

EXECUTIVE SUMMARY

INTRODUCTION

This chapter is the non-technical summary of the Environmental and Social Impact Assessment (ESIA) for the Ruvyi102 hydropower plant construction and operation project, in Burundi. It presents a summary of the project environmental and social impact assessment results, which was already the subject of ESIA in 2015, validated by the Burundian authorities.

The Ruvyi102 run-of-river hydropower project is located about 60 km to the south-east of Bujumbura and 13.5 km north of Mahwa, on the border between the provinces of Bururi and Gitega, central regions of the country. It consists of a set of electricity production facilities including a 1.65 MW plant, as well as a power line of 2.4 km to transport the electricity produced to the national grid.



Location of the Ruvyi102 Hydropower Project site



The developer is Songa Energy, which is registered as a limited liability company in Burundi, which is a joint venture between Songa Energy US and Virunga Power. Songa Energy is developing small, 1MW to 10MW, grid-connected hydropower plants in rural Burundi. The company works with local communities and the national utility company to extend transmission lines into the area surrounding the hydroelectric plants, providing much needed electricity to hundreds of thousands of homes and businesses. In 2015 Songa Energy investigated several locations across Burundi and was given exclusive rights by the Government of Burundi to study four hydropower sites in central Burundi.

The overall objective of an impact assessment is to guide the implementation of the project in accordance with national and international regulations and with the aim of avoiding or minimizing negative impacts of the project on the natural environment, socio-economic activities and human health. The study is led by SHER Ingénieurs Conseils (Belgian consulting engineering company active worldwide) and conducted by Artelia, an independent engineering group with worldwide activities in several sectors including environment and energy.

INSTITUTIONAL AND LEGAL FRAMEWORK

Institutional framework

At the institutional level, the Ministry of Environment, Agriculture and Livestock is responsible for managing environmental issues. The Burundian Office for Environment Protection through its Directorate of Environment and Climate Change is in charge of the analysis of Environmental Impact Assessments.

A range of other ministries may be involved on specific themes, in the development of this project.

Legal framework

The political context of the project is marked by the existence of relevant political documents, framed and inspired by the Vision Burundi 2025, whose motto is: «In 2025, Burundi is a United Nation, Solidarity and Peace; A Country Built on a Society of Law with a Rich Cultural Heritage; A Prosperous Economy at the Service of the Well-Being of All».

Key policies that can provide a framework for project development include: the National Environmental Strategy, the National Water Policy, the National Climate Change Strategy, the National Development Plan (PND BURUNDI 2018-2027), the Strategic Framework for Growth and Poverty Reduction CSLP II or the National Gender Policy.

The energy sector is primarily governed by Law N° 1/014 of 2000 on the Liberalization and Regulation of the Public Service of Drinking Water and Electric Power, which provides the framework for electricity generation, transmission and distribution infrastructure, including easements for electricity distribution and transmission lines. The sector is supported by The Burundian Rural Electrification Agency (Decree N° 100/318 of 2011).

The environmental aspects are defined by an institutional, legislative and regulatory framework within which environmental actions in Burundi are now carried out. The Code of Environment defined by the Law N° 1/010 of 30th June 2000, provides the general framework to protect and manage the environment against all forms of degradation. It is supported by a set of texts that provide the implementation of actions such as the Decree N° 100/22 of 7th October 2010 on the Procedure for Environmental impact assessment or the Law N° 1/02 of 26 March 2012 on Water Code which sets the basic rules and related institutional framework to ensure rational and sustainable management of water resources, amenities, and hydraulic public interest works.

In addition, the Constitution of the Republic of Burundi promulgated on 7th June 2018 sets out the main principles governing the Republic of Burundi. It specifies in particular the rights and duties of citizens. A whole set of texts support and frame the socio-economic context of the country. Within the framework of Ruvyi102 project, it can be mentioned the Burundi Land Code (Law N°1/008 of 1 September 1986, revised by Law N°1/3 of 9 August 2011) which is the primary regulatory tool for the management of land assets, supported by the Ministerial Order N°720/CAB/304/2008 of 20 March 2008, updating the compensation rates for land, crops and buildings in the event of expropriation on grounds of public utility. Also the Labor Code (Decree-Law N°1/037 of 7th July 1993), the Public Health Code (Decree-Law N°1/16 of 17 May 1982) and the Law N°1/6 of 25 May 1983 on the Protection of the Patrimony National Cultural can be cited.

Also, the national regulatory and legislative framework is supported by the conventions signed or ratified by the country as well as specific guides made by some international institutions, organizations or commissions, to take environmental and social issues into account in the implementation of project including dam projects. As the project plans to seek international funding, this ESIA meets the performance standards of international donors such as the African Development Bank (AfDB) operational safeguards (OS) and the International Finance Corporation (IFC) Performance Standards (PS) which cover the following themes: environmental and social assessment, labor and working conditions, land acquisition and involuntary resettlement, indigenous peoples, cultural heritage, health and safety of populations, pollution prevention, preservation of biodiversity and natural habitats, sustainable resource management.

PROJECT DESCRIPTION AND JUSTIFICATION

The Burundian electricity production potential is characterised by a high dependence on hydroelectric power, which is largely underexploited. With less than 5% of the population having access to electricity¹, Burundi needs to develop its electricity production and supply. It is in this context that the Ruvyi102 project is being implemented and plans to produce 1.65 MW.

The project is located on the Ruvyironza River, which forms the border between Ryansoro Commune and Buraza Commune to the East. Overall, the site area is characterized by rolling hills covered by vegetation (grass and Eucalyptus trees) and rock outcrops.

The proposed hydropower scheme features the following characteristics:

- River closure:
 - 1.3m-high and 10.5m-long concrete ogee shape spillway;
 - **Flushing and intake works**, on the left bank;
 - Fish ladder, on the left bank;
 - Masonry wing walls on both river bank for the closure of the river during extreme flood events.
- Waterway on the left riverbank:
 - 2 compartments desilting structure (discontinuous flushing) following the intake works;
 - 1km-long **headrace canal**: 2m wide and 1.80m-high;
 - **Forebay**;

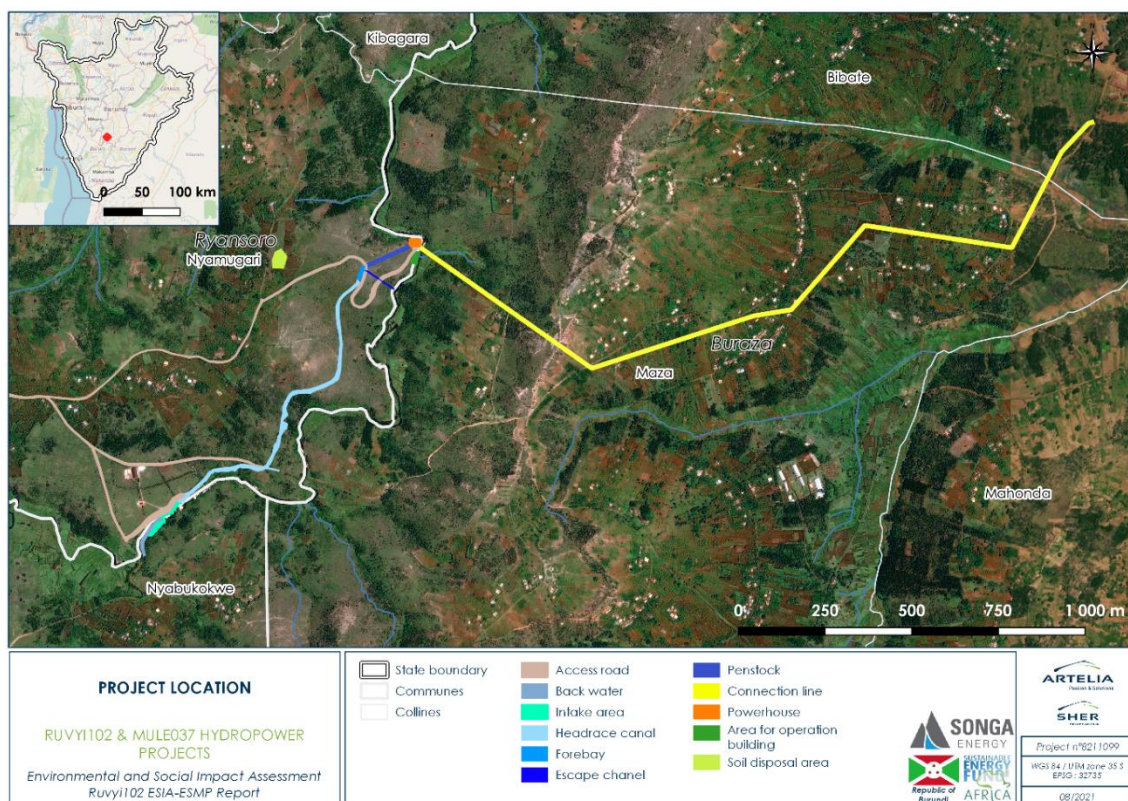
¹ Plan national de développement du Burundi (PND) 2018-2027

- 160m-long welded steel **penstock** to the Y-manifold;
- 38.55m of gross head captured.

The waterway will join the **powerhouse** and the **tailrace**, located downstream on the left riverbank. All features will be supervised by a control and monitoring system.

The project will also include:

- Two new access roads to serve the hydropower project facilities;
- **A 2.4 kilometer long Grid interconnection** of 30 kV line, to bring the produced electricity to the national grid;
- **Temporary infrastructures** which include borrow area and quarry, temporary diversion and building and site facilities.



Infrastructure location

DESCRIPTION OF THE PROJECT ENVIRONMENT

Physical environment

The **climate** in the study area is characterized by an alternation of two seasons: a rainy season which generally extends from October to May, and a dry season from June to September. However, some effects of climate change have already been felt by exceptional rainfall and prolonged drought period which has impacted the populations and the environment.

The study area is characterized by a hilly context with altitudes between 1,600 and 2,200 m. **Soils** are locally degraded by various pressures such as poor land use, deforestation, overgrazing, overexploitation, climatic changes.



Illustration of the depth of the Ruvyironza valley

Geology is composed of granites accompanied by mineralized pegmatites. Granitoid rocks and very fine ones have been observed on the project site. The **seismic risk** is evaluated for Burundi as medium and the main spatial concentrations of earthquakes are far from the weir site.

Concerning **water resources**, the study area is potentially located on fractured aquifers which varies according to impairment levels and cracking. The Ruvyironza River is a permanent river marked by a succession of flow facies, with sections of relatively calm flow and sections of rapids accompanied by outcropping bedrock which constitutes hard spots against erosion. Upstream of the future weir, the slope is very low (0.5%) and after the future weir the slope is steeper (between 1.8% and 4%).



***Uniform flow upstream of the future weir
in agricultural flood zone***



***Rapids zone linked to the presence of boulders
and rock outcrop***

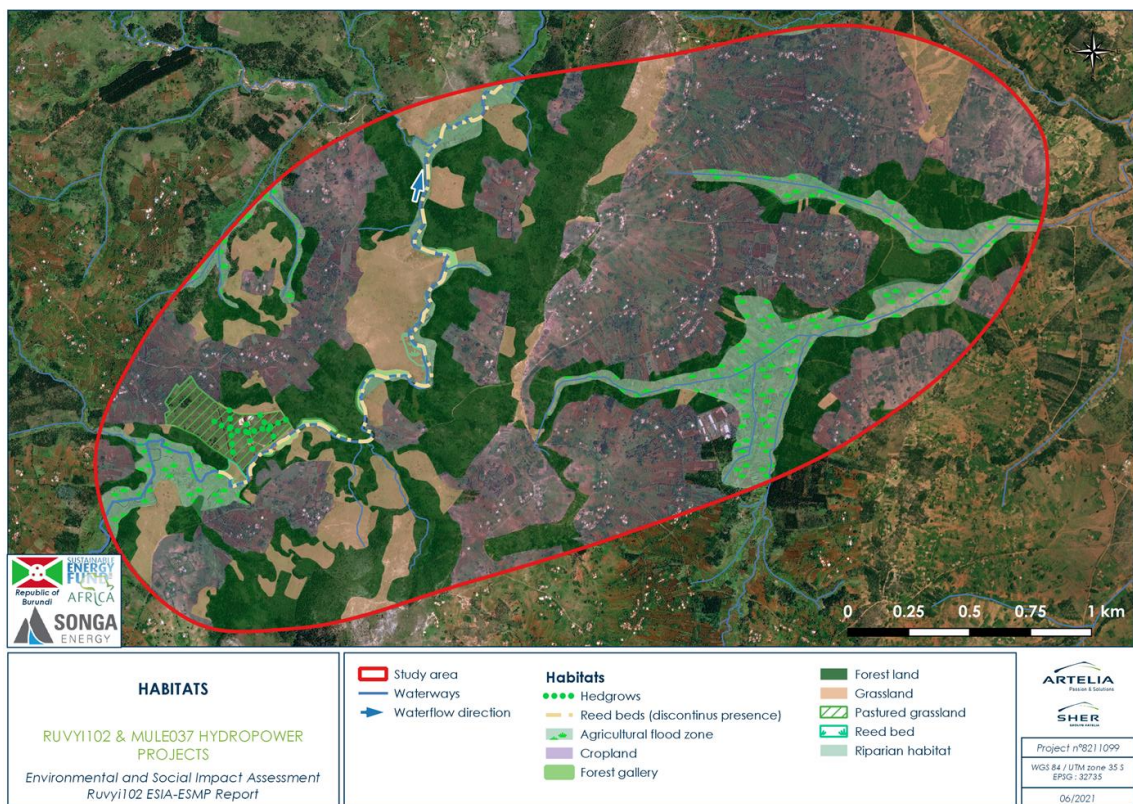
The river is characterized by two hydrographic seasons: dry season from July to September with a minimum average streamflow of 1.9 m³/s and wet season from October to June with a maximum average streamflow of 6.2 m³/s in April. The mean annual flow is estimated at 4 m³/s. The streamflow at the Ruvyi102 Hydroelectric Project site is less than 3.4 m³/s 50% of the time and higher than 7.3 m³/s only 10% of the time (over a year period). The flow guaranteed 90% of the time (329 days per year on average) is estimated at 1.7 m³/s.

Water sampling have been done in the Ruvyironza in order to have a baseline water quality in the study area.

Biological environment

Biodiversity in the study area is globally low due to strong anthropogenic and agricultural pressures. No protected areas are affected by the project, the nearest being Karera falls and Bururi Forest nature reserve, respectively located at approximately 30 km south-east and south-west of the project site.

A large part of habitats has been modified by human activity or degraded (forest gallery for example). The biodiversity is characterized by a low diversity comprised of common species to accommodate human activities. There is no presence of flora or terrestrial fauna species that trigger critical habitat according to the IFC-PS6 (Biodiversity conservation and sustainable management of living natural resources). However, two fish species (*Labeobarbus acuticeps* and *Amphilius aff. Uranoscopus*) are considered endemic, at the scale of a few watersheds in Burundi, Rwanda, and the larger Eastern, Southern, and Central African region. According to the IFC-PS6 these species trigger the need for a critical habitat assessment and review of the thresholds, which was completed as part of this study.

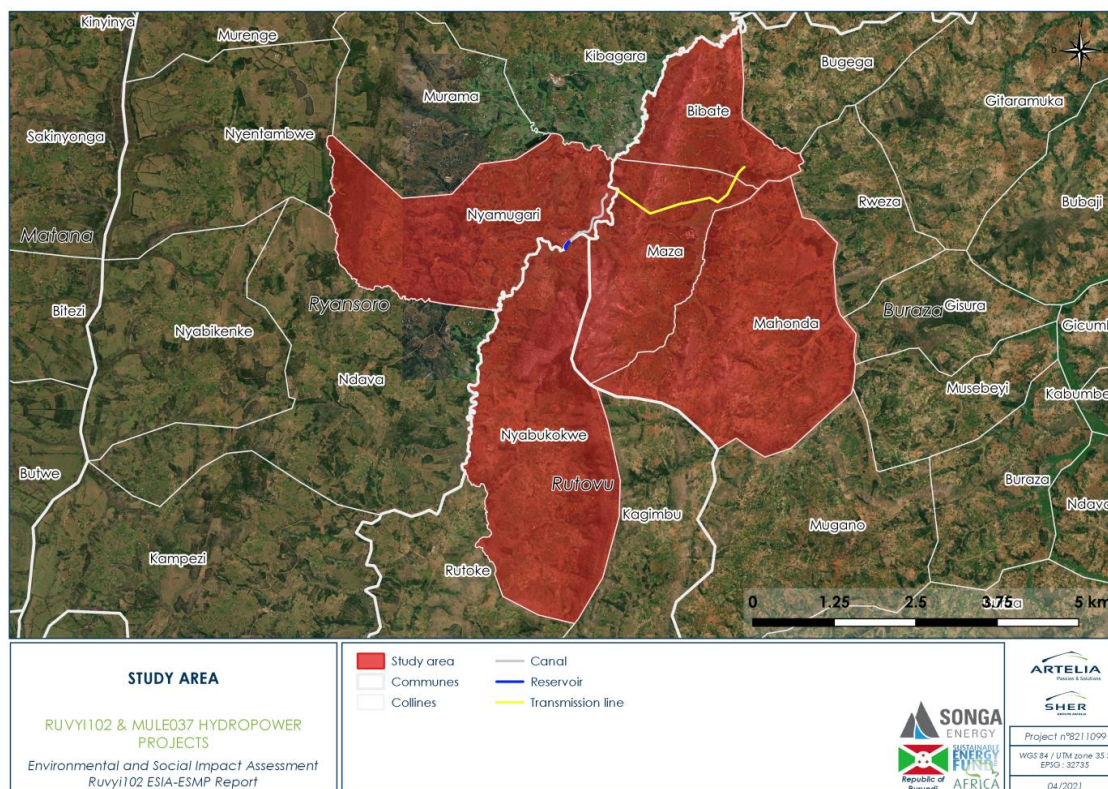


Habitat map

Plants around Ruvyironza River are mostly providing provisioning services. Eucalyptus is the most used plant by the population as it is their primary source of income.

Social environment

The **local governance system** is based on decentralized institutions: the communes and the collines. The communes have under their responsibility several public services including, water and sanitation, health, public security, and education. Communes are also in charge of land management. If communes have technical staffs, they however lack financial services to invest in public services. The collines represent the smallest governance level in the country. Colline councils are in charge of managing everyday affairs on their territory. Women and young people are usually excluded from local governance bodies and decision process.



Source: ARTELIA, 2021

Map of the collines impacted by the project

Natural resources management are a crucial component in the area, since the predominant livelihood strategy remains heavily dependent on land. The area is affected by land scarcity and fragmentation, even though less than the rest of the country. Therefore, land is a source of economic vulnerability and generates recurrent conflicts.

The management of forest is also sensitive, as the country has known a steady diminution of forest areas for more than a century, due to continuous encroachment for agriculture. In addition, the Burundian population remains strongly dependent on wood as the main source of domestic energy. Considering the low level of activities linked to the river in the study area, no specific stake related to water management has been identified.

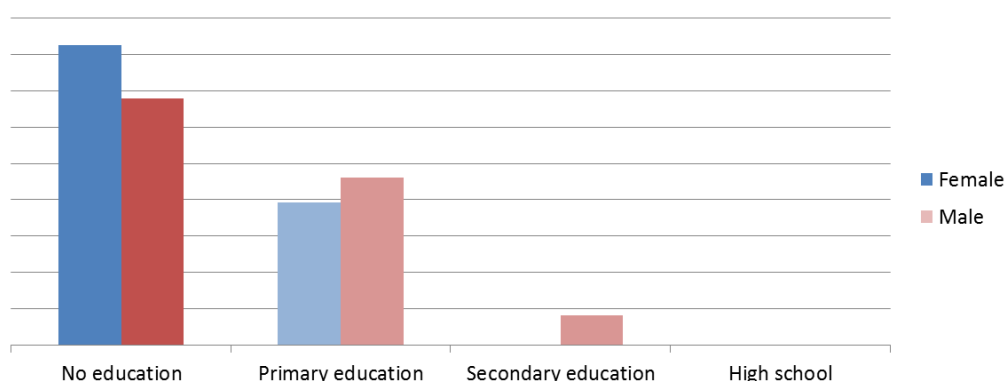
Family and social relationships appear to be generally good in the study area. However, important gender issues exist within households, notably domestic violence and the sexual division of labor. Moreover, unwanted teenage pregnancies are a serious issue in the study area.

In Burundi, the **living conditions and housing** are characterized by poverty: more than two thirds of the population live below the poverty line and 39% are in extreme poverty. In the study area, the main housing type is isolated. The walls of the houses are almost always made of brick, while the roofs are mainly made of tiles. The equipment inside the house is very modest.



Dwellings with a tiled roof

Regarding **education**, in the study area, 86% of school-age boys and 82% of school-age girls are enrolled in school. However, 60% of adults are illiterate, unable to read or write. Disparities are observed by gender (68% of women are illiterate compared to 55% of men) and age (85% of those over 60 are illiterate, and this rate even rises to 100% for those over 70).



Source: Artelia, 2021 (household survey)

Gender disparities in education access

The main **health problems** affecting the population in the study area are: malaria, eye problems, respiratory problems, intestinal disorders and parasitic diseases. Regarding HIV, which is a relatively taboo subject locally, about 30 people are currently being treated for HIV at the Ryansoro and Condi health centers, but many cases go unreported.

Food security is a crucial issue in Burundi. Rural households are very dependent on their agricultural production and these are very sensitive to changes. However, households have adopted strategies to reduce risks (notably polyculture) and no famine events have been reported in the study area in the past five years.

The study area does not suffer from **insecurity**, although some problems may occur locally. Drowning cases were reported throughout the three communes in the study area. These accidents occur mainly during rainy periods, generally when crossing the river. Traffic accidents have also been reported, but they remain relatively

rare. Drug and alcohol use is not currently a problem in the study area. Prostitution is also not common but there are indications that some women are involved in clandestine prostitution.

Security in the study area is ensured by the police and by the Joint Human Security Committees (JHSC). JHSC are often considered as serving the ruling party, the National Council for the defense of democracy – Forces for the defense of democracy (CNDD-FDD) and they are regularly accused of violating human rights and abusing their power to persecute political opponents. JHSC have a predominant power at local level.

Water quality is considered good by the population and local authorities, but access to improved water sources is uneven across the collines.

In rural areas, only 2% of the Burundians have access to **electricity**. The study area is not connected to the electricity grid. Households in the study area do not have diesel generators and only 10% have a solar panel. The main source of energy for cooking is firewood (especially Eucalyptus wood). For lighting, the vast majority of the inhabitants use battery-powered lamps.

The vast majority of Burundian households have no means of personal **transport**. In the study area, only 4% of households own a bicycle and 1% a motorcycle. Residents do not own a car or van.

There are several **organizations acting in the area**, most of them being involved for several years on the promotion of reproductive health and community empowerment. The presence of foreign international organization has however drastically diminished since 2017, following the issuance of restrictive rules by the Burundian government.

As of today, **employment** remains low in the study area: communities rather rely on agriculture and other land oriented activities to generate income.

Agriculture is the main economic activity around the project and is the main source of income for almost all households. Agriculture is traditional with low yield and poor soils. Agriculture follows a seasonal pattern and is based on natural fertilization from livestock. Local value chains associated to agriculture provide additional incomes to both men and women.

Despite a complex polyculture allowing farmers to harvest most of the year, local agriculture remains strongly vulnerable to extreme natural events. Extensive techniques used by farmers requires vast lands which has become scarcer in the area, thus limiting the possibilities of extending cultivated areas. Through self-consumption, agriculture ensures household food safety.

Livestock breeding is widespread in the area. While richer households focus on big livestock (cattle), poorer households invest in small livestock (goats, guinea pigs). Livestock is a key element to ensure fertilization and agriculture productivity. Land scarcity however limits the quantity of livestock a household can own.

The area is specialized in **timber** production. Indeed, a consequent proportion of land is dedicated to Eucalyptus, which is used to produce charcoal, firewood, or construction materials. Timber generates important incomes for households. The timber value chain (logging, charcoal) also provides incomes for local youth which are suffering from land scarcity and unable to start their own farm.



Plot of polyculture



Cows grazing near the Ruvyironza



Carbonization process for timber

Households in the study area are marginally engaged in **other economic activities**, such as handicraft, brickwork, tailoring and trade. Pottery is traditionally practiced by Batwa communities.

Regarding the **cultural heritage**, despite the importance of Christian religion, traditional beliefs involving spirits are still widespread and respected by local communities. However, no specific place of cultural importance has been identified during field surveys. In addition, the area is not known for archeological importance and has suffered from continuous erosion across the centuries.

The study area presents several **groups with vulnerabilities**: women, elderly, youth, children, people with disabilities, landless people and Batwa communities. The challenges are particularly high for women, the elderly and Batwa communities.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Impacts and measures linked to the project location

COMPONENT OR ACTIVITY	POTENTIAL IMPACTS	RAW IMPACT EVALUATION	MITIGATION MEASURE:	RESIDUAL IMPACT EVALUATION	OFFSET STRATEGY (IF NECESSARY)
<p>AM = AVOIDANCE RM = REDUCTION MM = MONITORING IM = INFORMATION TM = TRAINING ENM = ENHANCEMENT</p>					
PHYSICAL ENVIRONMENT					
All component	The entire analysis of impacts on the physical environment (geology, hydrologic impact, impact on water quality, impact on sedimentary transport and GHG emissions) was grouped under the sections related to the impacts of construction and operation activities	-	-	-	-
BIOLOGICAL ENVIRONMENT					
Modified habitat	Definitive loss of modified habitats linked to the project footprint, important for cultural and artificial habitat (this topic is treated in the social impact assessment) and low on other modified habitat (highland meadow for example)	Low	A large part of habitats has been modified habitats by human activities. However mitigation measures were proposed during the design phase: <ul style="list-style-type: none"> Establishment of main infrastructures (road acces, derivation channel, electric line) in modified or altered habitats with a lowbiodiversity value (highland meadow, crop) (RM) ; Avoidance of the forest gallery along the river (natural habitat) (AM). 	Low	-
Natural and critical habitat	Definitive loss of natural and critical habitats linked to the project footprint (Torrential river, humid forest gallery)	Low	<ul style="list-style-type: none"> Avoidance of the forest gallery along the river (natural habitat) (AM). 	Low	-
Flora	Direct destruction linked to the project footprint	Low	No specific measure, mainly common specie used by the population, no protected specie, no endangered (EN) nor Critically endangered (CR) regarding UICN red list and no endemic specie	Low	-
Terrestrial species	Direct destruction or habitat alteration linked to the project footprint	Low	No specific measure, mainly common species with no issues regarding IUCN Red List, no endemic and no migratory specie	Low	-
Fish	Direct destruction or habitat alteration linked to the project footprint	Low	A choice of a low rise weir (low footprint in the river) including a fish passage whose characteristics (slopes, lengths) are based on the morphological characteristics of the river, and specifically the natural rapid areas (RM)	Low	-
SOCIAL ENVIRONMENT					

COMPONENT OR ACTIVITY	POTENTIAL IMPACTS	RAW IMPACT EVALUATION	MITIGATION MEASURE: AM = AVOIDANCE RM = REDUCTION MM = MONITORING IM = INFORMATION TM = TRAINING EnM = ENHANCEMENT	RESIDUAL IMPACT EVALUATION	OFFSET STRATEGY (IF NECESSARY)
Land management	By reducing the available land (through the acquisition of land within the project rights-of-way), the project will raise land pressure and may tend to increase land conflicts.	Low	The E&S Coordination Committee should include members of the Colline Councils (and in particular persons already involved in land management, such as the "Bashingantahe"), to prevent conflicts and help their resolution in case they occur (RM).	Low	-
Housing	Six houses are located within the existing project rights-of-way and could therefore be affected by the project. The number of houses potentially affected is not high, but an impact on housing can be very damaging for the concerned households.	Significant	The Main contractor (MC) should be able to easily avoid all of these homes, by adjusting the final layout. Therefore, the six houses located near the current rights-of-way can and must be avoided (AM). On this basis, resettlement will be limited to economic displacement, without physical displacement.	No residual impact	-
Livelihoods and economic activities	<p>The Project location will lead to two main types of impacts on livelihoods and economic activities:</p> <ul style="list-style-type: none"> - Loss of land, related to the acquisition of the land rights-of-way for all facilities except the connection line, and the safety perimeters associated with these facilities. In total, 5.19 ha of land will be lost. - Restriction of land use, related to the installation of the connection line. In total, 3.31 ha of land will be subject to the following land use restriction: (i) construction will be prohibited under the line and (ii) trees and crops going above 3 meters (such as banana trees, mango and avocado trees as well as Eucalyptus) will be prohibited under the line. Low crops will be allowed. 	Important	<p>Some measures have already been taken to avoid and minimise this impact as part of the project design, particularly with regard to the route of the connection line.</p> <p>However, it is important to add an additional mitigation measure: modifying the design of the project by raising the height of the line (RM). This measure will significantly reduce the impact on perennial crops (and to a lesser extent on trees with economic value) over a large area. In particular, this would greatly reduce the impact of the project on banana cultivation, which represents both a source of income and food security for the inhabitants of the study area.</p> <p>This will help to decrease the impact, but the level will still be substantial.</p>	Significant	To manage economic displacement, a Land Acquisition and Livelihoods Restoration Plan (LALRP) will be established (CM). Particular attention should be paid to gender issues and vulnerable households.
Cultural and archeological heritage	<p>The project rights-of-way will have several potential impacts on cultural and archaeological heritage:</p> <ul style="list-style-type: none"> - Local communities still rely on a traditional belief system involving "spirits", which reside mainly in the forests and the river. Through its rights-of-way, the project could disturb these spirits. 	Significant	<p>For the management of the impact on cultural heritage, the measures to be put in place are the following:</p> <ul style="list-style-type: none"> - Regarding the impact on spirits: organise appropriate ceremonies, if necessary, to appease the spirits residing in the affected areas. This activity should be defined and organised in close collaboration with the local authorities and E&S Coordination Committee (RM). 	Low	-

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	<ul style="list-style-type: none"> - The project rights of way could affect isolated graves. This is particularly the case in the vicinity of the river, where people who have drowned are regularly buried. - Although there is little evidence for the presence of archaeological remains, it is possible that the project's right-of-way will be located on land containing archaeological remains, and will therefore affect this heritage. 		<ul style="list-style-type: none"> - Regarding the impact on isolated graves: precisely identify all graves located within the project rights-of-way. Then: (i) the MC should avoid affecting graves as much as possible (AM), by adjusting the final design; and (ii) in the event that certain graves cannot be avoided, their relocation should be ensured in accordance with local customs and traditions (RM). 		

Impacts and measures during the construction phase

COMPONENT OR ACTIVITY	POTENTIAL IMPACTS	RAW IMPACT EVALUATION	MITIGATION MEASURE: AM = AVOIDANCE RM = REDUCTION MM = MONITORING IM = INFORMATION TM = TRAINING ENM = ENHANCEMENT	RESIDUAL IMPACT EVALUATION	OFFSET STRATEGY (IF NECESSARY)
PHYSICAL ENVIRONMENT					
Air pollution and dust	<ul style="list-style-type: none"> ▪ Air quality degradation with engines ▪ Dust is generated on site, by opening the foot-print areas (naked soil), earthmoving operations, storage of excavated materials and products, material crushing units and the concrete plant 	Low	<ul style="list-style-type: none"> ▪ Regular control and maintenance of construction machinery and trucks (RM) ▪ Limitation of clearing around the river (AM). The quantity of naked soil and green waste will therefore be very limited ▪ Reuse, composting and reclamation of waste, including green waste (RM), minimizing the burning of green waste ▪ Limit the speed of vehicles (RM) for example to 30 km/h in all inhabited areas and if necessary (complaints) regular watering of the most sensitive sections ▪ Inform local populations of work activities (IM) ▪ The monitoring of atmospheric and dust emissions will be done through the grievance register and observation of road edges (MM) 	Low	Non concern
Noise	Due to the presence of many gears, engines and workers around the river and culture areas for several weeks to several months	Low	<ul style="list-style-type: none"> ▪ Regular control and maintenance of construction machineries and trucks (RM) ▪ Limit the speed of vehicles (MR) ▪ Definition of standards to be respected by devices (RM) ▪ Definition of standards to be respected at the level of inhabited areas and in the natural environment (RM) ▪ Setting standards for the use of personal protective equipment (PPE) (RM) ▪ Shot Alert Procedure and strict explosives storage and handling procedure (RM) and Inform local populations of work activities (IM) ▪ Monitoring of noise (MM) 	Low	Non concern
Soil erosion	<ul style="list-style-type: none"> ▪ Damage to soil conservation/reconstitution ▪ Change of physical quality of surface waters 	Significant	<ul style="list-style-type: none"> ▪ Conservation of a strip of vegetation (10m) around the Ruvyronza to stop and/or slowdown sediment before they arrive in the river (AM) 	Low	-

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			<ul style="list-style-type: none"> ▪ Sediment trap (RM) ▪ Optimization of Cuts-Fills (RM) ▪ Installation of drainage and sedimentation systems (RM) ▪ Establishment of a monitoring procedure of sediment and erosion control (MM) ▪ Material deposit areas management (RM) ▪ Implement stream crossing devices (RM) 		
Water quality	The risk of degradation of the chemical and biological quality of water can be induced by the temporary density of construction activities and population.	Significant	<ul style="list-style-type: none"> ▪ Implementation of a waste water treatment system (RM) ▪ Implementation of a waste collection, monitoring and treatment program (RM) ▪ Identify oil storage areas (RM) ▪ Storage of chemicals on appropriate areas (RM) ▪ Identify material deposition sites (RM) ▪ Machinery and equipment maintenance area (RM) ▪ Define strict procedures for the filling of tanks of vehicles (RM) ▪ Prevention of toxic pollution (RM) ▪ Exclusive use of authorized pesticides in Burundi and/or recognized by WHO (RM) as toxic pollution (PM) ▪ Implementation of a monitoring plan of water from construction site quality (MM) 	Low	-
Waste production	Large quantities of waste will be generated by construction activities with indirect impact on physical environment	Significant	<ul style="list-style-type: none"> ▪ Development and implementation of an adapted waste management plan (RM) included specific measures about domestic, construction and hazardous wastes 	Low	-

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BIOLOGICAL ENVIRONMENT					
Terrestrial biodiversity	Main impacts on fauna and flora species concern: <ul style="list-style-type: none"> ▪ Clearing operations, opening the project foot print ▪ Accidental or unintentional introduction or propagation of invasive alien species ▪ Noise nuisance from different construction activities and the operation of construction equipment ▪ Non-compliance with site rights-of-way ▪ The increase of people (workers and immigration) around the site (indirect impact) 	Significant to Low	<ul style="list-style-type: none"> ▪ Work planification regarding biodiversity issues (AM) ▪ Protection and access (RM) ▪ Maintaining water quality (RM) ▪ Organization of work in the river of the Ruvyronza (RM) ▪ Flora invasive species management (RM) ▪ Workers training session and sentization on ecological issues and staff and social influx management (TM and RM) 	Low	-
Aquatic biodiversity	<ul style="list-style-type: none"> ▪ Degradation of physical environment and water quality ▪ Clearing operations and waste disposal in aquatic ecosystems ▪ Site management during construction phase 	Significant		Low	-
SOCIAL ENVIRONMENT					
Community infrastructures	In order to carry out the construction work, the MC will: (i) rehabilitate and widen some existing roads, (ii) create new paths (access roads) and (iii) create one or several bridges. During the works, traffic could be partially disrupted.	Low	The MC should keep disruption to road traffic to a minimum (RM).	Low	-
Livelihoods and economic activities	During the construction phase, the main impact of the project on economic activities will be the degradation of crops by the power line works. This impact will occur in two main ways:	Significant	The MC will need to avoid and minimize this impact by adjusting the final layout and identifying suitable access routes (AM / RM). It is expected that all damages can not be avoided and that some will be detrimental to the affected households.	Significant	To manage economic displacement, a Land Acquisition and Livelihoods Restoration Plan (LALRP) will be established (CM). This plan

COMPONENT OR ACTIVITY	POTENTIAL IMPACTS	RAW IMPACT EVALUATION	MITIGATION MEASURE: AM = AVOIDANCE RM = REDUCTION MM = MONITORING IM = INFORMATION TM = TRAINING EnM = ENHANCEMENT	RESIDUAL IMPACT EVALUATION	OFFSET STRATEGY (IF NECESSARY)
	<ul style="list-style-type: none"> - By the creation of small access roads in some places (in particular when the electric line moves away from the road), which could encroach on agricultural land. - By the works themselves (installation of the pylon, running of the cable), which will cause temporary damages to agriculture and land crossed: trampling of plants and soil compaction by the passage of the machines. 				should include a clear compensation procedure for damage to agricultural land and crops caused by the power line works.
Employment and local entrepreneurship	<ul style="list-style-type: none"> ▪ Risk of conflicts related to employment, due to: (i) certain inhabitants may present unfavourable characteristics for employability, (ii) potential monopolisation of jobs by certain dominant social groups, (iii) potential difficulties in distributing jobs fairly among the different collines, (iv) potential favouritism by local authorities towards young Imbonerakure serving the ruling party, and (v) potential tensions within households arising from men's enrichment. ▪ Risk of conflicts related to subcontracting, because of potential discrepancies between the needs of the MC and the expectations of local businesses. ▪ Risk of creating dependency of employees on wage labour for their subsistence, which could lead to possible economic difficulties in case of abandonment or neglect of agricultural activities during the works. ▪ Risk of increased household workload for one spouse, in case the other one is employed by the project. 	Significant	<ul style="list-style-type: none"> ▪ In order for job creation to have a truly positive impact, without conflict or adverse impacts, a relevant recruitment strategy should be in place (RM/EnM). ▪ In order for local subcontracting to have a truly positive impact, a relevant local subcontracting strategy should be implemented (RM/EnM). ▪ Other risks will be reduced by the definition of a limited period of employment for each person recruited – which is also part of the local recruitment strategy (RM). 	Positive	-
Local demography	<ul style="list-style-type: none"> ▪ Population may grow, due to (i) the arrival of workers, (ii) the return of former inhabitants and (iii) voluntary and spontaneous migrations that the project may generate during the construction phase. Several factors make the Ruvyi102 project favourable to spontaneous migration, but 	Important	<ul style="list-style-type: none"> ▪ The first measure to be put in place is to limit the growth of the population, by preparing an Influx Management Plan (RM). 	Positive	

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	<p>these influxes are expected to be moderate due to the small scale of the project and the limited employment opportunities offered.</p> <ul style="list-style-type: none"> ▪ This increase in the local population can have both positive and negative impacts on the environment and local socio-economic dynamics: <ul style="list-style-type: none"> - Positive impacts: the presence of workers and new settlers will generate monetary flows that partly feed the local economy and contribute to the creation of new economic opportunities and outlets that will encourage the opening of businesses. - Negative impacts: even a temporary increase in population size in the collines of the study area could have repercussions on several compartments of the human environment. In particular: (i) the presence of mainly male workers and migrants could disrupt family cohesion and aggravate the issue of unwanted pregnancies of young women, which is a crucial issue at present; (ii) population growth could lead to a deterioration in the health status of the population through overloading of the health infrastructure and a proliferation of communicable diseases; and (iii) population growth could lead to pressure on natural resources and inflationary phenomena, whereas food security is a crucial issue in the study area. 		<ul style="list-style-type: none"> ▪ Additional measures can be put in place to avoid, reduce and monitor potential negative impacts that could result from an increase in the population: <ul style="list-style-type: none"> - Awareness-raising activities will be carried out on the subject of unwanted pregnancies, in partnership with a local NGO (TM). - Ensure free and anonymous access to contraception (AM) for local women (condoms but also implants) and for site workers (condoms). Information should be transmitted directly to young women in the study area (TM). - Monitoring the use of health centres in the vicinity of the study area. If the thresholds are exceeded, put in place support measures for the health centres (reinforcement of medical staff, equipment, etc.) (MM).- The E&S Coordination Committee should include persons already involved in land management, such as the "Bashingantahe", to prevent land conflicts (RM). - Regularly (every 3 months) monitor the prices of a selection of mainly (but not only) food items in local markets in order to anticipate inflationary effects that might be caused by the project (MM). 		
Community health and safety	<ul style="list-style-type: none"> ▪ Impacts on the health of communities, mainly related to: <ul style="list-style-type: none"> - The proliferation of communicable diseases. - Overcrowding of the health infrastructure, caused by the care of workers and/or migrants seeking employment. 	Important	<p>A Community Health and Safety Plan will have to be developed and deployed to reduce the health and safety risks on local residents, to:</p> <ul style="list-style-type: none"> - Support the good health of the population, through: (i) the implementation of a malaria prevention and control programme in the collines of the study area and (ii) a programme to prevent and combat the transmission of Sexually Transmitted 	Low	-

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	<ul style="list-style-type: none"> Impacts on community safety, mainly related to: <ul style="list-style-type: none"> - Raised road traffic which will increase the risk of traffic accidents. - Illegal intrusion by individuals on the site, which could affect their safety. 		Diseases (STDs) and HIV/AIDS targeting local residents, in partnership with a specialised local NGO. - Securing site activities and facilities, while respecting human rights. This Community Health and Safety Plan will be complementary to the Influx management plan, the Occupational health and safety plan, and the Traffic management plan.		
Workers health and safety	<ul style="list-style-type: none"> Impacts on the health of workers, mainly related to the proliferation of communicable diseases and exposure to dust and noise. Risks for workers safety, related to construction activities: transport accidents, traumatic accidents, musculoskeletal disorders and poisoning or burns to the skin or eyes. This construction work can lead to death or serious injury, especially when working conditions are not optimal. This impact depends on the level of training of the workers, their supervision and the application of safety rules. Risk of Gender-Based Violence and Harassment (GBVH) among workers (any owners, managers, supervisors or co-workers), such as: (i) sexual exploitation, abuse and harassment, (ii) violence and harassment that is physical and/or psychological, and (iii) financial abuse. 	Important	<ul style="list-style-type: none"> In general, the Project Owner (PO) will ensure that the MC and its subcontractors comply with the national labor regulations and ILO conventions to which Burundi is a signatory. An Occupational Health and Safety Plan will have to be developed and deployed to reduce the health and safety risks on workers, in order to: <ul style="list-style-type: none"> - Protect the health of employees. - Ensure healthy living conditions for the employees at the base camp. - Ensure the safety of employees at work. - Prevent GBVH. In addition, a Traffic Management Plan will also need to be prepared and implemented, based on the International Association of Oil and Gas Producers (IOGP) road safety rules. 	Low	-
Cultural and archeological heritage	Although there is no evidence for the presence of archaeological remains in the study area, the paucity of research in Burundi should lead to caution: unknown archaeological remains could be destroyed during the works, in particular during earthmoving and excavation activities.	Significant	<ul style="list-style-type: none"> Sensitise workers on the existence of potential archaeological artefacts in the ground to be stripped and on the procedures for reporting discoveries to supervisory staff (TM). Implement a Chance Find Procedure during earthworks and excavations and require subcontractors to comply with this procedure as part of their contract. 	Low	-

Impacts and measures during the operation phase

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PHYSICAL ENVIRONMENT					
Climate change	Ruvyi102 is considered to be a low-emission power plant and will participate to the reduction of the national carbon emission factor of the electricity mix. Moreover, it will help reducing the dependence to forest and fuel.	Positive	No specific measure on this topic	Positive	-
Hydrology	Modification upstream the weir (low water period and flood period)	Low	-	Low	-
	Modification downstream the weir (low water period and flood period)	Important	<ul style="list-style-type: none"> Optimization of the flood and trip management, in order to limit project impact on flow seasonality and to limit project impact on small flood event (RM) Environmental flow (RM) in the by-passed section in order to protect aquatic ecosystem in dry season 	Significant	-
Sedimentation	Accumulation of sediment upstream of the threshold and alteration of solid transport	Significant	Operation of a powerful flush valve (RM)	Low	-
Waste production	Waste will be generated by operation activities although volumes are much smaller than the construction phase,	Low	Development and implementation of an adapted waste management plan (RM)	Low	-
Maintenance activities	Direct impact on physical environment	Significant	<p>Development and implementation of a corridor and access maintenance procedure (RM)</p> <p>Maintain/promote an herbaceous layer or low cultural activities, in the electric line corridor, to minimize maintenance and soil erosion (RM)</p>	Low	-
BIOLOGICAL ENVIRONMENT					

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Fish	<ul style="list-style-type: none"> ▪ Physical modifications and link with aquatic ecosystem ▪ Ecological continuity ▪ Fish mortality during the operation 	<p style="color: red; font-weight: bold;">Important</p> <p style="color: orange; font-weight: bold;">Significant</p> <p style="color: green; font-weight: bold;">Low</p>	<ul style="list-style-type: none"> ▪ Environmental flow (RM) in the by-passed section in order to protect aquatic ecosystem in dry season ▪ The installation of a fish is considered as relevant (RM) ▪ Carry out a study on the ecology of the two species (EnM) at stake at the scale of the Ruvyironza watershed ▪ Specific monitoring of fish population upstream and downstream the weir (MM) during the first five years of the operation phase 	<p style="color: green; font-weight: bold;">Low</p>	-
Terrestrial fauna	Risk of in-flight collision for birds with the electric line	<p style="color: green; font-weight: bold;">Low</p>	Use of various bird protection devices (RM)		
SOCIAL ENVIRONMENT					
Community infrastructures	As part of its work, the MC will (i) rehabilitate and widen some existing roads, (ii) create new paths (access roads) and (iii) create one or several bridges. This potential impact is positive, especially with regard to bridges. However, local communities and their leaders expect a broader support in terms of access to basic services. In particular, expectations were raised during the consultations regarding access to electricity and water. This could lead to tensions between the local population, the local authorities and the project.	<p style="color: orange; font-weight: bold;">Significant</p>	To make the impact on community infrastructure positive: <ul style="list-style-type: none"> - The population should be allowed to use the bridges and roads (EnM). - Within the framework of the SEP, the project should provide accurate information, in a transparent and clear manner, on the real benefits of the project for the population (TM). 	<p style="color: blue; font-weight: bold;">Positive</p>	-
Livelihoods and economic activities	In operational phase, the project will have three main impacts on livelihoods and economic activities: <ul style="list-style-type: none"> - Impacts on hydrology will result in a significant decrease in soil fertility in 3.04 hectares of agricultural flood areas located in the short-circuited section. 	<p style="color: red; font-weight: bold;">Important</p>	With regard to flooding, it will be necessary to define operating conditions for the power plant that will reduce the impact on the agricultural flooding areas located in the short-circuited section (RM). However, operating constraints and maintenance will not allow to obtain the	<p style="color: red; font-weight: bold;">Important</p>	To manage economic displacement, a Land Acquisition and Livelihoods Restoration Plan (LALRP) will be established (CM). This plan should include a

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	<ul style="list-style-type: none"> - The back water will flood and therefore affect 0.06 ha of land (mainly forests). - The operation of the line may require maintenance activities on the pylons. The passage of machinery and the work may cause agricultural damages. 		same flood conditions as in the baseline (that is to say prior to the project).		clear compensation procedure for damage causes to agricultural land and crops caused by the power line works.
Water resources and uses	The project will have no impacts upstream of the back water, nor downstream of the plant. The impacts, in terms of water use, will be restricted to the short-circuited section. However, apart from agricultural activities, the river is currently used very little by the population.	Low	No particular measure beyond the reserved flow.	Low	-
Employment and local entrepreneurship	<p>In the operation phase, the positive spin-offs in terms of employment and local subcontracting will be limited:</p> <ul style="list-style-type: none"> - The operation of a weir only requires a limited number of direct employees (about 10 people), with qualified profiles (engineer level) - a level of qualification that the local communities might not meet. - The monetary flows that fed the local economy during the construction phase will be reduced or even disappear with the closure of the site. This economic decline will be gradual, and its consequences may take several weeks or even months to materialise, taking the form of the closure of businesses offering goods and services to workers and migrants, the disappearance of certain markets for local agricultural production, an increase in unemployment, etc. All these elements could lead to economic slump and dissatisfaction on the part of the population. 	Significant	<p>In order for the impact to be positive, the risks of opposition should be limited by implementing the following measures:</p> <ul style="list-style-type: none"> - During the construction phase, anticipate the activities that can be sustained during the operation phase, in particular all the maintenance activities of the facilities. Then, determine which of the identified jobs can be reserved for local communities (RM). - Within the framework of the SEP, inform PAPs about the real employment opportunities during the operation phase (TM). 	Positive	-

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Community health and safety	<p>During the operation phase, the project will pose two types of risks to the health and safety of local communities:</p> <ul style="list-style-type: none"> - The impacts of a run-of-river hydropower project project on public health are generally related to waterborne diseases. In the case of the Ruvyi102 project, the creation of a small pond upstream of the weir could favour the proliferation of malaria vectors. However, this pond will be very limited in size, as the Ruvyi102 weir is not a reservoir but a run-of-river weir. - The presence of operational land-based structures poses risks to the safety of people, particularly children. The structures that represent the most important sources of danger are the water transport facilities (which presents a risk of falling and drowning) and the power line (which presents a risk of electrocution). 	Important	<p>To avoid and reduce risks to the health and safety of local residents, the following measures should be implemented:</p> <ul style="list-style-type: none"> - Set up a regular epidemiological monitoring programme (MM) with the health authorities. In the event of an increase in the prevalence of water-borne diseases, measures to destroy the breeding grounds could be implemented (RM). - Cover the inlet canal (AM). - Ensure the fencing of the land-based structures and prohibit access to these structures (RM). - Deploy adequate signage and protective equipment at land-based structures (MR). - Carry out awareness-raising actions targeting mainly the general public (in particular children) but also municipal technical services (TM). 	Low	-

IMPACT ON ECOSYSTEM SERVICES

The analysis shows that some provisioning services (priority type I or type II) are present in the study area: cropland, agroforestry and Ruvyironza water.

A set of measures already presented in the different themes (physical, biological and human environments) help to avoid, reduce and compensate for the impacts on provisioning, cultural, regulating and supporting ecosystem services. The measures planned for social aspects also respond to these challenges. No additional measures are proposed specifically on this topic.

CUMULATIVE IMPACT

According to the data at our disposal, there are no known planned in-stream projects in the watershed affected by the Ruvyi102 project. However, an electrification project for 36 localities not yet electrified throughout the country is planned by the *Régie de production et de distribution d'eau et d'électricité* "REGIDESO". It aims in particular to electrify two localities close to the study area: Ryansoro and Buraza.

This project aims at improving the living conditions of the populations in the study area by giving them access to modern and clean energy services. The investment program includes the extension of the MV and LV network: extension of lines and creation of connection stations.

The main cumulative impacts will then concern several aspects:

- The two projects studied will require land rights, leading to the loss of arable land, trees, plantations and even buildings for the people affected, in a context where land pressure is high;
- The planning for the electrification of the 36 localities is not known. However, if the two projects have simultaneous construction periods, they could have a cumulative effect on the influx of workers in the two communes concerned as well as on all the effects induced by these influxes such as the increased risk of spreading diseases;
- Both projects are expected to create temporary to permanent local jobs between the construction and operation phases, although these opportunities are expected to remain relatively limited;
- Both projects will actively participate in the development of the country through the production and distribution of electricity in the country. These projects will increase the rate of access to electricity and thus greatly improve the living conditions of the beneficiary populations and promote local development;
- No cumulative hydrological nor environmental impact have been identified from the mini-hydro projects on Ruvyironza River planned by the Ministry of Energy.

It should be noted that the negative cumulative impacts are still manageable through the measures proposed in the Environmental and Social Management Plans of the two projects and do not require additional measures.

PUBLIC CONSULTATIONS

Consultations during the ESIA preparation phase took place from November 2020 to April 2021, as part of field activities. Their main objective was to inform stakeholders and to gather expectations, concerns and recommendations to improve project design.

Consultation forms were adapted to the local context, and to the different stakeholders met by the survey team. Four methods of consultation were used, according to the targeted audience:

- **Meeting with local authorities and communal technical services;**

Commune	Represented authorities	Date	Length	Attendees
Ryansoro	Communal authorities	November 16, 2020	3h14	Total: 17 (No women)
Rutovu	Communal authorities	November 25, 2020	1h50	Total: 14 (including 1 woman, or 7%)
Buraza	Communal authorities	March 25, 2021	1h15	Total: 10 (No women)

Low attendance of women is explained by the fact that few of them hold these positions.

- **Public information meetings** with the communities from the different collines, open to all and taken as a whole;

Commune	Colline	Target audience	Date	Length	Attendees
Ryansoro	Nyamugari	Local communities	November 17, 2020	0h59	Total: 59 (Women: 19, or 32%)
Rutovu	Nyabucokwe	Local communities	November 26, 2020	1h42	Total: 42 (Women: 16, or 38%)
Buraza	Maza	Local Communities	March 26, 2021	2h30	Total: 32 (Women: 6, or 18%)
Buraza	Mahonda	Local Communiites	March 25, 2021	1h15	Total: 19 (Women: 6, or 31%)

Low attendance of women is explained by their place in the local hierarchie and their responsibilities in household's chores: women's voices are usually heard within the household but they do not participate to community's decisions.

- **Focus group discussions** (FGD) with selected groups from the different collines, for example **young people, farmers, and women** and **Key informant interviews** (KII), with resource persons such as medical staff in health centers;

Commune	KII local authorities	KII Commune technical services (agriculture & land)	KII Health centre	FGD Women	FGD Youth	FGD farmer
Ryansoro	X	X	X	X	X	X
Rutovu	X	X	X	X	X	
Buraza	X					

- Consultations as part of **household surveys**.

Commune	Colline	Number of HH surveys ²	
		Male	Female
Ryansoro	Nyamugari	15	13
Rutovu	Nyabucokwe	2	7
Buraza	Maza	27	10
	Mahonda	3	1
Total	78	47	31

² Gender of the respondent, not the head of the household

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The objective of the ESIA is to identify potential impacts that can result from the project activities and to develop mitigation measures that are technically appropriate, financially acceptable and readily applicable in the context of the project.

The recommended measures are discussed during the consultation sessions and selected in a consensual framework. The proposed mitigation measures include preventive measures to avoid the creation of an impact, corrective measures to eliminate or reduce an impact, and compensatory measures for unavoidable impacts.

The ESIA (and its attendant complementary studies) is a planning document that provides decision-makers with the elements necessary to make a decision to commit or abandon the project. The initial state of the physical, biological and social environment is described in details, potential impacts are technically assessed and proposed mitigation measures are clearly justified.

The ESMP has a very different role. It is an operational document, which aimed to complete the analysis defining the operational context in which measures are implemented. Since the beginning of the project, the ESMP becomes the reference document for all the stakeholders, both for monitoring action programs and for conflict resolution. The ESMP is a complementary document of the ESIA, aiming to facilitate the implementation and the monitoring of the various recommended measures by the ESIA.

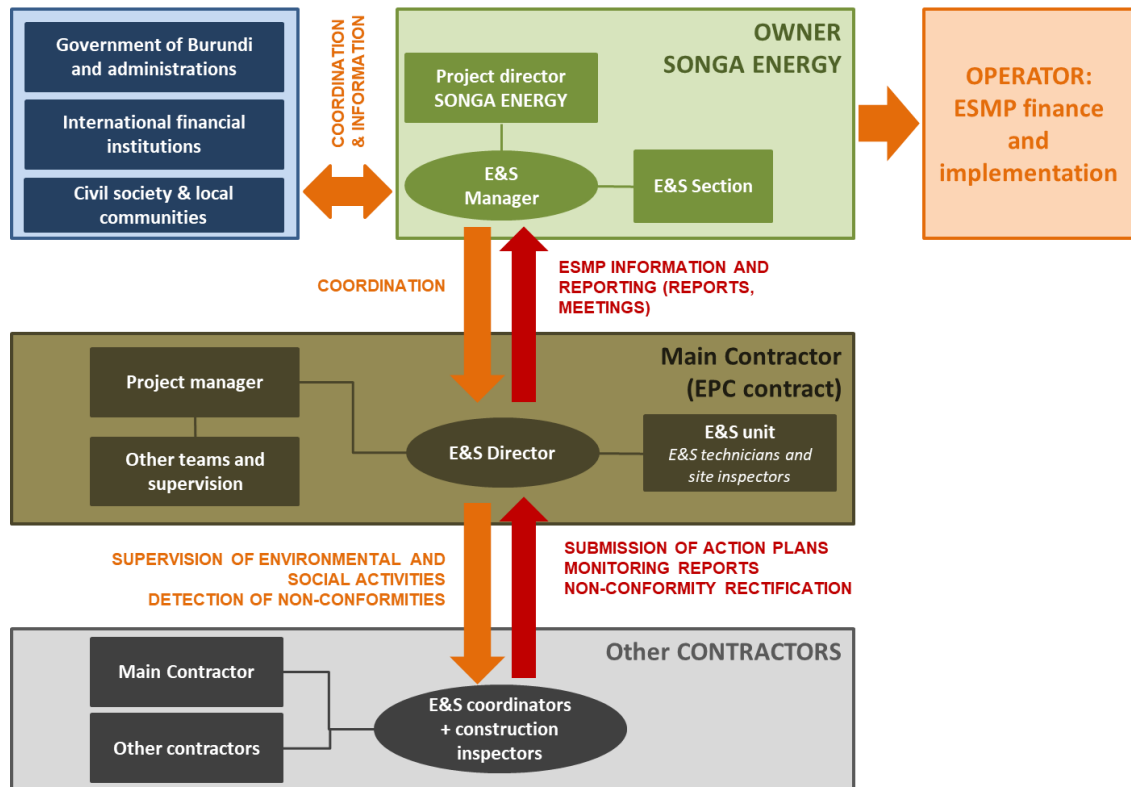
The ESMP organization is part of the overall organization that will be given to the project both during construction and operation phases. Each entity with a direct responsibility for the implementation of the project must have a responsibility for environmental and social management. At this stage, the identified entities are:

- The project owner (PO);
- The Main Contractor (MC);
- National and local authorities.

The project owner (PO), Songa Energy, will establish a call for tenders to select a Main Contractor (MC) capable of delivering the equipment in a “turnkey” manner. In other words, the PO will establish an EPC (Engineering, Procurement, and Construction) type contract. The selected Main Contractor will be responsible for the design and construction of the project and will therefore act as both Main Contractor and construction contractor. It is the MC that will involve other companies on its activities, through subcontracting, for the realization of dedicated services.

The diagram below presents, on the basis of the information available, the organization planned for the implementation of the ESMP.

Organization chart for the ESMP implementation



Through specific plans and procedures, the ESMP implements all the measures identified in the ESIA and which aim to preserve the integrity of the physical, biological and human environment in the Study area of influence.

For the Ruvyi102 Project the different plans and procedures are proposed:

Main environmental and social management procedures:

- Control procedures;
- Communication and stakeholder engagement;
- Human resources management;
- Chance find procedure;
- Land acquisition and livelihood restoration plan (LALRP);
- Indigenous people plan (IPP);
- Environmental Monitoring Plan;
- Biodiversity Action and Monitoring plan (BAMP);
- Incident Management Procedure.

Main environmental and social management plans for construction phase:

- Access management plan;
- Traffic management plan;
- Influx management plan;
- Occupational health and safety plan;
- Community health and safety plan;
- Culturage heritage management plan;
- Support plan for local economic activities;
- Air pollution and noise management plan ;
- Waste management plan;
- Earthwork and erosion management plan;
- Hazardous products and pollutants management plan;
- Discharge and water management plan.

Main environmental and social management plans for operation phase

- Community health and safety plan;
- Support plan for local infrastructures;
- Waste management plan;
- Hazardous products and explosives management plan.