water quality contamination.

b) Loss of cultivable land for weir and canal construction

Due to the construction of irrigation channels, a part of the cultivable land in the canal area will be covered by water and therefore lost for agricultural activities.

Impact Significance

This impact is unavoidable but is going to be low in significance in terms of magnitude as the affected area is government land.

Mitigation Measure(s)

One of the proposed mitigation measures is to incorporate into the Mukunguli rice scheme and allocate plots for cultivation in the marshland to be developed.

c) Soil erosion

During the construction of the irrigation infrastructures (which will involve clearing of vegetation, excavation works, earth moving, etc.), the earth excavation from the weirs and irrigation & drainage canals will create a pile up of soil. These activities may result in the increased erosion in areas where vegetation has been stripped and stockpile. This could lead to increased sediments deposited into the valleys and the rivers downstream.

Impact Significance

This impact is going to be low in significance in terms of magnitude because the project in itself is aimed at improving soil conservation through reduction of erosion. The erosion that will occur during the construction will be minimal and localized in the areas where excavation will take place only. The impact duration is only expected to be felt during the construction phase.

Mitigation Measure(s)

Soil erosion occurring during the construction phase of the project can be avoided through:

1. Planting vegetation in the buffer zone of the cleared site immediately after construction of canals, especially the main irrigation canal;
2. Only clear areas earmarked for construction;
3. Create contour drains during construction. However, efforts should be made to contain earth movement activities to dry seasons so as to avoid sheet and rill erosion. This measure may delay the project implementation program, therefore the protection and use of the stock pile is the alternative choice to prevent this impact.

d) Air and noise pollution

During site clearing, foundation excavation and site leveling, laterite exaction, large masses of soil are likely to be displaced. Heavy machines will be used for this purpose. The expected adverse impacts include the likelihood of air pollution and respiratory diseases as a result of dust from the site especially in the early stages of construction, noise pollution and gases from exhaust fume, possibility of oil spillage from machines such as; excavators, trucks, wheel loaders, etc.

Mitigation measures

In order to reduce the quantities of exhaust fumes, all plant and construction vehicles will be operated according to manufacturer's recommendations and shall be properly supervised, managed and maintained in good condition and adjusted to limit the emission of black smoke. Designated access routes will be set and complied by the Contractor to confine the areas likely to be affected by air pollution due to construction traffic. There shall be no burning of waste materials on site.

In order to minimize the noise from construction activities, the Contractor shall restrict any of his operations, which result in undue noise disturbance to nearby communities and dwellings (e.g. blasting activities and operation of heavy machinery and construction traffic) between hours of 6:00 and 18:00. Badly maintained construction equipment will not be allowed to operate on the site to ensure quiet operation. Designated access routes will be set and complied by the Contractor to confine the areas likely to be affected by noise pollution due to construction traffic.

7.2.2.2 Biological Impacts

a) Destruction of marshland biodiversity

Some crops, grasses and trees established in the project area will have to be destroyed. This is because they are either in areas where weir and channels will be constructed. The project affected people (PAPs) would lose benefits which they were already reaping from these enterprises including getting food for home consumption, getting produce for sale and getting fodder for livestock.

Impact Significance

This impact is going to be fairly significant in terms of magnitude because local population in Ruhango and Kamonyi depends a lot on agriculture as a means of livelihood. The scope will be localized and felt in the access roads, canal and weir area. The impact will also be long term in terms of duration on canal and weir sites because the crops and land will be lost for as long as the project is implemented.

Mitigation Measure(s)

This impact is unavoidable and will be mitigated through compensation measures which will include compensation of land, crops and trees on canal and weir sites.

7.2.2.3 Socio- economic impact

a) Population Migration

The construction of water intake, irrigation infrastructures and access roads will attract many people in search for employment and settlements.

The effect of this impact will be felt in the health sector through increased rates of AIDS infection and other diseases that are spread through demographic changes and in environmental sector in terms of degradation. This impact will put pressure on social facilities including health care, water, energy, sanitation and land. This indirect impact could also lead to degradation of marginal areas including hillsides, wetlands and forested areas as sources of fuel wood. Water resources will also be degraded through contamination with faecal matter as the sewer system is lacking in the area.

Impact Significance

This impact is going to be low in significance in terms of magnitude as the time spent on project sites is reduced. The scope will be localized and felt in the reservoir area command area. The duration will be short that is during construction of irrigation infrastructure and land husbandry works.

Mitigation Measure(s)

This impact is unavoidable and will be mitigated through provision of social infrastructure including water and sewer. During construction phase of the project, the contractors should have employment policy which gives preference to the local people. By employing the locals, this would discourage population influx to the area.

b) Occupational and community health hazards

During construction, workers will be subjected to situations that could be detrimental to their health and safety. Injuries caused by handling of construction equipment, spills and leakage of hazardous materials, injuries from stepping on or using sharp objects, fires; Communicable disease hazards due to interactions among the workers or with service providers such as food vendors; Emissions of dust from clearing and excavation works and fumes from vehicles and other machinery that might cause respiratory dysfunctions, are some examples of health hazards.

Mitigation Measure(s)

To avoid or reduce the effects of some of these occupational health hazards, it is proposed that the following measures are implemented:

- Spraying water regularly to suppress excessive dust during construction is strongly recommended;
- Workers on the site should be provided with appropriate protective gears such as; wellington boots, helmets, nose masks, eye goggles and overalls.

- The contractor should enforce and impress on their workers to use the protective gear. To this effect, the contractor shall have a staff department specifically following up on the safety compliance on site.
- The contractor together with local authorities is required to enforce acquiring medical insurance “mituelle de sante” for all workers as a means of affordability of treatment.
-
- Regular sensitization on ways of HIV prevention, importance of proper hygiene is important during execution of this project.
- A visible perimeter should be established next to the sites requiring construction works and use of machinery (e.g. weir reconstruction).
- Sensitization on construction risks to be conducted in nearby schools and other public institutions to minimize risks to public health.
- Regular monitoring to avoid presence of non-workers on site, especially minors. Hired workforce among the locals should not include people younger than 18 years of age.

7.2.3. Impacts during Operation Phase

The operation phase entails the actual irrigation of the hillsides after the water has been harvested. It also includes the valorisation of areas treated with land husbandry technologies. The potential adverse impacts in this phase include:

7.2.3.1 Physical environment

a) Reduced Water Flow/Downstream Flooding

The construction of weirs and other irrigation infrastructures involves deviation of the flow of water to the irrigation channels. Due to this, the downstream water users might experience temporary shortfall in the amount of water available therefore disrupting activities and sources of livelihood that depend on the water. This is a short term impact that only happens when the water will be diverted to the reservoir.

Impact Significance

The impact will be minimum in terms of magnitude, severity and scale. The diversion of a portion of Mukunguli stream water will reduce the river flow downstream. This impact is short term.

Mitigation Measure(s)

- ❖ Regulate water abstraction for irrigation and other uses. The diversion should only be started during rainy season to enable other users downstream to continue to receive water all time and in adequate quantity.

There is a need to install master meters as part of the infrastructure to be developed. The master meter will be used to control the amounts of water abstracted from the streams thus allowing for management of water flow downstream.

b) Water wastage

The retention of water in the weirs and irrigation canals would lead to increased evaporation leading to surface water loss, ground seepage and spills. However due to mild climate of the area, no much loss of water through evaporation is anticipated. The only anticipated water loss will be through leaks and ground seepage.

Impact Significance

The water loss will be through percolation, spills and leaks, evaporation among other factors. As the temperature in the project sites are mild, loss of water through evaporation is not going to be of significant impact.

Mitigation

For losses through ground seepage, the irrigation canals should be lined. This will prevent ground seepage of water in loose soil. This measure will only apply in areas where the soils are loose or sandy. The irrigation farmers can adopt water saving irrigation approach.

c) Changes in Hydrology

The construction of irrigation and drainage network in the command area will affect the hydrological flow of the revering system creating an environmental flow, thus affecting the command area habitat.

Mitigation

To reduce the impact of the subprojects on the catchment hydrology, the river weir and irrigation design should not divert more than 20 % of the water flowing in the stream. In case the design abstract more than 20 %, the return flow from the farms should compensate for this flow. In case there is more than one catchment feeding the stream, only one catchment should be used for irrigation while the other will continue flowing to ensure continuous water flow in the marshland and downstream.

d) Surface Water Resource Pollution

The use of fertilizers and pesticides in the command area is going to be a potential source of introducing nutrients into the water resource of the Mukunguli river and Akanyaru river.

These chemicals, if applied in large amounts and at inappropriate time, will pollute water resources in the rivers and have cumulative effects in the basin and groundwater. Pesticides applied will bio-accumulate in the soaked soils of the command area, upset the natural ecological balance and biodiversity of the wetlands downstream.

Impact Significance

The impact can be high in terms of magnitude and depending on the quantities of chemicals used. The scope of the impact will be felt throughout the drainage system and beyond hence cumulative and will be long term for as long as the chemical runoff continue ending up in the drainage network causing nutrient load effect. However, taking into consideration the national consumption of fertilizers per hectare (less than 4 kg/ha/year) (MINAGRI, 2007) and pesticides (0.1 kg/ha/year), the impact of fertilizer and pesticide is not going to be severe.

Mitigation Measure(s)

The RSSP has prepared a Pest Management Plan for the entire project which will provide guidance on the judicious use of chemicals in the cultivation and production of crops. Farmers should also be trained in techniques of agrochemical applications (handling, labelling and application of agro-chemicals under field conditions).The training should be incorporated in a farmer's field school curriculum.

Extension workers should also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution.

Putting in place techniques aiming at filtering pollutants introduced into the water system through farm runoff such as creation of buffer zones along streams, stabilizing drainage canals with grasses, etc. should be encouraged.

Alternatively, a baseline test of the water quality and progressive tests are necessary to understand the effect of the project on the quality of water bodies and curb any likely impacts there may be before water quality deteriorates. This can be entered in the MOU with the University of Rwanda laboratory to monitor the quality of these waters for precaution purposes.

e) Sub surface Water Contamination

Infiltration of irrigation water in excess of available root zone storage will penetrate beyond the reach of roots and eventually recharge groundwater. Nitrates, salts, and other chemicals used in crop cultivation that dissolves in the soil water will move with the water. Crops with high water and N requirements (rice and vegetables) will increase the potential risk of nitrate pollution to groundwater. Because they do not evaporate, nitrates/nitrites are likely to remain in water until consumed by plants or other organisms.

This impact will be felt more in areas with light-textured soils and intensive production of shallow-rooted crops that will contribute to considerable nitrate losses by leaching.

Mitigation

Mitigating ground water contamination will require similar measures as used in preventing surface water pollution. Preventive measures will include practicing IPM and rational application of fertilizer only as a last results while use of organic manure.

f) Canal Siltation

Siltation of the canals might occur from mudslides of the hillsides adjacent to the perimeter canals, collapsing of embankments or canal slopes, soil erosion from heavy rains, cattle encroaching on the marshland and trampling over earth made canals. With silt in the canals, they will be blocked resulting in low water flows to the rice paddies causing dryness of soils and eventually low yields. This low flow might also cause conflicts amongst rice farmers over irrigation water. Furthermore, clogged canals could soon become possible breeding site for mosquitoes if not maintained and unclogged.

Mitigation Measure(s)

(1) Establishment of silt trap zones

Silt trap zones have been included in the general design of the project and the canals will be flushed as frequent as possible to minimize this impact.

(2) Training on maintenance of the water canals

The project team should provide training for the local farmers on how to operate and maintain the water intake points, and canals to ensure that there is no blockage or flooding. Regular communal work for maintenance of canals and weirs should be mandatory for all rice growers. Regular inspection of canals and adjacent slopes is necessary to repair areas likely to collapse into the canals thereby reducing siltation.

g) Water logging and salinization

There are four main ways through which salinization can occur in irrigation practice. These ways are:

- Addition of lime in most of the soils during the cultivation to boost the soil fertility.
- Residues of solutes applied to the soil in the form of artificial and natural fertilizers as well as some pesticides that have not been taken up by crops;
- Salts which occur naturally in soil may move into solution or may already be in solution in the form of saline groundwater. This problem often occurs in deserts or arid areas where natural flushing of salts (leaching) does not occur and where the groundwater level is both high and saline, water will rise by capillary action and then evaporate, leaving salts on the surface and in the upper layers of the soil; and
- Salts carried in 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. The salt concentration of incoming flows may increase in time with development activities upstream and if rising demand leads to drain water reuse; irrigated regime is intensified, even though the saline layers might be far below the soil surface and the irrigation water applied is of high quality.

Based on the above means of salinization, there is high probability of salt build up to occur in the intervention areas especially through the residue salts and salt build up in the soil profile.

Mitigation

With a properly determined crop water requirement, micro-management of irrigation water to specifically satisfy this need and regular monitoring of CropWat requirement to regulate the water quantity released to the catchments, the likelihood of water logging and salinization will be minimized. Training of farmers to regulate quantities of water used will be a long term investment in sustaining the chemical properties of the soil for continuous fertility.

7.2.3.2 Biological environment

a) Emergence of pests and crop diseases

The rice irrigation scheme could introduce new kinds of pests and crop diseases in an area that mainly grows banana, maize, sorghum and cassava. Examples of pests are birds that feed on grain and would increase in number once rice is introduced to the area. Such pests could affect production of other crops cultivated on the hillsides.

Mitigation Measure(s)

Based on experiences of similar rice irrigation schemes in other places, rice cooperatives have been able to apply pesticides such as; Cypermethrine and Beam, to fight pests. It is proposed these pesticides are also applied to this project but in controlled quantities guided by the IPM and trained agronomists in the area.

An Integrated Pest Management (IPM) study should be initiated to assess likely pests and crop diseases that emerge with rice schemes. This study will give recommendations on how to control likely pests and crop disease invasions.

Scare crows are an old traditional means of preventing birds from encroaching on plantations. These along with rotating shifts of adults watching rice fields and the other plantations could

one way to solve this issue. Children should not be allowed to skip school to chase away birds from the plantation fields.

b) Invasive aquatic weeds

Eutrophication of the weirs and canals from contaminated run-off by fertilizers applied on hillsides could possibly encourage resurgence of water hyacinth and any other aquatic weeds in the weir & canals. In addition native aquatic weeds are likely to become more invasive to the irrigation infrastructures. This could eventually affect the efficiency of the irrigation infrastructures to hold and channel water, resulting in insufficient irrigation in the command area.

Mitigation Measure(s)

- Periodic manual removal of weeds from the weir and canals is proposed, to avoid the possibility of an uncontrollable invasion of the irrigation infrastructures by weeds.
- Controlled use of fertilizers and pesticides both on hillside and marshland cultivation to reduce on eutrophication from contaminated run-off.

7.2.3.3 Social environment

a) Increased Spread of Water Borne Diseases

Households feared that there would be an increase in the incidences of malaria because the water reservoir would serve as a breeding ground for mosquitoes. They also feared that there would be a “cool breeze” prevailing as a result of the water mass that would result in respiratory related problems due to continuous exposure of residents. They also cited stomach-related disorders specifically infestation by worms, as a result of young household members using the irrigation water for domestic purposes (drinking and cooking) when not supervised.

Impact Significance

The impact of disease spread will be long term for as long as the reservoir is existing and drainage canals which are habitats for disease vectors and the scale and severity is also moderately high and can be severe especially for children under 5 years and pregnant mothers who are vulnerable to malaria.

The scope of the impact will initially be localized but transmission of the disease is likely to extend the scope beyond the project area.

Mitigation Measure(s)

The RSSP should develop a program in collaboration with the Ministry of Health (MINISANTE) and the local communities which undertakes bi-annual survey of health records in Health Care Facilities (HCFs) to ascertain the spread of malaria and other water borne diseases. This data should then be used to develop a disease prevention programme within RSSP that could include use of Insecticide Treated Nets for malaria control, Indoor Residual Spraying among others.

The project should also develop water points or, in collaboration with EWSA, supply water to PAPs for domestic uses. Awareness meetings on hygiene of potable water will be encouraged.

b) Emergence of Pests and Crop Diseases

The increased acreage of irrigated hillside land will create a more humid environment that may result in an increase of agricultural pests and plant diseases. Change to a more uniform environment on the subproject areas will favour vigorous species adapted to a wide variety of conditions. Diseases and weeds will spread quickly via the re-use of waste-water and drainage water.

Increase pests and plant diseases will affect farm harvest and lead to food insecurity and malnutrition in areas of Southern part of the country. Increased pests and crop diseases will trigger increased use of pesticides leading to water contamination.

Mitigation

To mitigate against emergence of pests and diseases an incorporation of IPM approaches are proposed. These measures should involve rotational cropping practices which preserve greater diversity in habitat thus reducing impact of pest and diseases. Maize or bean varieties used in this project should be selected from the ones already introduced in Rwanda in order to avoid new diseases and pests.

c) Resistance to change of livelihood

Different crops are practiced in the marshland, including rice, banana, cassava, potato, sorghum, Napier grass, etc. There might be resistance against developing the marshland for only rice production. Some of those that depended on the marshland for a living through the different activities mentioned above are worried about the change in livelihood and source of income once rice is made monoculture.

Mitigation Measure(s)

As the marshland belongs to the Government, it is allowed to develop it especially for a public benefit such as this agricultural intensification for food security in the country. However, it is proposed that all current users are integrated into the rice scheme by allocating them plots of land for rice production. This can be done along with intense sensitization on the profitability of rice production as opposed to their current income earners. It is with such combination that resistance to change of livelihood is likely to be eliminated.

d) Water conflicts from the creation of irrigation scheme

With the coming of the rice irrigation scheme that involves; demarcating of the marshland into plots, land consolidation program for collective growing and harvesting, distribution of water through canals for irrigation, if the locals are not organized into institutional frameworks, this might be cause of conflict over who gets water for irrigation and what amount is meant for each of the plots, quarters or sectors. This can escalate in conflicts, enmity or vandalism.

Mitigation Measure(s)

It is proposed that RSP3 along with local authorities are to organise locals into a cooperative and a Water Users' Association (WUA) before commissioning the developed marshland. The Cooperative will comprise of the members growing rice in the Mukunguli marshland. Farmers will be sensitized on the importance of working under a cooperative, trained on modern techniques of rice growing, have the benefit of irrigation for cultivation throughout the year, encouraged to open savings accounts in the local bank "Umurenge SACCO" through which

sales from an agreed percentage of their produce will be banked, trained on maintenance of their rice paddies and the irrigation infrastructure.

The Water Users' Association (WUA) will manage the amount of water used for each section of the rice paddies and amount of water realised drained from Mukunguli river. WUA will collect revenues for water bills used by the locals; this could be done preferably as deductions off the farmers' harvest. These revenues will be used for maintenance of irrigation infrastructure, which cannot be done by the farmers during communal work "Umuganda". WUAs will also resolve arising conflicts over water distribution within the marshland.

e) Vandalism of Irrigation infrastructure

With the coming of the project, a number of infrastructure will be made from metal or steel or concrete, for example; sluice gates, valves, HDPE Pipes. It also should be noted that not all locals will be pleased with the project initiatives, later on the existence of petty thieves in the area. From experience of previous irrigation projects, if farmers are not organised in such as to have community policing to guard the infrastructure and crops of the marshland, they will be vandalized and sold elsewhere.

Mitigation Measure(s)

Creation of the cooperative as the management structure at the project site, sensitization of farmers to ensure project ownership and effecting community policing as a means of ascertaining security, will collectively avoid vandalism.

Regulations on penalties against perpetrators convicted of vandalism are necessary. Punitive actions towards perpetrators by the authorities will facilitate compliance by the locals thereby avoiding vandalism.

7.3 SUMMARY OF IMPACT ANALYSIS MUKUNGULI

Table 9: Summary of impact analysis

Environmental Impact	Impact type								Mitigation		
	Positive		Negative		Duration		irreversible	and	Cumulative		
1. Construction of weirs and irrigation canals	Significant	Not significant	Significant	Not significant	Short term	Long term	Irreversible	Cumulative	Required	Not required	Observations
Loss of vegetation			X		X				X		
Water table modification				X							
Natural habitat				X	X				X		
Water quality			X		X				X		
Land inundation			x		X				X		
Modification of flows for downstream users				X		X				X	
Sediment transport regime				X							
Weirs and canals invaded by plants				X		X			X		
2.Marshland Irrigation											
	Significant	Not significant	Significant	Not significant	Short term	Long term	Irreversible	Cumulative	Required	Not required	Observations
Increase in soil erosion,			X		X			X	X		

Increased salinization			X			X		X	X		
Increased leaching				X	X			X	X		
Water quality degradation in weirs and canals			X			X		X	X		
Deoxygenation of receiving water,			X		X				X		
Clogging of canals from weeds,			X			X			X		
Sedimentation				X	X			X	X		
Degradation of water systems,				X	X				X		
Depletion of aquifers from over-exploitation,			X			X		X	X		
Disturbances to flow regimes,			X			X			X		
Waste/inefficient water use,				X		X			X		
Competing water uses				X		X			X		
3.Rice planting and maintenance											
	Significant	Not significant	Significant	Not significant	Short term	Long term	Irreversible	Cumulative	Required	Not required	Observations
Biodiversity Loss				X		X					
Reduction of soil fertility				X		X			X		
Siltation				X	X				X		
Forest ecosystem quality losses				X		X			X		

Unsafe or unauthorized agrochemical use in seedling nurseries											
Unintended land-use changes or shifting of use pressures to other areas				X		X					

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR MUKUNGULI SITE

An Environmental and Social Management Plan is an action Plan or Management Strategy for the implementation of mitigation measures identified in an ESIA. This EMP should be implemented by several institutions, which are directly or indirectly involved in this subproject.

Mukunguli subproject EMP is an update of EMPs developed for Mukunguli following some changes done in subproject design.

The objectives of this Environmental and Social Management Plan (EMP) are:

1. To bring the project into compliance with applicable national environmental and social legal requirements and the World Bank's environmental and social policies OP 4.01;
2. To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts and/or to enhance the subproject beneficial impacts;
3. To address capacity building requirements to strengthen the Borrower's environmental and social capacities if necessary.

The Environmental Management for Mukunguli is broadly divided into an Environmental and Social Management Plan (EMP) and an Environmental Monitoring Plan. The Environmental and Social Management Plan details mitigation and management measures to be undertaken during the construction and operational phases of the project in Tables 9 and 10 respectively. The Environmental Monitoring Plan details monitoring activities and measures to be undertaken during construction and operation.

8.1. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan for Mukunguli subprojects are presented in the following tables

Table 10: Environmental and Social Management Plan for the Construction phase

Activity	Adverse Impacts	Mitigation Measures	Implementation Schedule	Responsibility	Budget (US\$)
Construction of river weirs and other irrigation infrastructures	Loss of land and assets for weir and canal construction	This is unavoidable impact and will be mitigated through compensation of land on weir and canal sites	During construction	SPIU RSSP/LWH Social safeguards team	60,240
	Soil and water contamination due to Oil spillage	Inspecting the contractor's equipments, to confirm their good condition, certified by the "National Automobile Inspection centre", in order to reduce on the likelihood of oil spillage Re-fuelling, oil change, maintenance works, repair works need to be allocated a restricted area, far from the water stream and marshland	During construction	SPIU RSSP/LWH Environmental safeguard Team	-
	Air pollution	All plant and construction vehicles to be operated according to manufacturer's recommendations and shall be properly supervised, managed and maintained in good condition and adjusted to limit the emission of black smoke. Designated access routes will be set and	During construction	SPIU RSSP/LWH Environmental safeguard and Engineering Team	40,000

		<p>complied by the Contractor to confine the areas likely to be affected by air pollution due to construction traffic. There shall be no burning of waste materials on site.</p> <p>Spraying water regularly to suppress excessive dust during construction is strongly recommended;</p>			
	Soil erosion	<ol style="list-style-type: none"> 1. Planting vegetation in the buffer zone of the cleared site after canals construction; 2. Create contour drains during construction. 	During construction	SPIU RSSP/LWH and Districts	5,000
	Destruction of marshland biodiversity	This impact is unavoidable and will be mitigated through compensation measures which will include compensation of land, crops and trees on canal and weir sites	During construction	SPIU RSSP/LWH Social safeguards team	See compensation budget above
	Population Migration	This impact is unavoidable and will be mitigated through provision of social infrastructure including water and sewer. During construction phase of the project, the contractors should have employment policy which gives preference to the local people. By employing the locals, this would discourage population influx to the area	During construction	SPIU RSSP/LWH Environmental safeguard Team	
	Occupational	It is proposed that the following measures are implemented:	During construction	SPIU RSSP/LWH	20,000

	health hazards	<ul style="list-style-type: none"> Workers on the site should be provided with appropriate protective gears such as; wellington boots, helmets, nose masks, eye goggles and overalls. The contractor should enforce and impress on their workers to use the protective gear. To this effect, the contractor shall have a staff department specifically following up on the safety compliance on site. The contractor together with local authorities is required to enforce acquiring medical insurance “mituelle de sante” for all workers as a means of affordability of treatment. Regular sensitization on ways of HIV prevention, importance of proper hygiene is important during execution of this project. First aid facilities to be availed 		Environmental safeguard Team	
Total					125,240

The total cost for ESMP during construction phase is 125,240 \$ US, compensation cost inclusive.

Table 11: Environmental and Social Management Plan for the Operation Phase

Activity	Adverse Impacts	Mitigation Measures	Implementation Schedule	Responsibility	Budget (US\$)
River deviation and weir & canal filling	Reduced water flow downstream during the time of river deviation and weir/ canal filling	Regulate water abstraction for irrigation and other uses. The diversion should only be started during rainy season to enable other users downstream to continue to receive water all time and in adequate quantity.	Design and operation phases	Irrigation Engineer, SPIU RSP/LWH EO, cooperative, WUA	
	Water wastage	For losses through ground seepage, the irrigation canals should be lined. This measure will only apply in areas where the soils are loose or sandy. The irrigation farmers can adopt water saving irrigation approach	Design and operation phases	Contractor, Irrigation Engineer, cooperative, WUA	
	Changes in Hydrology	The river weir and irrigation design should not divert more that 20 % of the water flowing in the stream. In case the design abstract more than 20 %, the return flow from the farms should compensate for this flow. In case there is more than one catchment feeding the stream, only one catchment should be used for irrigation while the other will continue flowing to ensure continuous water flow in the	During design and operation phase	SPIU RSP/LWH Irrigation team	

		marshland and downstream			
	Sub surface Water Contamination	Mitigating ground water contamination will require similar measures as used in preventing surface water pollution. Preventive measures will include practicing IPM and rational application of fertilizer only as a last results while use of organic manure	During design and operation phase	SPIU RSSP/LWH EO	
	Surface Water Resource Pollution	The RSSP has prepared a Pest Management Plan for the entire project which will provide guidance on the judicious use of chemicals in the cultivation and production of crops. Farmers should also be trained in techniques of agrochemical applications (handling, labelling and application of agro-chemicals under field conditions).The training should be incorporated in a farmer’s field school curriculum. Extension workers should also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution	During operation phase	SPIU RSSP/LWH EO	

	Canal Siltation	<p><i>Establishment of silt trap zones</i></p> <p>Regular communal work for maintenance of canals and weirs</p> <p><i>Training on maintenance of the water canals</i></p>	During construction phase	RSSP irrigation team, Contractor, SPIU RSSP/LWH EO	10,000
	Water logging and salinization	<p>With a properly determined crop water requirement, micro-management of irrigation water to specifically satisfy this need and regular monitoring of CropWat requirement to regulate the water quantity released to the catchments, the likelihood of water logging and salinization will be minimized.</p> <p>Training of farmers to regulate quantities of water used will be a long term investment in sustaining the chemical properties of the soil for continuous fertility</p>	During operation phase	SPIU RSSP/LWH EO	10,000
	Water Weeds	<p>protection of the catchments and rational application of fertilizer in farms to avoid weed infestation</p> <p>Regular maintenance of infrastructure</p>	During construction and operation phase	RSSP irrigation team, SPIU RSSP/LWH EO, WUA	See budget above

Marshland irrigation	Soil erosion	<ul style="list-style-type: none"> • Construction of terraces, soil bunds and their stabilization with trees/grasses in catchments area • Creation of a buffer zone along the canals • Proper maintenance of irrigation infrastructures 	operation phase	SPIU RSSP/LWH land husbandry team, SPIU RSSP/LWH EO, Cooperative	See budget above
	Reduced Water Flow	<ul style="list-style-type: none"> • Regulate water abstraction through practices and design of the intake structures; 	During construction and operation	RSSP & Cooperative/ WUA RSSP & RNRA	-
	Water wastage	Adopt water saving irrigation approach	During operation phase	RSSP Engineers, Cooperative,	-
		Water abstraction fees	During operation phase	Cooperative/ water users association	-
	Change in hydrology	Control water abstraction through management practices	During irrigation	LWH & Cooperative members	-
	Soil salinization or acidification	Control irrigation water quality through seasonal chemical analysis	During irrigation	RSSP	10,000
	Water borne diseases	<ul style="list-style-type: none"> • Prevent or remove aquatic vegetation from canals and reservoir • Regularly fluctuate water levels 			

		<ul style="list-style-type: none"> • Periodic rapid drying of irrigation canals; • Prevent contamination of water bodies with faeces; • Supply safe and clean drinking water 	Operation phase	WUA, Cooperatives, RSSP and local authorities	-
		Control measures including: (i) Providing for biological vector control (eg. Suitable fish species) in reservoir; (ii) Preventative measures (provision and promotion of insecticide treated mosquito nets) (iii) curative measures (provision for medications at the health center/ Hospital)	Operation phase	SPIU RSSP/LWH EO and Ministry of Health	-
	Population migration	Control settlement in fragile areas (marshlands & steep hills) Provision of social infrastructure including water, sewer	Construction & operational phase	RSSP Engineers and Local authorities	-
	Loss of livelihoods	Compensate for properties, land and crops loss Integrate the people into the project beneficiaries	Planning stages	RSSP Social Safeguards and Local authorities	See compensation budget above
	Emergence of pests and crop diseases	IPM approaches are proposed and capacity building	Operation phase	LWH & MINAGRI	10,000

Application of agrochemicals (compost, fertilizer and pesticides)	Water Pollution	<ul style="list-style-type: none"> • Adoption Integrated Pest Management (IPM) approach. • A training program on application of agro-chemicals under field conditions • Create buffer zones/ silt trap zone around the reservoir and command area downstream 	<p>Design and planning stages</p> <p>Design and planning stages</p> <p>During construction phase</p>	<p>RSSP Agronomist & RAB</p> <p>RSSP Agronomist & RAB</p> <p>RSSP Land Husbandry Specialist</p> <p>SPIU</p> <p>RSSP/LWH EO, Engineers</p>	<p>budget above</p> <p>budget above</p>
	Use of child labour	Reinforce compulsory free twelve years education policy	During construction and operational phases	Local authority	-

Failure of the Weir and irrigation canals	Excessive seepage	Lowering the water to a safe level; determining the source of seepage and do repairing	During operation phases	operator, Supervising RSSP Engineer,	Cost can only be determined at the time of infrastructure failure
	Cracks in the weir or collapsing of canals embankments	Doing repairing after determining the source of cracks or collapsing	During operation phases	Infrastructure operator Supervising RSSP Engineer	Cost can only be determined at the time of infrastructure failure
Total					40,000

The total cost for ESMP during construction and operation phase is 165,240 \$ US, compensation cost inclusive.

8.2. ENVIRONMENTAL MONITORING PLAN

The Environmental and Social Management Plan for Mukunguli is presented in tables below

8.2.1 Environmental Monitoring Plan for the Construction Phase

Table 11. Environmental Monitoring Plan for the Construction Phase

Activity	Adverse Impacts	Proposed Mitigation measures	Responsibility	Implementa-tion schedule	Frequency	Budget (\$ US)
Compliance	Potential absence of compliance to the EMP and REMA licenses and regulations	Routine inspections of the site, routine environmental records (water, sanitation and waste management), Construction materials, audits and incident Reports as and when required (e.g. for pollution, accidents, etc.)	LWH EO REMA District MINAGRI	During construction	At least once a month	15,000
Erosion control	Soil erosion	1. Planting vegetation in the buffer zone of the cleared site immediately after canals construction of canals 2. Only clear areas earmarked for construction; 3. Create contour drains during construction. contain	RSSP Land Husbandry Specialist, EO	During construction	Daily	15,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsibility	Implementa- tion schedule	Frequency	Budget (\$ US)
Weir and Canal design and construction	Fugitive dust generated during excavation works could cause respiratory diseases	Wetting the surface during Construction	Contractor	During construction	As required	10,000
	Soil erosion	Create contour drains during Construction; Efforts should be made to contain earth movement	Contractor	Construction phase	Before start of works	
Monitoring site activities	Exhaust pollution	Maintenance records will be kept for all construction vehicles and plant equipment engines.	RSSPEngineers	During construction	Ongoing	
Construction of weir and canals	Contamination of surface and ground water	Records will be kept on site of inspection and approval of fuel and oil storage and dispensing facilities. Routine inspections will be made of such facilities for leaks and discharges to ground.	RSSPEngineers &EO	During construction	Daily	
	Use of child labour	Regular inspection of construction site and community monitoring to report on any minors on site.	Local authority, community leaders		Monthly	

Activity	Adverse Impacts	Proposed Mitigation measures	Responsibility	Implementa-tion schedule	Frequency	Budget (\$ US)
		Regular inspections will be carried out for works to audit safety the site including actual construction operations, workshops and storage facilities, documents required to certify conformity of equipment, tools and materials used by the Contractor.	SPIU RSSP-LWH EO	During construction	At any time	5,000
Occupational Health and Safety	Potential accidents	An inventory shall be kept of all explosives brought to site and used on site	RSSPEO and Engineers, Contractor	At any time during construction	Ongoing	5,000
Sanitary	Risks to Health and Safety on the construction site	Sanitation, waste management and pollution control protocols will be monitored	RSSPEO	Every 2 months	Ongoing	5,000
Compliance	Risks to Health and Safety on the construction site	Documents to certify conformity of tools, equipment and materials used by the Contractor shall be kept on site and be available for inspection.	Contractor	During the construction phase	-	5,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsibility	Implementa- tion schedule	Frequency	Budget (\$ US)
Infrastructure maintenance	Loss of livelihood downstream Unnecessary repair work	Prepare a maintenance schedule for 6 month period (routine maintenance & repair) Regular removal of floating debris/ invasive plant species in the weir & canals	RSSP Supervising Engineer Cooperative/W UA	During operation phase	As required	Cost can only be determined at the time of Reservoir maintenance
Total						30,000

The total cost for the monitoring of ESMP during construction phase is 30,000 \$ US.

8.2.2. Environmental Monitoring Plan for the Operational Phase

The monitoring plan defines and identifies monitoring activities will take place, when and by whom and identifies the indicators and data collection methods and identifies training and capacity building needs of the institutions and persons to implement the plan.

As indicated on the monitoring schedule below, monitoring will be done by numerous institutions and persons but coordinated by M&E division of SPIU RSSP/LWH secretariat in Kigali and the focal person will be the Environmental Officer who should be employed by the Project immediately before the commencement of the project.

To ensure effective and reliable data collection, the key persons from the institutions to be involved in the monitoring will be trained on the indicators to be monitored, sampling methods, and data collection techniques to be used. The SPIU RSSP/LWH M&E Department will organize a training program in Mukunguli site and train the participants. Participants for this training will be from the institutions involved in implementation of the monitoring plan which are SPIU RSSP/LWH M&E Department, Environmental Office, Agronomist, and irrigation engineering, REMA, District, Cooperative, WUA, MINAGRI, Ministry of Health,. SPIU RSSP/LWH can commission a consultant to develop modules for M&E if need be.

The SPIU RSSP/LWH Department will be the monitoring data depository and bank and will coordinate the collection of these data as described in the schedule. The Department will need to install a monitoring and tracking system.

Technical data that might not be collected by the cooperative members /beneficiaries, SPIU RSSP/LWH district M&E officers will be in charge of this.

SPIU RSSP/LWH Project secretariat will need to facilitate the Environmental Officer to purchase sample collection equipments especially for water sample collection. The national meteorological survey will be responsible for monitoring the river flows. A portable hydro flow meter (river flow measuring gadget) will be ideal for a project of this nature that has many sites to be monitored.

As the SPIU RSSP/LWH has M&E component with budget, the cost of implementing this plan will be minimal as the plan will be integrated into the project component.

Food and Agriculture Organization seasonal crop assessments capacity can be used in monitoring food security indicators in all the subproject sites.

It should be noted that, SPIU RSSP/LWH is a project of MINAGRI and as such it will come to an end after the already determined cycle, while the project operations will continue

even after the end of the project. At the end of the project, the responsibility of monitoring the project impacts will rest with the respective agencies and REMA and the respective cooperative members.

Water Quality Monitoring

During the operation period, monitoring is proposed for water quality especially to determine the level and concentration of pesticides and fertilizer content in the command area.

The consultant proposes the identification of different points of the command area in order to monitor the quality of water. Periodic taking of water samples should be undertaken preferably twice a year during the cultivation season to determine water quality. Water sampling points should be at the beginning of the command area, middle and at the mouth of the marshland. These samples should be taken by the SPIU RSSP/LWH Site agronomist to the SPIU RSSP/LWH environmental officer who should then take them in an accredited laboratory for testing. The results should be used to design appropriate water quality mitigation programs. The same will apply to analysis of water quantities in relation to the abstraction impacts. Different stations will need to be identified and flow quantities recorded during different times of the year preferably during the wet and dry season respectively. The results should be used to deduce the impacts of the abstraction of water on the hydrology of the marshlands and the wider catchment basin.

Monitoring Diseases Spread

In order to monitor the possible impacts of the marshland development to malaria and bilharzias spread in the area, the SPIU RSSP/LWH sociologist together with the SPIU RSSP/LWH District staff need to undertake periodic surveys of the health records around the marshland to ascertain prevalence of disease spread. The surveys should be done 2 times in a year. Even though it cannot be proven that the SPIU RSSP/LWH project could be directly contributing to the spread of these diseases, the results can be used to assist SPIU RSSP/LWH increase its interventions on malaria and bilharzias prevalence.

Table12. Monitoring plan for the operation phase

Impact	Parameter	Indicator	Method	Frequency of Measurement	Responsibility	Cost Estimate (USD)
Physical Environment						
Water pollution	Quality	Nutrient Load (Nitrates, phosphates, potassium, pesticide residue, COD & BOD, Turbidity)	Bi-annually during wet and dry season (samples should be taken from the inlet and outlet points of the developed area	Once every dry and rainy season (ie 4 times a year)	SPIU RSSP/LWH	20,000
Reduced Water flow	Quantity	Flow rates per second	River/stream gauging	Continuous	RNRA& SPIU RSSP/LWH& REMA	
Water wastage	Water availability		Install water meters in the intake point	Continuous	SPIU RSSP/LWH, REMA & contractor	

Table 12. Monitoring plan for the operation phase (Cont'd)

Socio-economic Environment						
Water-borne Diseases	Disease prevalence	Increased cases of malaria and bilharzias among other water borne diseases	Review of health records	Quarterly	SPIU RSSP/LWH, community and Ministry of Health	5,000
Safety Hazard	Safety of livestock and humans	Reported cases of incidences and accidents Seepages and leakages reported or observed on the dam colour, turbidity and change in seepage chemical content	Review and evaluation of incidents and accidents register Direct observation of seepage water	Continuous monitoring of leakages, seepages, movements through instrumentation	SPIU RSSP/LWH (engineer) &RNRA	5,000
Total						3,000

8.3. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN IMPLEMENTATION

The Environmental and Social Management Plan (EMP) will be implemented by several institutions mentioned below which are directly or indirectly involved in this subproject.

8.3.1 World Bank

World Bank is the financier of the project including the implementation of the EMP within the budget of SPIU RSSP/LWH. The main role of the bank is to ensure that compliance is achieved as per the requirements of the EMP.

8.3.2 Ministry of Agriculture and Animal Resources (MINAGRI)

Ministry of Agriculture and Animal Resources (MINAGRI) through the SPIU RSSP/LWH is the lead agency in the implementation of this EMP and the project. The role of the MINAGRI is to implement mitigation measures, coordination of monitoring activities maintenance of monitoring information, building the capacity of other actors in IPM, environmental management and in collection and analysis of monitoring data.

The MINAGRI through SPIU RSSP/LWH will also supervise infrastructure design and construction including reservoirs and drainage/ irrigation channels. The role of MINAGRI will be to ensure that the reservoirs and drainage/ irrigation channels are constructed according to the specifications, international technical and safety standards.

The SPIU RSSP/LWH Environmental Officer will be the focal point for training in EMP and agrochemical application and will liaise with the Ministry of Agriculture and Animal Resources for technical support. He will also liaise with other stakeholders to execute the plan. It should be noted that all the capacity building activities should be hands-on through the FFS approach.

The training for capacity building of cooperatives will include among others:

a) Pesticide/Fertilizer/compost Application Training

The training objective is to ensure beneficiary farmers in the project area do not pollute water resources through unsustainable application of inorganic and organic fertilizers. This capacity building activity can be undertaken by MINAGRI/SPIU RSSP/LWH with the technical support from Rwanda Agriculture Board (RAB) and research institutions such as University of Rwanda.

The SPIU RSSP/LWH Agronomist and the district level field agronomist will conduct training to the local farmers on the safe application of pesticides and fertilizers. This is a practice that can immensely contribute to the reduction of possible chemical pollution of the marshlands. The training on pesticide application touches on the quantities to apply, timing (when), and protective gears to wear among others and should be incorporated in the Pest Management Plan.

b) Training on IPM

The training program will cover amounts of fertilizer to be applied per hectare of land and during what conditions should be undertaken before commissioning of the project. The types and amounts of pesticides should also be part of this training.

This training should be a hands-on that can be introduced in the Farmer's Field School (FFS) model adopted by the project. RAB has the capacity to undertake this activity.

c) Training on buffer zone management

Grass and trees will be grown in the buffer zone of the main irrigation canal and along Mukunguli river. Training on tree and grass planting, maintenance will be organized for beneficiaries. This activity will be carried out by MINAGRI/SPIU RSSP/LWH.

d) Efficient water use

Inefficient use of water in the farmland could cause water logging, health impacts and loss of water downstream. The project irrigation engineer will coordinate training in irrigation water use.

8.3.3 Rwanda Environment Management Authority

Rwanda Environment Management Authority (REMA) is the oversight authority over the environment in Rwanda. Its role will be of monitoring environment indicators as identified in this EMP. The role of Rwanda Environment Management Authority (REMA) includes:

Oversight Monitoring

As the lead agency responsible for the protection of environment in Rwanda, REMA will play the leading oversight role of monitoring the activities of the project according to the Organic Law establishing REMA and its functions.

Site Inspection Visits

REMA will undertake regular site visits to inspect and verify for themselves the nature and extent of the impacts and the extent to which the mitigation measures proposed in this ESMP are being complied with or vice versa. He will then be expected to make viable recommendations based on its findings to the SPIU RSSP/LWH.

Periodic Reports

In collaboration with REMA, the SPIU RSSP/LWH, will prepare periodic environmental consolidated reports on the monitoring progress of the water catchment and command area development. These reports should be forwarded to the World Bank for information.

8.3.4 Community Group/Project Beneficiaries

The project beneficiaries being the people on the ground will have the role of execute some of the mitigation measures, collecting and monitoring the identified indicators and practicing sustainable farming as well as catchment rehabilitation and management. The project beneficiaries are organized in cooperatives which have management committees for water, production and maintenance.

8.3.5 Contractors

The contractor will be in charge of designing and constructing the infrastructure according to the World Bank operation policy on dam safety, restoring the borrow pits and degraded areas, ensuring the safety of the users and others.

8.3.6. Ministry of Health

Due to possible health impacts especially malaria and bilharzias in the subproject areas, the ministry of health comes into the picture of this project. The role of the ministry of health will be to promote environmental health, health prevention methods including sleeping in treated nets and monitoring incidences of malaria and bilharzias.

8.3.7. Local Authorities

The SPIU RSSP/LWH subprojects are being implemented in several districts which are administered by the respective district authorities. These local authorities have jurisdiction over the subproject areas and control the marshlands including use and conservation. The department of agriculture and animal husbandry would be the focal point in Nyamasheke District and concerned Sectors.

The role of the local authorities will be to monitor and ensure sustainable utilization of the command area after the project period. They will be the agency close to the project and will ensure the ESMP is implemented by the different stakeholders as indicated.

8.4. SUMMARY MEASURES TO MITIGATE WORLD BANK SAFEGUARDS TRIGGERED BY RSSP

The World Bank safeguard policies triggered by RSSP as well as proposed mitigation measures are presented in Table 13 below.

Table 13: Summary measures for mitigating World Bank safeguards triggered by RSSP

Bank Safeguards	Mitigation/Response
Involuntary Resettlement (OP 4.12)	Preparation of RPF and RAP
Pest Management (OP 4.09)	Adoption of Integrated Pesticide Management (IPM) Practices including Training, Implementation of Pest Management Plan
Natural Habitats(OP 4.04)	Undertaking ESIA studies and avoiding locating project- sites in natural habitats
Physical Cultural Resources (OP 4.11)	Undertaking investigation and inventory of cultural resources that may adversely be affected by the Project in each project site and putting in place mitigation measures whenever required
Environmental Assessment(OP 4.01)	Undertaking screening to categorize projects and developing EMPs as required.
Projects in International Waterways (OP 7.50)	Notification to riparian countries
Safety of Dams (OP/BP 4.37)	Following Guidelines for small dams in Rwanda OP 4.37 is not triggered for Mukunguli site.

9. CONCLUSION AND RECOMMENDATIONS

The irrigation project development in Mukunguli site has many positive impacts. The minor negative impacts of the proposed activities may be mitigated. The positive impacts from the proposed activities in Mukunguli site include poverty reduction, food security, rural development, irrigation efficiency among others. The adverse impacts include:

- ❖ Reduced Water Flow during water diversion
- ❖ possible canal siltation
- ❖ Surface water pollution due to use of pesticides and fertilizer and possible contamination of ground water
- ❖ Migration of people in search for employment and settlements
- ❖ Increased Spread of Water Borne Diseases
- ❖ Emergence of Pests and Crop Diseases, etc.

Mitigating measures to minimize negative impacts include: establishment of silt trap zone along canals; compensation for land, crops and trees lost for canal and weir construction; provision of social infrastructures including water and sewer; regulating water abstraction for irrigation and other uses; adoption of water saving irrigation approach by beneficiaries, capacity building of beneficiaries in agrochemicals application, awareness campaign on the prevention of water borne disease and hazards related to unrestricted entry into the weir; development of water drinking points, etc.

Based on the results and measures proposed in the EMPs, generic recommendations for Mukunguli subproject are formulated as follows:

- ❖ The project beneficiaries should be trained in good farming techniques, pest management (especially in the area of Integrated Pest Management (IPM) and fertilizer application), operation and maintenance of irrigation infrastructures;
- ❖ Beneficiaries should also be trained in efficient irrigation water management.
- ❖ Awareness campaign on the prevention of water borne diseases, mainly malaria and bilharzias and hazards related to unrestricted entry into the water intake or canals
- ❖ Monitoring plan developed in this study should be implemented to monitor the indicators during and after the project lifecycle. Emphasis should be on water quality (nitrates, potassium, phosphates and pesticides residues)
- ❖ SPIU RSSP/LWH should be equipped to have capacity to undertake parameter sample as identified in the monitoring plan.

Conclusion

The Mukunguli subproject activities considered in this study are environmentally feasible due to the fact that proposed interventions are environmentally friendly. In addition, the adverse impacts anticipated can be effectively managed by following the designed EMPs which includes mitigation measures already thought out in the design and feasibility study phase.

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ANNEXURES

Annex 1: Attendance list and Minutes of the consultative meeting with cooperative leaders

Abaturanyi kandi bakwawe nze ko kutazatwanya
 hasi mugisha nze gusa ahubwo bizajyanyana m'imin-
 mo yagufata nze imisozi ikikije igishanga aya MWU-
 NGUKI hahubwo iminwanya suni, hatwaho ibibye bivanze
 niinyaka, noletse nokuruzurura amashyamba niitoki,
 abagenwabikorwa basobanurira nze ko bagomba kuz-
 tegura ibyapombwa byaburira muntu mu igina nze
 aha bongeye kwibutse ko imitungo izabwirakwiza aribikuraye
 kuwa 16/08/2016 ntawemurwe gutera ibihohi
 abagenwabikorwa bibukijwe kutanga amakuru kubite-
 mbo bitwara amazi ahubikuraye kuziranga bitaza-
 nyizwa m'iminimo yaguturaye igishanga noletse no
 kumisozi igikikije, banabwirakwiza kutwara nze mukazi

Ikitoronderwa: Abaturanyi bikorwa bibukijwe kuzafata
 iyambere kuzatanga amakuru kuziranga
 iminimo yose izabwirakwiza nze twarapapamukirye
 ahari imibiri ihabwaho yari ayamakuru
 a-pomba guturaye kuziranga

- IBIBAZO 0° Guturira ubuyobozi bwa RSP/KWH
- 1° Gerard - KANKA-KINAZI
 imihana yaturaye mugisha nze ese burwese azaba
 ahariwa kumuhariwe?
 - 2° Christine MUKABAZI
 yashimye aya ne uziraye kumuntu wabafajije
 kwiterambere

3. Alexius USABIMANA : Ibyibutirwa imyaka
nini imimmo izatungira nyari;

4° Epifanie : Arashima cyane umunyobozi
wumungaheta ari umunyobozi (uziyel)

Munyobozi ibibazo : Bamaze imyaka kumimmo
yagutiyura imyaka ko mujyemaza imimmo
ubuhungu azabithyiramo imbaraga ko
ntamwe uzanyirizwa imyaka

5° Joseph : Ababaza ubutaka butahunguho umwari
bukajya aha hunguho umwari kandi
nyirakome atabashije kuvuhungu bizapote
biti?
cyo cyose yashyizeho azapana ubuho.
bozi bwa COPROLIZ ikamuha inama

Abagenera bikome bakome kubwirwa kandi ko
hari abababwirwa umwamba zigishyirwa bakubwirako
am'ahabo kandi ntacyo ari ahaho ni aha leta
kabone umwamba baha koretha, byarashimwo nyuma cyane
ko umwamba pa ubutaka ntawe azabumwambura
aza komeza abukorethe. gusa abubwo buri wese arashyirwa
bwa kubukorethe neza

6° Emmanuel KANZA : Ababaza imimmo y'ubutaka niba
izayye itangwe muri COPROLIZ umwamba
leta.

Yashyizeho umwamba azawutanga
hamwe kandi abanyamwamba.

Umunyobozi w'inama : Mukamuseke Franck ~~prés COPROLIZ~~
Umwanditsi w'inama : ~~NSIRANZA Pascalie LH Supervising Engineer~~
MUKUNGUZI SITE ~~10/11~~

. URUTONDE RWABITABIRIYE IKAMA Y'IMIRIMO YO
GUTUNGANYA IGISHYamba CYA MUKUNGUZI
KU WA 9/08/2016

	IZINA	KYO YATURUTSE	ICYO AGASHYamba	UMUKUNGUZI
1.	RUKONDO Robert	NYANZA (LWH/RSP)	CAD/AGRICULTURE	
2.	NDEREJIMANA Mafirebo Marcellin	HYCOGEC CONSULTANT	Site Engineer	
3.	NDAYAMBASE Fabien	HYCOGEC CONSULTANT	Site Technician	
4.	UMWITAMUJE-ABAKIRYA	VIGI MOPOROKO		
5.	KALINDA syliver	Pekezidashyamba w'ABAKORESHAMAZI		
6.	NDAKENGELWA Eugene	Cooperative Coopriza	Manager WVO	
7.	RURANGWA Vitor	COOPROZIZ	Agronomist	
8.	UKWIZAGIRA J. Paul	NYANZA (LWH/RSP)	Project engineer MUKUNGUZI	
9.	KABANDANA Vedoste	SOTRAMETECO	Genol	
10.	KAREHANO Gaspard	SOTRAMETECO LD	Project Manager	
11.	KAZE Bienvenue	RSSP	Project engineer	
12.	PASCAR NYIRANZA	LWH/RSP/NYANZA	LH Engineer	
13.	NIYONKURU Cyrano	HYCOGEC	Project/Eng. team leader	
14.	MUTONI Felix	Coopriza	Compoble	
15.	NDATAMBAJE Jules	LSSP	CAD	
16.	MUCAMBIRA Bonfo	LWH/RSSP Nyanza	DDA	
17.	Mbabazi Foma	RSSP	SSO	
18.	Muhamuroni Francine	présidente Coopriza		
19.	BIAGANDA Walter	HYCOGEC	Site Technician	
20.	SINZINKAYO Gaspard	Star Construction Ltd	Surveyor Consultant	
21.	NGOBOKA Cédric	Star Construction Ltd	Project Manager	
22.	MASIKO THOMAS	Star Construction Ltd	Intern	
23.	HODARI J. Pierre	Star construction Ltd	Project engineer	

INSHAKA KOMVUGO Y'INAMA YO GUTUNGANYA IGISHANGA
NO KUGUFATANIZA IMISOZI IGIKIKIJE (MUKUNGULI)

I gishanga cya MUKUNGULI tigiye gutunganywa
nimushinga wa SPIU RSSP/KWH ukonere muri
MINAGRI!

Hamwe nibuyobozi bwa COPRODIZ, INZEGO zibaze
nibuyobozi bw'umushinga wa RSSP/KWH nyuma yo
guhabya ikaze kuri kuri nese witabiriye
inama bagamirwe kunyuma zikurikira:

- 1° Gusobanurira abaturage ukunye igishanga kizabura-
nywa ndetse nokubabwira imisozi igikikije
- 2° kwakira ibibazo

Abagenerwabikorwa basobanurirwe naza kubibwira umunye
imitungo izimurwa mu mihigo yagutunganywe igishanga
ko gushyirwa mu muryango abafite ibyazo bababwirako kubabwirako
bapuzigara gusa ibitarera akababwirako bigaburirwa
nibuyobozi bwa RSSP/KWH bukababwirako imurako,
abagenerwabikorwa bakababwirako kuzababwirako
nibubwira umunye (muri byo biturako, bakabwirako
magamirwa) kuzitabira imihigo, abagenerwabikorwa
bakabwirako kuzababwirako ibikorwa cyakomeye imubabwirako
zizababwirako muri igihe yagutunganywe igishanga
cya MUKUNGULI

3. Alexius USABIMANA : Ibyibutirwa imyaka
nini imimino izatungira nyari;

4° Epifanie : Arashima cyane umunyobozi
wumungahota aho umuamiruziye;

Munyobozi ibibazo : Bamaze imyaka kumimino
yagutiyura imyaka ko muhanga umimino
ubuhungu azabithyiramo imbaraga ko
ntamurwe umunyarwanda imyaka

5° Joseph : Ababaza ubutaka butahunguho umwari
bukajya aha hunguho umwari kandi
nyirakome atabashije kuvuhungu bizapote
biti?
cyo cyose yashyizeho azapana umuho.
bozi bwa COPROLIZ ikamuha inama

Abagenera bikome bakomeye kubwirwa kandi ko
hari abababwirwa umumunsi zigishyirwa bakubwirako
am'ahabo kandi ntacyo ari ahaho mu aha leta
kabone umuho baha komeye, byarashimye nyirakome
ko umuho umuho umuho umuho umuho umuho
aza komeye abukomeye. gusa abubwo buri wese ari umuho
bwa kubukomeye meza

6° Emmanuel KANZA : Ababaza imimino y'ubutaka umuho
izayye itangwe umuho COPROLIZ umuho
leta.

Yashyizeho umuho umuho umuho umuho
hamwe kandi ababwirako.

Umunyobozi w'umunsi : Mukamurungi Franckie ~~prés~~ ~~prés~~
Umwanditsi w'umunsi : MUKAMURUNGI PASCALIE LH ~~Supervising Engineer~~
MUKUNGUZI SITE ~~Site~~

AMAZINA	UMURENGE	AKAGARI	UMUKONO
1. Umuhanzi ubuho. El. Ni	MUGINA	KABUGONDO	AMU
2. BIZIMANA Melome	MUGINA	KABUGONDO	AMU
3. MUGIMANA ZA SILIVANI	MUGINA	KABUGONDO	AMU
4. HABAKURUKA Jeremiyah	KINAZI	KUTABO	AMU
5. Nzeyimana 'de Dieu	MUGINA	KABUGONDO	AMU
6. Ntamburira Innocent	MUGINA	KABUGONDO	AMU
7. UWIZESIMANA J.M. Vianney	MUGINA	KABUGONDO	AMU
8. HAKIZIMANA Théodol	MUGINA	KABUGONDO	AMU
9. TWA BIRAMUNGE Venant	KUTABO	KABUGONDO	AMU
10. NTABARESHYA	KINAZI	KUTABO	AMU
11. MUYANEZA Sylva	MUGINA	KABUGONDO	AMU
12. Habizimana Marcel	MUGINA	KABUGONDO	AMU
13. Kanegye Madesze	MUGINA	KABUGONDO	AMU
14. Kubasiyaha Oliba	MUGINA	KABUGONDO	AMU
15. Mukadisi Rosette	MUGINA	KABUGONDO	AMU
16. Mwijarshi Jozefine	MUGINA	KABUGONDO	AMU
17. MUSA BYEMALIZA J. Barce	MUGINA	KABUGONDO	AMU
18. MUSA WAMA Shya	MUGINA	KABUGONDO	AMU
19. Hito. ye zu Egi	MUGINA	KABUGONDO	AMU
20. HAKIZIMANA FREDIEN	MUGINA	KABUGONDO	AMU
21. MUSA BYEMALIZA J. Barce	MUGINA	KABUGONDO	AMU
22. Nzeyimana Elie	MUGINA	KABUGONDO	AMU
23. Nshimiyimana Emanuel	MUGINA	KABUGONDO	AMU
24. TUYIZERE Aphrodis	MUGINA	KABUGONDO	AMU
25. HAVUGIYA Jemye Yoma	MUGINA	KABUGONDO	AMU
26. Nshimiyimana Mungali Theresia	KINAZI	KINAZI	AMU
27. Karekezi Vincent	KINAZI	KINAZI	AMU
28. MUSA BYEMALIZA J. Barce	MUGINA	KABUGONDO	AMU
29. TUYISABE FARMUSINA	MUGINA	KABUGONDO	AMU
30. Mukanyanolwi	MUGINA	KABUGONDO	AMU
31. Muzababwira	MUGINA	KABUGONDO	AMU
32. MUYOMUYE SHY	MUGINA	KABUGONDO	AMU
33. NTABANDA Ephem	MUGINA	KABUGONDO	AMU
34. Kuriheba J.M. Vianney	MUGINA	KABUGONDO	AMU
35. Nshimiyimana Emanuel	MUGINA	KABUGONDO	AMU
36. MUSA BYEMALIZA J. Barce	MUGINA	KABUGONDO	AMU
37. MUSA BYEMALIZA J. Barce	MUGINA	KABUGONDO	AMU
38. Habakurama Adarber	MUGINA	KABUGONDO	AMU
39. Mukanyanolwi	MUGINA	KABUGONDO	AMU

Ahagana	Umuzege	Akagali	Umuromo
MUKANKUSI Siliveriya	mugima	Kabogando	---
MUKAZERA ROZINE	KANKA KINAZI	RUTABO	---
MUTA BARUKA	KINAZI	RUTABO	---
SITANDONI	KINAZI	RUTABO	---
NYABENDA EPEFANI	KINAZI	RUTABO	---
NGURUTETE Nesiti	KINAZI	RUTABO	---
KABAYIRO Berwa	KINAZI	KINAZI	---

AMAZINA	UMURENGE	AKAGARI	UMUKO KO
1. Ndirikubwimana Gavelle	Mugina	Kabugondo	Handwritten
2. Nyiramanama Alphonsine	Mugina	Kobugomolo	Handwritten
3. Kwisenzo Elic	Mugina	Kabugomolo	Handwritten
4. Mubamugema Florence	Kinazi	Rutabo	Handwritten
5. Nyiroro Sisiyi	Kinazi	Rutabo	Handwritten
6. Mubamugema Veronique	Kinazi	Rutabo	Handwritten
7. Sengerishobo Kizizi	Kinazi	Rutabo	Handwritten
8. NIRERE Scolastique	Mugina	Kabugondo	Handwritten
9. MUKAKABANGWA Alpha	KINAZI	KINAZI	Handwritten
10. Nshimiyimana Callixte	Kinazi	Rutabo	Handwritten
11. Nyirurunda Claude	Kinazi	Rutabo	Handwritten
12. Terakamba Gerard	Kinazi	Rutabo	Handwritten
13. Nizanye Ferdyia	Kinazi	Rutabo	Handwritten
14. Nshimiyimana	Kinazi	Kabugomolo	Handwritten
15. Bizimana	Kinazi	Kinazi	Handwritten
16. Turatsinze Joseph	Mugina	Kabugondo	Handwritten
17. Ndayambaje Theoret	Mugina	Kabugondo	Handwritten
18. Ndayambaje Nepo	Kinazi	Rutabo	Handwritten
19. Ndayambaje Jean	Kinazi	Rutabo	Handwritten
20. Nshimiyimana Alphard	Kinazi	Kinazi	Handwritten
21. Nkurunziza Fabiyana	Kinazi	Rutabo	Handwritten
22. Ndayambaje JE	Mugina	Kabugondo	Handwritten
23. Ndayambaje Daniel	Kinazi	Kinazi	Handwritten
24. Ndayambaje	Kinazi	Kinazi	Handwritten
25. Ndayambaje	Kinazi	Kinazi	Handwritten
26. Ndayambaje	Mugina	Kabugomolo	Handwritten
27. Nshimiyimana	Kinazi	Kinazi	Handwritten
28. Nshimiyimana	Kinazi	Rutabo	Handwritten

AMAZIKA	UMUREKWE	AKAGARI	UMUKO
1. MUYISENGA Kplwase	MUGIRA	KABUTOKO	Ommyo
2. Mugemanaite Barwabe	MUGIRA	Kabugondo	Ommyo
3. Abimubenshi Felagiz	KINAZI	KINAZI	Ommyo

AMAZIKA

UMURENGE

AKAGARI

UMUKOHO

MWIZERWA Emmanuel	MUGINA	KABUGONDO	Handwritten signature
Rusumba bizi Viator	Mugina	Kabugondo	Handwritten signature
Bamunabese	mugina	Kubugondo	Handwritten signature
HABAMENSHI J BORO	KINAZI	MPARA	Handwritten signature
Twa gwa omukuru wella	Mugina	Kabugonda	Handwritten signature
NTako m'uye marisa	Mugina	KABUGONDO	Handwritten signature
Nshimiyimana Cesar	Mugina	Kabugondo	Handwritten signature
Dusabumunyezi Joseph	Mugina	Kabugondo	Handwritten signature
Bugingo Jean de Dieu	Mugina	Kabugondo	Handwritten signature
Munyigyo Felix	Mugina	Kabugondo	Handwritten signature
NYA bera m'ye Haded	MUGINA	KABUGONDO	Handwritten signature
nda himana na	mugina	KABUGONDO	Handwritten signature
MUKANOHeli feohie	MUGINA	KABUGONDO	Handwritten signature
MUKASHema feohie	MUGINA	KABUGONDO	Handwritten signature
Ngimuhanga Karori	MUGINA	KABUGONDO	Handwritten signature
Ntaganda Isidal	mugina	Kabugondo	Handwritten signature
UZABUKIHO Immanuel	MUGINA	Kabugondo	Handwritten signature
malumi J Claude	KANKA KINAZI	KANKA	Handwritten signature
NKUNANEZA Daniel	KINAZI	NYABISINAH	Handwritten signature
HABAKURAMA Abdulberi	KINAZI	II	Handwritten signature
KAKA HIRE	mugina	KABUGONDO	Handwritten signature
Nshimiyimana Alois	MUGINA	KABUGONDO	Handwritten signature
MUKAHIGIRO Epiphane	MUGINA	KABUGONDO	Handwritten signature
Sezibera Givestre	Mugina	Kabugondo	Handwritten signature
Maramba Papiya	Kubugondo	Kabugondo	Handwritten signature
Tuyituyineza Emm	Mugina	Kabugondo	Handwritten signature
Nyabendo Vedaste	Mugina	Kabugondo	Handwritten signature
MUKABODEGE stefaniya	MUGINA	KABUGONDO	Handwritten signature
Gombano Celestin	MUGINA	KABUGONDO	Handwritten signature
Nsaguye J pierri	KINAZI	Rutabo	Handwritten signature
NSENGIMANA Craver	MUGINA	KABUGONDO	Handwritten signature

