

ルワンダ共和国
農業動物資源省

ルワンダ共和国

ルワマガナ郡灌漑施設改修計画
準備調査

準備調査報告書
(ANNEX)

平成29年2月
(2017年)

独立行政法人
国際協力機構 (JICA)

NTCインターナショナル株式会社

農村
JR(先)
17-005

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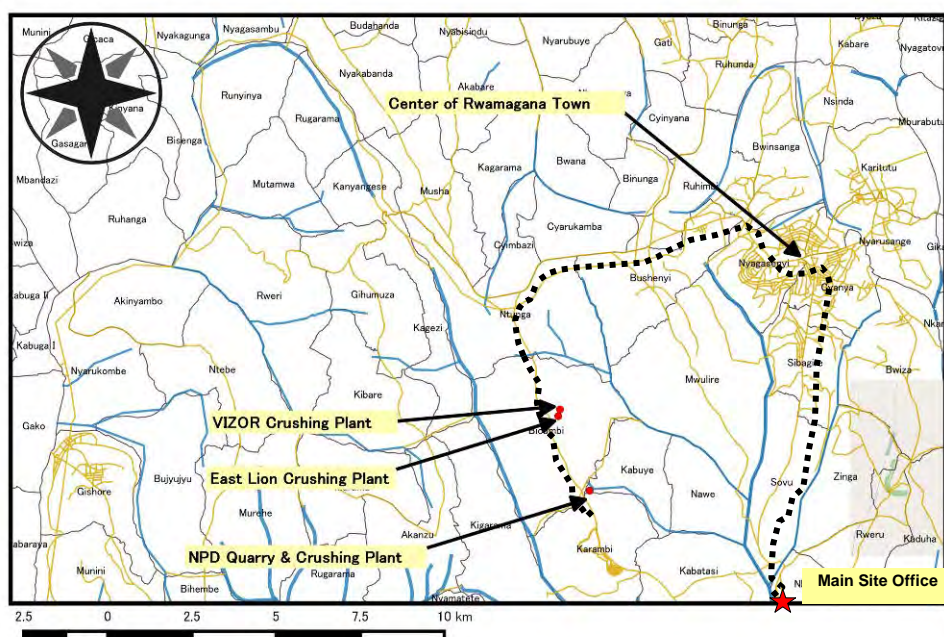
ANNEX 1 総合現場事務所及び採石場の検討結果

ANNEX 1 Selection Criteria and Comparison Results for Other Sites to be used by Project

Table 1 Comparison of Candidate Quarry Sites and Crushing Plant

Site Name	East Lion Crushing plant	VIZOR Crushing plant	NPD Quarry Site & Crushing Plant
Item	Aggregate / Crushed stone	Aggregate / Crushed stone	Aggregate / Crushed stone
Administrative Location	Bichumbi, Rwamagana District	Bichumbi, Rwamagana District	Kabuye, Rwamagana District (Close to border between Karambi, and Bichumbi)
Distance from center of Rwamagana (km)	13.5km	13.5km	16.8km
Coordinate	1° 59' 35.00" S 30° 22' 06.40" E	1° 59' 28.60" S 30° 22' 08.10" E	2° 00' 46.20" S 30° 22' 36.60" E
Usage	Construction material for road, building etc.	Concrete material for hydropower plant	Concrete material for infrastructure development
Customer	HORIZON, NPD, MINADER, etc.	Cristal company only (Indian company)	NPD only
Owner	East Lion (Chinese Company)	VIZOR (Indian Company)	NPD (Domestic Company)
Environmental and Social Considerations	Environmental impact will be insignificant because no residences are surrounding. However, adverse impact on occupational health and safety (e.g. disease of respiratory system) is concerned.		In addition to the impact mentioned in other two similar sites, adverse impact due to blasting is concerned.
Environmental License	Not confirmed	Licensed	Licensed
Production capacity	200 m ³ /day	N/A	N/A
Remarks	Have been operated since 15 to 16 years ago.	Started its operation from last year.	NPD is using this quarry plant for JICA/MINAGRI Ngoma22 irrigation project.
Evaluation	Not Recommended	Recommended	Not Recommended

Source: JST



Source: JST

Figure 1 Location Map of Candidate Quarry Site and Crushing Plants

Table 2 Comparison of Candidate Site Office

Site Name	Sovu Cell Office	Next to CoRiCya Warehouse	Rice Dry Area and/or office of CoRiCya
Distance from CoRiCya office	4.3km	0km	0km
Location Name	Sovu, Rwamagana District	Sovu, Rwamagana District	Sovu, Rwamagana District
Coordinate	1°59'56.20"S 30°25'53.30"E	2° 1'57.40"S 30°25'31.70"E	2° 1'59.80"S 30°25'29.87"E
Area Available (m ²)	Office: 100m ² Whole Compound: 1,100m ²	Vacant land: 1,300m ²	Dry area: 3,800 m ² Warehouse & backyard: 700 m ²
Owner	Land	Sovu Cell office (Govt.)	Rwamagana District (Govt.)
	Facility	Govt.	Nil.
Current Use Condition	Under use by Sovu cell office	Vacant	Under use by Cyaruhogo Rice Cooperative.
Environmental and Social Considerations	As a common impact during construction and operation of site office, some noise and dust to the surrounding environment is concerned though residential buildings are not located nearby.		
	In addition, sharing room space like Ngoma22 is to be considered.	In addition, this option needs land leveling and cleaning, though none of plants are subject to compensation.	In addition, it is necessary to find alternative area for drying rice.
Cost for usage	Negotiable	Free of charge	Negotiable
Remarks		Orally approved by Cell ES, and Chief of Zone.	
Evaluation	Not Recommended	Recommended	Not Recommended

Source: JST



Source: JST

Figure 2 Location Map of Candidate Main Site Office

ANNEX 2 環境影響評估調查TOR 承認書

The Director General
Rwanda Agriculture Board
P.O. Box 5016
KIGALI

Dear Madam

RE: Approval of Terms of Reference for Environment Impact Assessment study for Rehabilitation of irrigation facilities in Rwamagana District

Reference is made to the letter reference N^o **01.11/1232/016/DG/HQ** of 1st August 2016 submitting the Project Brief and Terms of Reference that are intended to guide the Environmental Impact Assessment study for the rehabilitation of irrigation facilities in Gashara, Bigugu, Cyimpima and Cyaruhogo Marshlands in Rwamagana District, Eastern Province..

After the review of the project document, the site visit and consideration of the provisions of laws governing EIA in Rwanda, we would like to inform you that your project falls in the category of works, activities and projects that have to undertake Environmental Impact Assessment prior to their implementation;

In this regard, the Terms of Reference that were presented have been examined and were found relevant. They were therefore approved to guide the conduct of the EIA study for your project.

However In addition to the ToR approved, the report must carefully include the information related to actual location of the irrigation facilities. The information provided in the EIA proposal during online application misses full details of project location (Cells, Sectors and wetland names). The information is important as it is the same information that is used by our EIA e-portal system in generating the certificate of approval after review and approval of the EIA study report.

The Certificate of approval will be issued after review and approval of the EIA study report.

Sincerely,

for  

Francis GATARE
Chief Executive Officer/RDB

Cc:

- Minister of Agriculture and Animal Resources
- Minister of Natural Resources
- Director General of REMA
- Mayor of Rwamagana District

ANNEX 3 環境チェックリスト

Annex 3 Environmental Checklist : 16 Agriculture, Irrigation, and Livestock

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) N (d) N	(a) EIA Report has been prepared and submitted to RDB which is the authoritative agency of environmental approval of Rwanda. (b) EIA Report will be reviewed by REMA and expected to be approved after reviewing. (c) Condition will be informed by RDB after review. (d) No particular other environmental permits are required.
	(2)Explanation to local stakeholders	(a) (a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) Project information disclosure and consensus building were done through multiple public consultation meeting, stakeholder meeting, and one to one meeting, etc with local and central stakeholders. Understanding from the local stakeholders has been obtained. (b) The comment from the local residents obtained during above meetings has been reflected to the project design.
	(3)Examination of alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Plural alternative plans (including the zero option) such as different location of dam axis, different type of enhancement of water storage capacity is examined comprehensibly with social and environmental

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				considerations.
2 Pollution Control	(1) Water Quality	<p>(a) Are considerations given to water pollution of the surrounding water bodies, such as rivers and groundwater by effluents or leachates from agricultural lands? Are adequate use/disposal standards for fertilizers, agrochemicals, and livestock wastes established? Is a framework established to increase awareness of the standards among farmers?</p> <p>(b) Is a monitoring framework established for water pollution of rivers and groundwater?</p>	<p>(a) Y (b) Y</p>	<p>(a) Existing water quality of the river and the groundwater is analyzed base on the baseline survey, and prevent measures towards the water pollution was established in the mitigation measures and the monitoring plan.</p> <p>(b) Monitoring items, frequency, implementation entity, and responsible organization are indicated in the monitoring plan.</p>
	(2) Wastes	<p>(a) Are wastes properly treated and disposed of in accordance with the country's regulations?</p>	<p>(a) Y</p>	<p>(a) First of all, project will reuse excavated soil as counterweight of dam as much as possible. Assumed wastes (other excavated soil, felled trees, and garbage from camping site) will be processed according to the regulation of Rwanda and the related local government.</p>
	(3) Soil Contamination	<p>(a) Is there a possibility that impacts in irrigated lands, such as salinization of soils will result?</p> <p>(b) Are adequate measures taken to prevent soil contamination of irrigated lands by agrochemicals, heavy metals, and other hazardous substances?</p> <p>(c) Are any agrochemicals management plans prepared? Are any usages or any implementation structures organized for proper</p>	<p>(a) N (b) Y (c) Y</p>	<p>(a) The source of salinization of soils has not been confirmed and it is not expected by the project implementation.</p> <p>(b) Soil contamination by the hazardous waste and heavy metals are not expected because the project doesn't have a plan to use them. Moreover, the ratio of heavy metals in the soil in project area within the limits.</p> <p>(c) Soil contamination by the spilt oil from construction machines and vehicles during construction period is</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		use of the plans?		anticipated, but to be prevented by mitigation measures and monitoring.
	(4) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) Subsidence is not expected because extraction of a large volume of ground water will not be done during the construction and operation period by the project.
	(5) Odor	(a) Are there any odor sources? Is there a possibility that odor problems will occur to the inhabitants?	(a) N	(a) Although exhaust gas from construction machines can be an odor source, critical impacts are not expected because of little or no working of heavy machinery in a small area.
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) There is no protected area in the project area. Protected area in the country are well isolated, hence such impacts are not anticipated.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that the project will result in the loss of breeding and feeding grounds for	(a) N (b) Y (c) N (d) N (e) Y	(a) The project area includes flood plain and marshlands whose most of the parts are already have been cultivated. However, ecologically valuable habitat in the project area is not reported or confirmed. (b) According to the EIA survey, three bird species listed in the country's protected list are confirmed. However, two of three are migrant birds and all of them are LC or NE according to the IUCN because population is big and getting increase or moderate. (c) There are alternative lands in the vicinity of the project area, so it is assumed that feeding and

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		<p>valuable wildlife? If they are lost, are there substitutes for the grounds near the original locations?</p> <p>(d) Is there a possibility that overgrazing will cause ecological degradation, such as impacts on wildlife habitats and desertification?</p> <p>(e) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?</p>		<p>breeding grounds will not be lost.</p> <p>(d) There are cattle grazing, but mostly are domestic activities and not a large scale. Therefore the impact on ecosystem and desertification of the project area is not expected.</p> <p>(e) Since the project mainly work for rehabilitation of existing facilities, such overgrazing or significant impact is not expected. Moreover, the project will introduce environmental buffer zone along the water reservoirs which will have a positive impact on the ecosystem.</p>
4 SocialEnvironment	(1) Resettlement	<p>(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?</p> <p>(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?</p> <p>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>(d) Is the compensation going to be paid prior to the resettlement?</p> <p>(e) Is the compensation policies prepared in</p>	<p>(a) N (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y</p>	<p>(a) No resettlement is expected, but loss of lands, impact on a means of livelihood is expected.</p> <p>(b) Community consultation meetings and workshops will be held to explain about compensation and measures of livelihood restoration and to get agreement from the community people before project.</p> <p>(c) RAP was developed based on socio-economic studies as well as a number of meetings with various stakeholders.</p> <p>(d) Compensation will be paid prior to the resettlement according to the both Rwandan laws and JICA guidelines.</p> <p>(e) Entitlement Matrix is included in the RAP report.</p> <p>(f) Vulnerable persons and/or his/her family will be assisted during the compensation process, and be</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		<p>document?</p> <p>(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>(g) Are agreements with the affected people obtained prior to resettlement?</p> <p>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>(i) Are any plans developed to monitor the impacts of resettlement?</p> <p>(j) Is the grievance redress mechanism established?</p>		<p>given priority of job opportunity during the construction period.</p> <p>(g) Agreements with the affected people will be obtained and compensation will be paid prior to resettlement.</p> <p>(h) There is no framework for the resettlement specifically in Rwanda; however, the RAP organization framework was suggested according to related Rwandan laws and JICA guidelines /WB OP 4.12 in the RAP. And also budget for preparation, implementation, and monitoring of RAP is estimated and the schedule of compensation and resettlement was discussed and presented in the report.</p> <p>(i) According to the Rwandan law, the grievance redress mechanism is proposed and will be established. Necessary cost for grievance redress mechanism is also calculated and presented in the RAP.</p>
	(2) Living and Livelihood	<p>(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(b) Is proper allotment made for rights to agricultural land use? Is there a possibility that the allotment will result in inequitable distribution or usurpation of land and available resources?</p> <p>(c) Are proper allotments, such as water rights</p>	<p>(a) N</p> <p>(b) Y</p> <p>(c) Y</p> <p>(d) N</p> <p>(e) N</p>	<p>(a) The project will improve irrigation efficiency and agricultural production. Some adverse impacts anticipated will be mitigated with compensation and livelihood restoration measures.</p> <p>(b) RAB will consider proper allotment of the land by getting improved irrigation facilities as well as command area. In addition, it is not assumed that convenience will be maldistributed to specific area or person.</p> <p>(c) The water rights registration application of the project</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		<p>allotment in the project are made? Is there a possibility that the allotments will result in inequitable distribution or usurpation of water rights and available resources?</p> <p>(d) Is there a possibility that the amount of water used (surface water, groundwater) by the project will adversely affect the downstream fisheries and water uses?</p> <p>(e) Is there a possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, filariasis) will be introduced? Is adequate consideration given to public health education, if necessary?</p>		<p>area will be done by RAB. However, it is emphasized that the unreasonable water fee will not be paid by community unless the regulations are corrected.</p> <p>(d) Impact on current spring water facilities used by community will be mitigated by construction of alternative facilities at each site. Hence, the community will be able to use the water constantly.</p> <p>(e) Though significant is not anticipated, RAB will work together with other agencies like Ministry of Health to sensitize community and provide necessary services like mosquito net etc as necessary.</p>
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) No such facilities are identified in the project area.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) Impact on landscape is not anticipated; rather it will be improved through the rehabilitation of old 60s-70s facilities.
	(5) Ethnic Minorities and Indigenous Peoples	<p>(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?</p> <p>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and</p>	<p>(a) N</p> <p>(b) N</p>	<p>(a) Not confirmed in the Project area.</p> <p>(b) Same as above.</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		resources respected?		
	(6) Working Conditions	<p>(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?</p> <p>(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?</p> <p>(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?</p> <p>(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?</p>	<p>(a) Y (b) Y (c) Y (d) Y</p>	<p>(a) Securing of working condition is implemented according to the related Rwandan laws and international rules such as OHSAS.</p> <p>(b) Measures to prevent industrial accidents are secured by mitigation measures such as obligation of wearing safety boots and a helmet during the construction work and the monitoring, which includes countermeasures for the accidents.</p> <p>(c) Safety education through measures such as a morning gathering, a toolbox meeting, a motto, or signboard will be given to construction workers. Construction contractor will prepare a safety and sanitation plan.</p> <p>(d) Setting of the reputation to promote an invasion prevention fence and danger around the construction area is set up. Construction plan and schedule will be informed to the community through signboard or direct announcement in advance. It is assumed that a guard worker for the purpose of prevention of ensuring safety and theft is to be placed.</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	<p>(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?</p> <p>(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?</p>	<p>(a) Y</p> <p>(b) Y</p> <p>(c) Y</p>	<p>(a) Noise, dust, water pollution are assumed. Mitigation measures and monitoring plan are established through EIA Study.</p> <p>(b) Though nests of the listed birds are not found during the field survey in F/S stage, move to the safer place if it's found during the construction.</p> <p>(c) Land acquisition, resettlement, temporarily halt of cultivation are assumed. Mitigation measures and monitoring plan are established through EIA Study and preparation of RAP.</p>
	(2) Monitoring	<p>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>(b) What are the items, methods, and frequencies of the monitoring program?</p> <p>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</p>	<p>(a) Y</p> <p>(b) -</p> <p>(c) Y</p> <p>(d) Y</p>	<p>(a) Monitoring plan has been made in the EIA process.</p> <p>(b) The monitoring items were decided considering the present condition survey results and impact evaluation. Monitoring methods were decided considering implementation practicability of Rwanda government and securing accuracy. Frequency was decided considering types of work, local situation, and health damage.</p> <p>(c) Monitoring framework has been suggested in the monitoring plan of both EIA and RAP. This framework has to be adapted reflecting the present condition of Rwanda as possible. RAB will designate one staff as Social Safeguard Officer of this project who will specifically work for the liaison with other organizations and a core actor of supervising the monitoring.</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				(d) Monitoring report on RAP progress shall be submitted by RAB in pre/post construction stage while Environmental Monitoring Report shall be prepared by Contractor and RAB during the construction period.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry checklist should also be checked. (b) For the projects including construction of large-scale weirs, reservoirs, and dams, where necessary, pertinent items described in the Hydropower, Dams, and Reservoirs checklist should also be checked.	(a) N (b) N	(a) Forest is out of the project object. (b) Small scale dam will be rehabilitated and constructed in the project.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) Y	(a) It is anticipated that the rehabilitation of irrigation facilities especially dam, spillway, and water intake valve house etc. will enhance the resilience against flood and heavy rain to be happened due to climate change in future.

ANNEX 4 環境モニタリングフォーム (案)

Annex 4 Environmental Monitoring Form

Monthly Environmental Monitoring Form Reported to JICA

Site Environmental Compliance Inspection and Monitoring Form

Form-1 for Pre-Construction Phase

Provided below is a sample form which may be utilized and adapted as needed to record the results of a compliance inspection or ambient monitoring at a project site.

Project Name : Project for Rehabilitation of Irrigation Facilities in Rwamagana **Implementing Agency** : Rwanda Agriculture Board (RAB)

Location : Rwamagana **Monitoring Agency** : XXXX Inc. If any

Date Reported : DD/MM/YYYY **Enforcement Agency** : RAB

Reporting Period : XX Quarter of YYYY

(Monthly)

1. Project Proponent

RAB's Environmental Awareness	Yes/No	Actions Required	Contractor Response / Comment
RAB aware of mitigation requirements?			
RAB has a copy of EMMP?			

2. Land Acquisition and Compensation

Resettlement Activities	Planned Total	Unit	Progress in Quantity		Progress in %		Expected date of completion	Responsible organization
			Till the last month	Up to the this month	Till the last month	Up to the this month		
1.Set up of RAP Implementation Structure								
1-1.Employment of Individual Valuer		Time						RAB
1-2 Designation of Social Safeguard Staff in RAB		M/M						RAB
1-3 Establish SRCC and DRCC		Committee						RAB
1-4 Training of officers involved for 1-3		Times						RAB
2.Update PAPs list and Final Asset Valuation								
2-1 Identification of final PAHs		PAHs						RAB
2-2 Announcement to Affected people		times						RAB
2-3 Cost estimation for expropriation		-						RAB
2-4 Consultation meeting		times						RAB
2-5 Revise RAP and signing based on the feed back at the consultation meeting		-						RAB
3.Progress of compensation in cash								
3-1. Cyaruhogo		PAHs						RAB
3-2. Gashara		PAHs						RAB
3-3. Bugugu		PAHs						RAB
3-4 Cyimpima		PAHs						RAB
3-5 Others		PAHs						RAB
4.Progress of compensation by land								
4-1. Cyaruhogo		PAHs						RAB
4-2. Gashara		PAHs						RAB
4-3. Bugugu		PAHs						RAB
4-4 Cyimpima		PAHs						RAB
4-5 Others		PAHs						RAB
5.Progress of land acquisition								
5-1 Cyaruhogo		Ha						RAB
5-2 Gashara		Ha						RAB
5-3 Bugugu		Ha						RAB
5-4 Cyimpima		Ha						RAB
5-5 Others		Ha						RAB
6. Construction of alternative water supply facilities								
6-1 Cyaruhogo		Pcs						Contractor
6-2 Gashara		Pcs						Contractor
6-3 Bugugu		Pcs						Contractor
7.Progress of any social supports such as job training, logistic assistance etc for vulnerables		HHs						RAB
8.Complain and Grievance Redress	N/A	Cases						

8-1 Nos.of solved cases by SRCC / DRCC	N/A	Cases							RAB
8-2 Nos .of unsolved cases by SRCC / DRCC	N/A	Cases							RAB

3. Record of Complain and Grievance Management

No	Date	Complain and Grievance from PAPs	Solution / Result / Any actions to be taken
1			
2			
3			
4			

4. Consultation Meetings with the Affected People

No	Date	Site	Nos of Participants	Key agenda and result of discussion
1				
2				

3				
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5. Notes;

Inspection Completed by: _____

Date: _____

Monthly Environmental Monitoring Form Reported to JICA

Site Environmental Compliance Inspection and Monitoring Form

Form-2 for Construction Phase

Provided below is a sample form which may be utilized and adapted as needed to record the results of a compliance inspection or ambient monitoring at a project site.

Project Name	: Project for Rehabilitation of Irrigation Facilities in Rwamagana	Implementing Agency	: Rwanda Agriculture Board (RAB)
Location	: Rwamagana	Monitoring Agency	: XXXX Inc.
Date Reported	: DD/MM/YYYY	Enforcement Agency	: Contractor(s)
Reporting Period	: XX Quarter of YYYY	Contractor(s)	: XXXX Co., Ltd.

(Monthly)

1. Contractor(s)

Contractor(s) Environmental Awareness	Yes/No	Actions Required	Contractor Response / Comment
Contractor(s) aware of mitigation requirements?			
Contractor(s) have a copy of EMMP?			

2. Mitigation Compliance Inspection

Impact / Mitigation Measures (From EMMP)	Mitigations Implemented? (Yes/No)	Mitigation Effective? (Yes/No)	Impact Observed/ Location	Action Required? (Yes/No) Describe if Yes:	Contractor Response / Comment
- Community is aware of construction schedule					
- Community is aware of contact address of complain and grievance redress mechanism					
- Equipment and vehicles are maintained and in good condition					
- Water is sprinkled on the dirt / unpaved road					
- Covering of all trucks against dust spread					
- Dust control equipment is installed at crushing plant					
- Drip trays are used when refuelling or maintenance					
- Reuse excavated material as much as possible					
- Solid waste are disposed at designated dumping site					
- Construction workers are provided education on site cleaning against litter					
- Safety Assemblage was held for workers					
- Safety tools (helmet, goggle, glove, etc) are provided to workers					

- Workers younger than 16 years old are not employed					
- First-aid kits (FAK) are available at all construction sites and yard					
- An accident and emergency response manual is available					

3. Water Quality at Outlet of Discharge from Sedimentation Pond and Concrete Waste Water

Item	Unit	Baseline Data			Monitoring Result			Model of Equipment used	Standards max. Limits ^{*1}	Action Required (Yes/No) Describe if Yes:	Contractor Response / Comment
		Date	Location	Amount measured	Date	Location	Amount measured				
pH	-							<9.0			
TSS or	mg/L							<50 ^{*2}			
Turbidity								^{*3}			

*1: RS110/2009 Water quality – Tolerance limits of discharged domestic wastewater
 *2 In case if TSS of baseline data was already exceed the set standards by RS110/2009, the figure measured by baseline data shall be used as maximum tolerance limit.
 *3: In case Contractor(s) prefer Turbidity to TSS, the Contractor measure TSS and Turbidity in the Baseline survey and identify the turbidity level at pre-construction stage which shall be used as maximum tolerance limit.

4. Water Quality in Alternative Water Supply Facilities (After drilling)

Item	Unit	Baseline Data Date: / /	Monitoring Result		Model of Equipment used	Standards max. Limits ^{*1}	Action Required (Yes/No) Describe if Yes:	Contractor Response / Comment
			Date:	Amount measured				
pH	-					6.5-8.4		
EC	dS/cm					0-3		
Nitrates	mg/L					150		
TDS	mg/L					0-2000		
Total Hardness	mg/L					500		

F-	mg/L					0.6-1.2		
SO ₄ ²⁻	mg/L					150		
Total Coli.	CfuX/ml					100		
Chloride	Mg/L					500		
Fe	mg/L					1-3		
Mn	mg/L					0.1-0.5		
*1: WHO Water quality guidelines, use range in domestic potable water								

5. Natural Environment

Item	Monitoring Result			Action Required (Yes/No) Describe if Yes:	Contractor Response / Comment
	Date	Nest of protected bird nests found on the trees to be affected? Yes/No	If yes, Number and location found		
Relocation of Bird nests					

6. Notes;

Inspection Completed by: _____

Date: _____

Biannual Environmental Monitoring Form Reported to JICA

Site Environmental Compliance Inspection and Monitoring Form

Form-3 for Operation Phase

Provided below is a sample form which may be utilized and adapted as needed to record the results of a compliance inspection or ambient monitoring at a project site.

Project Name	: Project for Rehabilitation of Irrigation Facilities in Rwamagana	Implementing Agency	: Rwanda Agriculture Board (RAB)
Location	: Rwamagana	Monitoring Agency	: XXXX Inc. If any
Date Reported	: DD/MM/YYYY	Enforcement Agency	: RAB
Reporting Period	: XX Quarter of YYYY	Contractor(s)	: XXXX Co., Ltd.

(Biannual)

1. Project Proponent (RAB)

RAB's Environmental Awareness	Yes/No	Actions Required	Contractor Response / Comment
RAB aware of mitigation requirements?			
RAB has a copy of EMMP?			

2. Mitigation Compliance Inspection

Impact / Mitigation Measures (From EMMP)	Mitigations Implemented? (Yes/No)	Mitigation Effective? (Yes/No)	Impact Observed/ Location	Action Required? (Yes/No) Describe if Yes:	Any Comment
-Irrigation facilities are operated according to bylaw.					
-Irrigation facilities are maintained according to bylaw.					
-Sensitization workshop for provision of knowledge about waterborne disease was held.					
-Preventive measure like mosquito net was provided.					
-Protection fence at dam body is in good condition.					
-Accident cases are recorded and countermeasures are addressed					

3. Natural Environment

Item	Unit	Monitoring Result	Action Required	Any Comment	Date & Locations
Fund from FONERA					
Afforestation in buffer zone					
Extant of protected bird species					
- Black-Headed Heron					
- Cattle Egret					
- Hamerkop					

4. Notes;

Inspection Completed by: _____

Date: _____

ANNEX 5 環境影響評估報告書



**Republic of Rwanda
Ministry of Agriculture and Animal
Resources(MINAGRI)
Rwanda Agriculture Board (RAB)**



Japan International Cooperation Agency

FINAL REPORT

**ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED PROJECT OF
REHABILITATION OF IRRIGATION FACILITIES IN RWAMAGANA DISTRICT,
REPUBLIC OF RWANDA**



**Prepared by:
BUREAU FOR ENVIRONMENTAL AND SOCIAL STUDIES/ BESST Ltd**

January, 2017

DISCLOSURE OF CONSULTANT

Name of the Project: REHABILITATION OF IRRIGATION FACILITIES IN RWAMAGANA DISTRICT, REPUBLIC OF RWANDA	
Nature of assignment	Preparation Environmental Impact Assessment(EIA) Report including baseline study
Name of approved EIA expert	Bureau for Environmental and Social Studies/BESST Ltd

I hereby undertake that all requirements included in terms of reference provided by the client and approved by Rwanda Development Board (RDB) are complied with. I also undertake that the facts given in this EIA report are factually correct to the best of our knowledge.

Managing Director
Bureau for Environmental and Social Studies
BESST Ltd

EXECUTIVE SUMMARY

Project background

The Government of Rwanda (GoR) is pursuing a comprehensive poverty reduction program which includes implementation of various sustainable agriculture projects. Agriculture sector in Rwanda counts for about 34% of the country's Gross Domestic Product, GDP (World Bank: 2013) and about 80% of the national population engages in the sector. However, the small-scale farming is majority and most of them are under rain-fed which production is very much affected by weather. Therefore, irrigation development which is less susceptible to the climate condition is desired for improvement of farmers' stable income.

To boost the agriculture sector, the Government of Rwanda (GoR) has set a goal in the third Strategic Plan for Agriculture Transformation (SPAT3) of increasing of irrigation area to 100 thousand ha by 2018. To contribute this strategy, projects such as Rural Sector Support Project (RSSP) involved in marshlands rehabilitation and irrigation facilities and Land Husbandry, Water Harvesting and Hillside Irrigation Project (LWH) have been implemented with support of the World Bank (WB) and other donors. With the support of its development partners, the government wants also to rehabilitate existing irrigation facilities developed from 1970s to 80s so as to increase water storage capacity and minimize wastage of water resources.

On the basis of above background, the GoR requested support from the Government of Japan (GoJ) for the rehabilitation of irrigation facilities in marshlands located in Rwamagana district including Cyaruhogo, Cyimpima, Bugugu and Gashara marshlands (Hereafter referred as Project). Preliminary surveys and design studies has started and the proposed project will invest in expanding the irrigation area through upgrading existing dams, construction of new dam at Cyaruhogo marshland and rehabilitation of existing irrigation main canal.

Although most project impacts are expected to be positive, some of the proposed civil works will have negative environmental and social impacts. In compliance with national environmental regulations, Japan International Cooperation Agency (JICA) guidelines for environment and social considerations, international safeguards policies like WB safeguards policies, NTC INTERNATIONAL Co., Ltd was entrusted by JICA as JICA Study Team (JST) to conduct preliminary studies including Environmental Impact Assessment (EIA) and to prepare Resettlement Action Plan (RAP). The JST has then sub-contracted Bureau for Environmental and Social Studies/BESST Ltd, a national approved EIA firm, to prepare EIA and RAP reports including baseline studies for the proposed project.

Objectives of the study

The objective of this study is to assist Rwanda Agriculture Board (RAB) who will implement the project to develop an EIA including an Environmental Management Plan (EMP) to ensure that the Project is implemented in an environmentally and socially sustainable manner and in full

compliance with Rwanda's and JICA guidelines as well as other international policies and regulations.

Approach and methodology of the study

To achieve the study objectives, the consultant followed procedures stipulated in national general guidelines and procedures for EIA, JICA guidelines as well as WB safeguards Policies. The study adopted the following approach: (i) preliminary assessment and review of preliminary design of the projects, design studies and EIA reports of similar project, (ii) review of secondary data on baseline information (iii) review of policies and regulations, (iv) review of previous meetings and consultations with stakeholders, (v) interviews with key stakeholders, and (vi) field surveys at the project sites including socio-economic baseline data, flora and fauna data, (vi) laboratory test for water and soil quality. Spatial data ,site locations, land cover, proposed infrastructure were described fully with clear maps using Global Position System (GPS) and Geographic Information System (GIS) tools for a comprehensive understanding of the area and project activities and to make the task of planning and monitoring easier during the implementation of the mitigation measures for the identified impacts.

Project location and description

The proposed project will consist at rehabilitation of irrigation facilities in four marshlands namely Cyimpima, Gashara, Cyaruhogo and Bugugu all located in Rwamagana district. The four marshlands are interlinked and are located between four sectors of Rwamagana district, Kigabiro, Mwurire, Munyaga and Rubona. Planned works will include the construction of new dam and new irrigation canals and related irrigation facilities at Cyaruhogo marshlands, rehabilitation and upgrade of three existing dams and main canals at Bugugu, Cyimpima and Gashara marshlands and construction/rehabilitation of access roads where necessary. The potential irrigation area for the four marshlands is about 205.8 ha and rice is the main crop in the marshlands.

Prediction and assessment of potential impacts

The project is expected to have both positive and negative impact. positive environmental impacts expected from the Rwamagana project include: increased productivity, temporary and permanent employment creation from construction works, transfer of skills from construction activity, flood control, affordability of medical insurance and education from jobs generated, land appreciation.

Expected adverse impacts range from physical environment impacts, biological impacts and social Impacts and include air and noise pollution, soil erosion from construction works, fire outbreaks, and modification of water table flows, water pollution and loss of biodiversity especially in submerged area. Social impacts include loss of lands, trees and crops but also loss of income during construction period.

Mitigation measures were proposed for each of the adverse impacts anticipated, to an extent that they can be avoided, reduced, limited or eliminated hence manageable. Furthermore, an Environmental Management Plan (EMP) and an Environmental Monitoring Plan indicating the mitigation measures, procedure to be followed, monitoring indicators, the responsible institutions to implement these measures and likely cost of implementing each of these mitigation measures have all been included. The total cost for the implementation and monitoring of environmental management plan is estimated at one hundred thousand eight hundred US dollars exclusive resettlement budget (100,800 USD).

Given the nature, location of the proposed project, proposed works and the potential impacts associated with the implementation of project, the consultant can conclude that the nature and extent adverse impacts identified can be avoided mitigated and eliminated by the implementation of appropriate mitigation measures. As a matter of fact, the rehabilitation of irrigation infrastructure in the targeted marshlands is bound to be executed in a sustainable manner and in compliance with national environmental regulations, JICA environmental and social considerations as well as WB environmental and social safeguards policies. This should be done by implementation of proposed mitigation measures and regular monitoring done as per the Environmental Management Plan (EMP) in the report.

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Appendix 2: List of participant of the meeting of 12th July 2016..エラー!ブックマークが定義されていません。

Appendix 3: list of stakeholders consulted at central government level エラー!ブックマークが定義されていません。

Appendix 4: Guiding questions for policy makers and regulators .エラー!ブックマークが定義されていません。

Appendix 5: Minutes of the meeting with the head of LIM department, RAB .エラー!ブックマークが定義されていません。

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ABBREVIATIONS

BESST	: Bureau for Environmental and Social Studies
CITES	: Convention of International Trade of Endangered Species
CBD	: Convention of Biological Diversity
EDPRS	: Economic Development and Poverty Reduction strategy
ESAP	: Environmental and Social Action Plan
EIA	: Environmental and Social Impact Assessment
ESMP	: Environmental and Social Management Plan
FAO	: Food and Agriculture Organization
GIS	: Geographic Information System
GPS	: Global Positioning System
IUCN	: International Union for the Conservation of Nature
IWRMP	: Integrated Water Resources Master Plan
IWUA	: Irrigation Water Users Association
IWRMP	: Integrated Water Resources Master Plan
JICA	: Japan International Cooperation Agency
MININFRA	: Ministry of Infrastructure
MINIRENA	: Ministry of Natural Resources
NGO	: Non-Government Organization
NISR	: National Institute of Statistics of Rwanda
OHS	: Occupational, Health and Safety
PGR	: Protected by Government of Rwanda
RAB	: Rwanda Agriculture Board
RDB	: Rwanda Development Board
REMA	: Rwanda Environment Management Authority
RNRA	: Rwanda Natural Resources Authority
RURA	: Rwanda Utilities Regulatory Agency
SPAT	: Strategic Plan for Agriculture Transformation
ToRs	: Terms of Reference
UR/CAVM	: University of Rwanda, College of Agriculture Animal sciences and Veterinary Medicine (UR/CVAM).
WHO	: World Health Organization
WUA	: Water Users Association
WMP	: Waste Management Plan

CHAPTER ONE: INTRODUCTION

1.1. Project background

The Government of Rwanda (GoR) is pursuing a comprehensive Poverty Reduction Program, which includes implementation of various sustainable agriculture projects. Agriculture sector in Rwanda accounts for about 34% of the country's GDP (World Bank: 2013) and about 80% of the national population engages in the sector. However, the small-scale farming is majority and most of them are under rain-fed which production is very much affected by weather. Therefore, irrigation development which is less susceptible to the climate condition is desired for improvement of farmers' stable income.

To boost the agriculture sector, the GoR has set a goal in the third Strategic Plan for Agriculture Transformation (SPAT3) of increasing of irrigation area to 100 thousand ha by 2018. To contribute this strategy, projects such as RSSP for marshland and LWH for hillside have been implemented with support of the World Bank and other donors. With the support of its development partners, the Government wants also to rehabilitate existing irrigation areas developed from 1970s to 80s so as to increase water storage capacity and minimize wastage of water resources.

On the basis of above background, the GoR requested support from the Government of Japan (GoJ) for the rehabilitation of irrigation facilities including Cyaruhogo, Cyimpima, and Bugugu and Gashara marshlands in Rwamagana. Preliminary surveys and design studies has studied and the proposed Project will invest in expanding the irrigation area through upgrading existing dams, construction of new dam at Cyaruhogo marshland and rehabilitation of existing irrigation canal.

Although most project impacts are expected to be positive, some of the proposed civil works will have negative environmental and social impacts. Therefore, in compliance with national environmental regulations, Japan International Cooperation Agency guidelines on environment and social considerations, international safeguards policies like World Bank safeguards policies, NTC INTERNATIONAL Co., Ltd was entrusted by JICA and Rwanda Agriculture Board(RAB) to conduct preliminary studies including EIA and RAP. JICA Study Team (JST) has then sub-contracted Bureau for Environmental and Social Studies/BESST Ltd, a national approved EIA expert, to conducted EIA and RAP including baseline studies for the proposed rehabilitation of irrigation facilities in Rwamagana District.

1.2. Presentation project proponent

RAB is an autonomous body established by law n°38/2010 of 25/11/2010. The law specifies that RAB has the general mission of championing the agriculture sector development into a knowledge based; technology driven and market oriented industry, using modern methods in

crop, animal, fisheries, forestry and soil and water management in food, fibre and fuel wood production and processing.

RAB was formed from three agriculture agencies, namely the Rwanda Animal Resources Development Authority (RARDA), the Rwanda Agricultural Development Authority (RADA) and the Rwanda Agriculture Research Institute (French acronym: ISAR). The GoR expects this reform to remove the historical legacy that created artificial gaps between research and extension, strengthen the linkage with policy, and establish efficiency in service delivery through institutional integration in the agricultural sector for improved livelihoods of the Rwandan people. This expectation premises on: physical proximity under one administrative structure, using a common standard operating procedure, which removes institutional boundaries by improving communication, mutual understanding and consensus building between extension, research and policy.

The vision of RAB is to improve food security and livelihoods of all Rwandans by transforming agriculture from subsistence into modern farming through generating research and extension innovations that generate sustainable crop, animal husbandry and natural resource management. RAB has the mission of developing agriculture and animal husbandry through their reform, and using modern methods in crop and animal production, research, agricultural extension, education and training of farmers in new technologies. Key responsibilities of RAB include the implement the national policy of agriculture and animal husbandry, contribution in determining policy in agriculture, animal husbandry, agricultural and animal husbandry research and technology and to provide farmers and consumers of agricultural products with information, techniques and services meant for improving their profession and supplying the internal market with increased and quality production thereby raising their agricultural and animal husbandry incomes.

RAB has 5 departments namely Crop Production & Food Security, Animal Resources Extension, Land Husbandry, Irrigation & Mechanization, Research and Corporate Services. It has also four regional offices known as agricultural zones: Eastern Zone, Southern Zone, Western Zone and Northern Zone.

1.3. Presentation of the consultant

BESST LTD (Bureau for Environmental and Social Studies) is a Rwanda company Registered with Rwanda Development Board (RDB) and Rwanda Environment Management Authority (REMA with its headquarter in Kigali, Rwanda (refer to the list of registered company for EIA, 2016-2017, page 5, number 38 found at www.rema.gov.rw). The company is specialised in EIA, RAP, climate change risk assessment, socio-economic assessment, baseline surveys, waste management, water and sanitation, advisory services in sectors ranging from Agriculture, energy development, infrastructure and housing development, transport and water supply. BESST Ltd houses a team of qualified experts with periodic support from vastly experienced

associates. Each of the qualified experts is privileged to have a minimum of masters in environmental sciences, university degree in civil engineering, wide experience in fields such as; water supply and sanitation, environmental studies, limnology, renewable energy, waste water treatment and construction works.

1.4. Objectives of the study

The overall objective of this assignment was to prepare the Environmental Impact Assessment (EIA) and a Resettlement Action Plan (RAP) including baseline studies. Specifically, the consultant prepared two standalone reports:

- a) Environmental Impact Assessment (EIA); and
- b) Resettlement Action Plan including provisional assets inventory and estimated assets value;

1.5. Scope of the study

Scoping study was undertaken by the consultant's team with an intention of collecting enough and relevant information so as to ensure that the EIA report is prepared in compliance with national environmental regulations and JICA guidelines for environmental and social considerations guidelines. The study covered the impacts of the projects from planning phase, construction and operational phases and considered all selected sites and their surroundings.

Therefore the Scope of work is to:

- Identify which legislation, policies (both local and international) are likely to influence impacts caused by this project.
- Develop an overview of the baseline environment of the project intervention area. i.e. study area description, physical, biological and social- economic-environment etc.
- Develop an overview of likely impacts (positive or negative) that could be caused by construction or upgrading of dams and rehabilitation of irrigation canal. .
- Propose mitigation measures against of the predicted adverse impacts identified.
- Propose an Environmental Management Plan (EMP) on how these mitigation measures can be implemented.
- Propose an Environmental Monitoring Plan with measurable indicators and parameters for these mitigation measures to ensure sustainability of the project.

1.6. Approach and methodology EIA study

The methodology adopted for conducting the EIA for rehabilitation of irrigation facilities in Rwamagana marshlands follows the conventional methods that meet the requirements of the organic law No. 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda, general guidelines for environmental studies and JICA guidelines. The collection of primary data, baseline information and secondary data on environment and social components, relevant documents and literature sources, desktop study, impact analysis, choosing mitigation and enhancement measures using different optimization tools and developing environmental protection, monitoring and management plans were made.

Focus groups discussions, meetings, questionnaires and interviews were common techniques by which local community consultations were also conducted.

The assessment followed a number of stages including scoping or preliminary assessment to understand and establish boundaries of the study, desk review of available literature, field visit to establish baseline data, analysis of all available data (secondary and primary data), prediction of positive and negative impacts, analysis of alternatives for such a project, proposal of mitigation measures leading to the preparation of an Environmental Management Plan and Environmental Monitoring Plan, incorporated in a comprehensive EIA report.

1.6.1. Preliminary assessment/ scoping study

A scoping study involved consultation with JST, RAB staff and Rwamagana district staff and initial a field visit to familiarise the study team with existing features and proposed project infrastructure. Scoping continued by visiting the site area again to understand the sectors the project covers, consult with cooperatives leaders and sector agronomists in the project area of influence so as to understand the existing marshlands conditions but also to understand the proposed rehabilitation activities.

The scoping exercise further entailed the following:

- Identification of the likely stakeholders who eventually were involved in the public consultation;
- Preliminary findings of the existing environment; (primary, biological and socio-cultural environment)
- Preliminary predictions of likely positive and adverse impacts;
- And finally establishing clear boundaries of the study and focus on the relevant issues concerning the study.

The scoping study also involved a preliminary desk review on existing policies and strategic plans related to marshlands development, irrigation and agriculture in general. Document reviewed include Strategic Programme for Agriculture Transformation II (SPAT II), other agriculture sector policies and regulations, Government Economic Development for Poverty Reduction Strategy (EDPRS II), World Bank safeguard policies and the organic law on the environment, similar project document especially those conducted during RSSP II and III as well as Rwamagana District Development Plan.

1.6.2. Review of Institutional, legislative and Policy framework

An intense deskwork was done of existing institutional legislation, policies, plans and programs, which are likely to influence different parts of the implementation of the rehabilitation of irrigation facilities in Rwamagana, its sustainability and ensure enhancement of the environmental resources. Key legal instruments include the following;

- Organic Law no. 04.2005 establishing the modalities of protection, conservation and promotion of the environment on,

- Law N° 32/2015 of 11/06/2015 relating to expropriation in the public interest Expropriation in the
- EDPRS II,
- RSSP 3 Project Appraisal Document;
- Strategic Programme for Agriculture Transformation II (SPAT II),
- National Water Resources Management Policy
- Land Policy
- Rwamagana, District Development Plan.
- Resettlement Policy framework for RSSP 3
- Environmental and Social management framework for RSSP 3

Other than national policies and regulations influencing this project, this review paid considerable attention to JICA guidelines on environmental and social consideration, regional protocols, World Bank safe guard policies and International conventions and JICA.

1.6.3. Public Consultation with Stakeholders

Information collected from the preliminary desk review, preliminary consultation with JICA study team and RAB staff and after having an initial field visit, the study team was able to identify the project key stakeholders. Without chronological priority, these stakeholders were identified in three categories. (1) First category of Government officials, (2) Second category of local government officials and (3) Third category of local farmers and cooperative leaders with activities in the marshland and immediate hillsides likely to benefit or be affected the project.

1.6.4. Baseline data and information

Information on the physical, biological and socio-economic environment was collected by a team of surveyors lead by a GIS expert and using a detailed questionnaire attached as appendix. Furthermore Soil and water samples were taken and tested in laboratory in order to check water and soil quality. More details on sampling and laboratory testing are presented in chapter 4.

Hydrological analysis

The data applied for the hydrological assessment included; daily rainfall records, daily stream flow, monthly evaporation and temperature, sediment concentrations, borehole yield and depth. This information was used to verify the potential capacity that will be contained in the reservoirs for irrigation. Available historical hydrometric data as well as meteorological data recorded at Kigali aero-station close to the project area was gathered from the relevant national institutions and analysed.

Water quality:

The water of from the reservoir sites, stream, and irrigation water and spring water has been analysed in Laboratory for a number of chemical parameters which can be used for assessment of water quality. The samples of water have been collected and analysed by University of Rwanda, College of Agriculture Animal sciences and Veterinary Medicine (UR/CAVM) The

samples were collected during the dry period August 2016 and were analysed next day after collection. The Guidelines for interpretation of water quality for irrigation are provided in FAO paper 29 - Water Quality for Agriculture, Rome, 1976. Key parameters assessed include pH, EC, ToC, BOD5, Nitrates, TDS, TSS, Tot P, Tot Coliforms, COD, OC, OM and Hardness

The water quality of springs used mainly for drinking purposes were assessed from samples collected from four marshlands namely Bugugu, Cyaruhogo, Cyimpima and Gashara. Samples were analysed in laboratory for a number of physical, chemical and biological parameters which can be used for assessment of water quality. The samples of water have been collected and analysed UR/CAVM. The results of analysis for main parameters were provided and assessed in comparison to and corresponding World Health Organisation (WHO) standards.

Sediment Yield Estimation- The determination of sediment yield into any dam is important as it has bearing on the life period of the dam. Sediment yield generated from the catchments upstream of the dam site is computed to ascertain the amount of sediments that will be deposited into the dam. In the case of this study, the gross soil erosion data from the survey study was considered as the sediment yield.

Environmental/ecological flows analysis- To establish this environmental flow, a simple methodology referred to as 'Montana Method' proposed by Tennant (1976), where by an environmental flow regimes are prescribed on the basis of the mean annual flow (MAF) was applied. This method provides guidelines for flow management based on the percentage of average flow, daily and monthly stream flow records, that would maintain biological attributes of a river as optimum conditions (>60%), outstanding (40%), excellent (30%), good (20%), fair, poor, minimum, or degrading (10%). In this study, 10% of minimum flow has been quantified as it is the least for the survival of the existing ecosystem before it is considered degraded.

Soil analysis

The soil quality of the project area has been analysed and surveyed through soil inspection points or pits at the density of three samples per each marshland and 12 samples were collected. Pits have been sampled in the first 30 cm and those presenting similar properties have been mixed in composite samples and analysed at UR/CAVM. The analyses are those recommended by the TORs and relevant for irrigation project including pH avail. P, EC, T-N, CEC, EC, K and Heavy metals.

Flora and fauna analysis

For the baseline survey on fauna, one reconnaissance route (rece) was established in each site (marshland). It was designed in a way that covers most representative areas within each site. The length of the reconnaissance routes varied according to the size of the site. Each reconnaissance route and data was recorded using a GPS for mapping purpose. For recording data on birds, two methods were used. The first method consisted of point counts where observation points were established at an interval of 200 meters along the reconnaissance route. At each point observers waited for 3 minutes to allow birds to settle down and then record all

sightings and calls of birds for a period of 10 minutes (Sutherland, W. 2000). The observers then moved on to the next point and repeated this same process. The second approach consisted of opportunistic sampling where all bird species seen or heard at different times of the day were recorded. For bird species identification, we used the identification keys provided by Stevenson & Fanshawe (2002).

For surveying flora, we used same reconnaissance routes established during fauna survey. All plant species encountered were recorded « Flore du Rwanda » in 4 volumes (Troupin 1978, 1983, 1985, 1988) was used as the main source for plant species identification. The circumscription of plant families follows APG (2009). Lastly, all trees that will be cut down and those which will be affected due to heightening of dam embankment and those which will be affected by the new construction work were identified measured and recorded for further valuation purposes (RAP report appendix 2).

For assessing the conservation status of each species, we used the IUCN Red List of Threatened Species, version 2016-1 (IUCN, 2016). Any endangered or listed species on IUCN red list were highlighted and brought to the client attention.

1.6.5. Impacts Assessment

Impacts prediction and analysis involved assessment of the entire project cycle i.e. project mobilization, construction, operation and decommissioning phases. Impact assessment applied number of tools and techniques to determine the 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. These tools were:

- *Geographical Information System (GIS)* - used to show the extent of a particular project activity influence on the area by mapping it out.
- *Checklist*- Under this section, project activities that might affect or enhance the livelihood in the project areas were listed and drawn against environment indicators and occurrence.
- *Cost benefit analysis (CBA)* - Which involved analysis of project activities in terms of their financial and economic effects to establish the cost implications of the impacts and the mitigation measures. Impacts was analysed according to market costs, foregone costs or opportunity cost. The CBA was used to assign economic values where feasible to impacts both adverse and beneficial.
- *Impact Matrix*- under the Impact matrix, the analysis by these tools of GIS, checklist, CBA, will be tested against their significant effect on recipients in the project area of intervention. Impact matrix in tabular format will be drawn, in which impacts from project activities will be tested against their significant effect on the areas of intervention.

For each adverse impact identified, its level of significance was indicated, mitigation measures proposed and an Environmental Management Plan (EMP) developed.

1.7. Report structure

The proposed Structure of the EIA report is as follows:

Chapter 1: Introduction and general background of the project;

Chapter 2: Project description;

Chapter 3: Policy, legal and institutional framework;

Chapter 4: Environmental, socio-economic and cultural Baseline data;

Chapter 5: Public consultation and participation;

Chapter 6: Project Needs and project alternatives;

Chapter 7: Impacts identification, evaluation and proposed mitigation measures;

Chapter 8: Environmental management Plan and Environmental Monitoring Plan;

Chapter 9: Conclusions and recommendations;

Appendices

CHAPTER TWO: PROJECT DESCRIPTION AND LOCATION

2.1. Project area

2.1.1. Location

The project of rehabilitation of irrigation facilities in Rwamagana district covers four marshlands located between four sectors namely Kigabiro, Mwulire, Munyaga and Rubona.

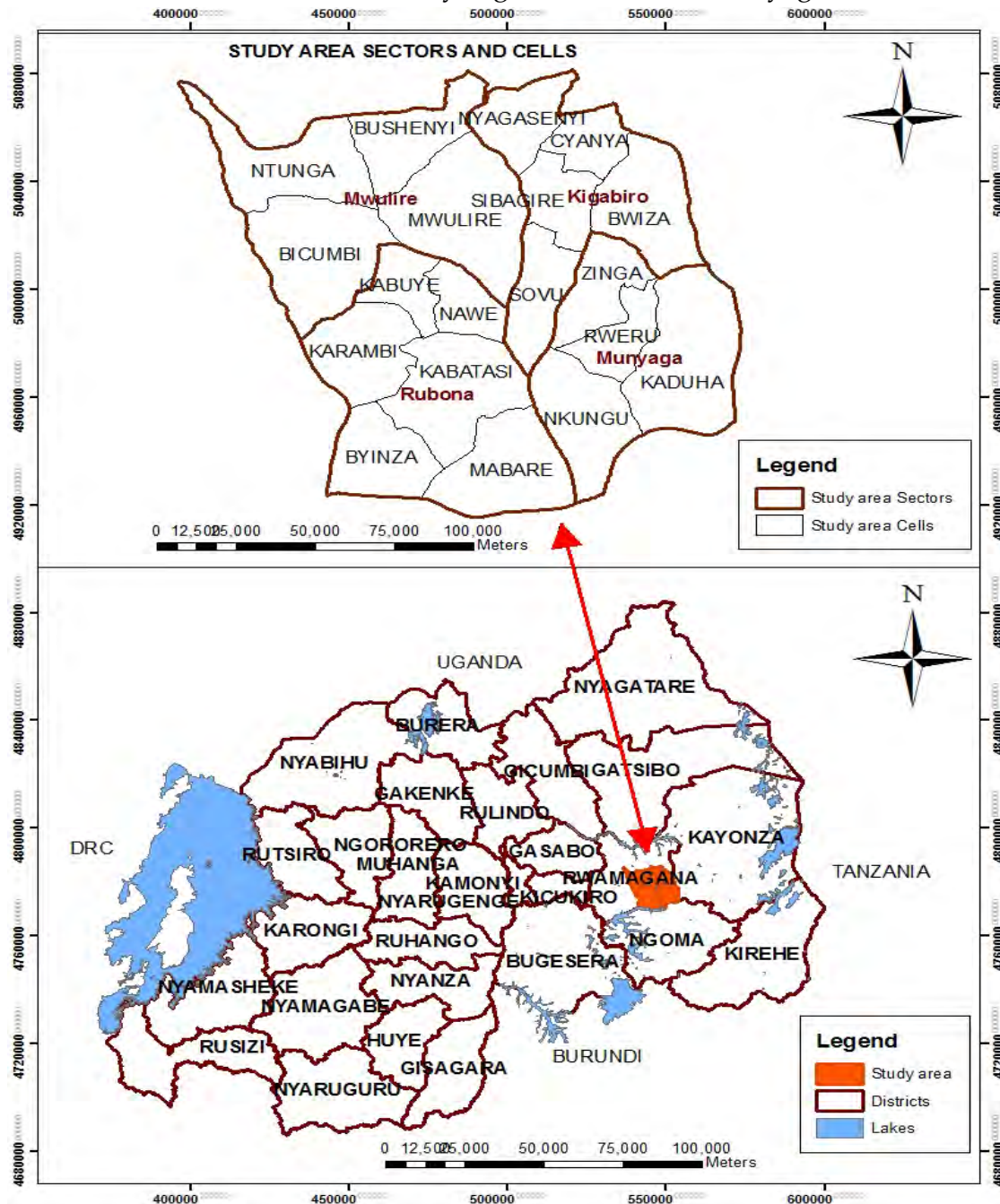


Figure 1: Administrative location of project area

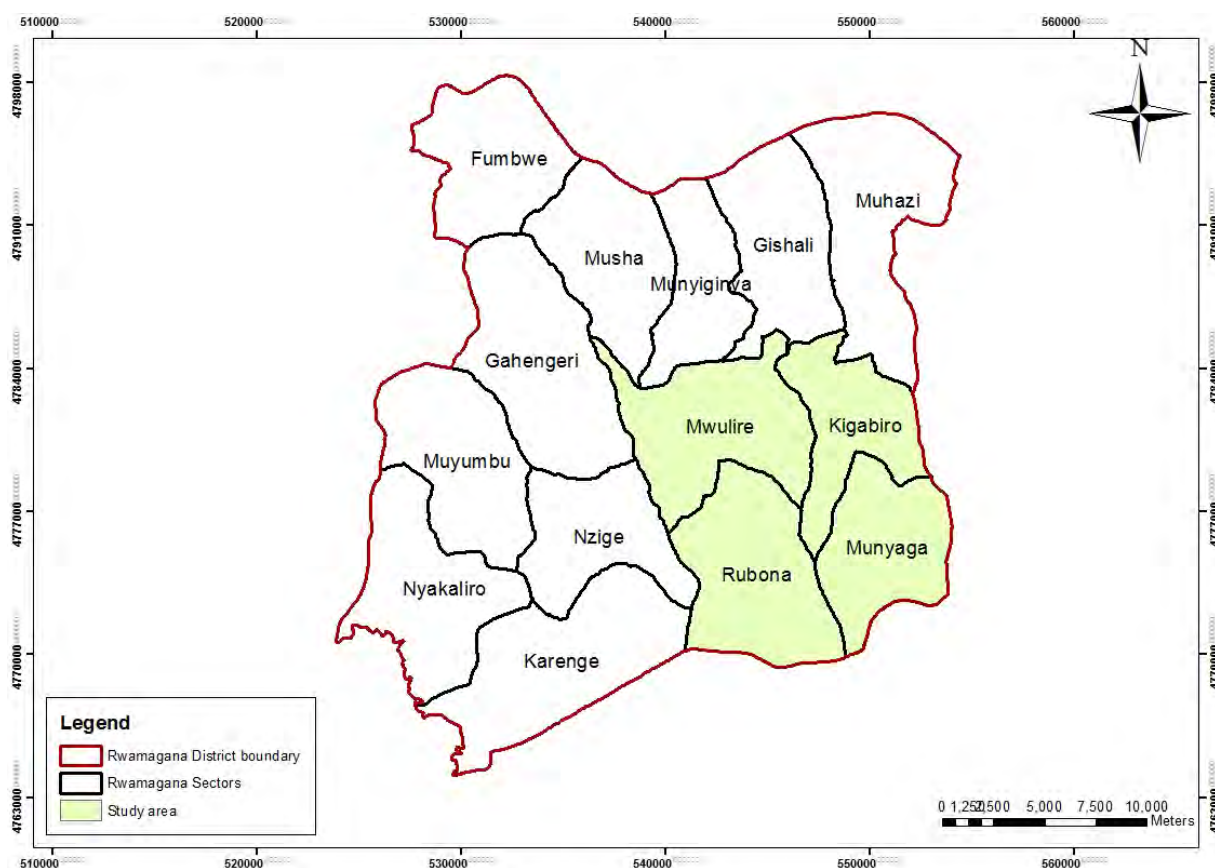


Figure 2: Project area in district context

2.2. Description of the project

2.2.1. Brief description and component of the project

Brief description and provision of the project are shown in the following table. However, it is notable that these contents shall be revised after site visiting and discussion among stakeholders.

Table 1: Key project information

Major Project Component	3 existing irrigation sites: rehabilitation/improvement of dam, main irrigation canals, and related facilities, access roads, etc. 1 new site: new development site is next to the aforementioned existing sites and similar irrigation facilities shall be installed newly. NB: Total distance of the irrigation canal expected is about 26.2km
Targeted Sites:	Rwamagana district, Eastern province, Republic of Rwanda
Responsible Organization:	Ministry of Agriculture and Animal Resources (MINAGRI)
Implementation Organization	Rwanda Agriculture Board (RAB)
Donor Agency:	Japan International Cooperation Agency (JICA)
Direct Beneficiary:	Farmers in irrigation area (1,345 HHs)
Indirect Beneficiary:	Consumers/buyers of the agricultural products

Source: JST 2016

2.2.2. Existing and proposed rehabilitation plan

The project will consist at rehabilitation of three existing dams at Cyimpima, Gashara and Bugugu marshlands and construction of a new dam at Cyaruhogo marshlands. The project is also planning to rehabilitate the existing main canals, intakes and water intake controlling houses, and access roads. The table below presents key futures of the planned rehabilitation works.

Table 2: Key futures of the planned rehabilitation works

Conditions	Item	Unit	Cyimpima	Gashara	Bugugu	Cyaruhogo
Existing conditions	Catchment area	Km ²	15.3	26.5	11.0(existing) 13.9(new)	7.7
	Dam capacity when constructed	M ³	540,000	380,000	35,000	No dam
	Current dam capacity	M ³	500,000	200,000	30,000	None
	Irrigated area	Ha	55.1	66.2	16.0	6.6
Rehabilitation plan	Proposed works		Rehabilitation of dam (Raise of dam height)			Construction of a new dam
			Rehabilitation of spillway and intake facilities			New construction of spillway and intake facilities
			Lining the main canal			

Source: JST, 2016

Table 3: Planned dam specifications

Dams	Catchment Area (km ²)	Irrigation Storage volume (m ³)	Sedimentation volume (m ³)	Total storage volume (m ³)	Full Water Level (m)	Water Depth at FWL (m)
Cyimpima	15.3	553,000	83,000	636,000	1,357.4	6.9
Cyaruhogo	7.7	271,000	76,000	347,000	1,353.7	8.2
Gashara	26.5	478,000	159,000	637,000	1,361.6	8.6
Bugugu	13.9	451,000	125,000	576,000	1,383.5	8.0

Source: JST, 2016

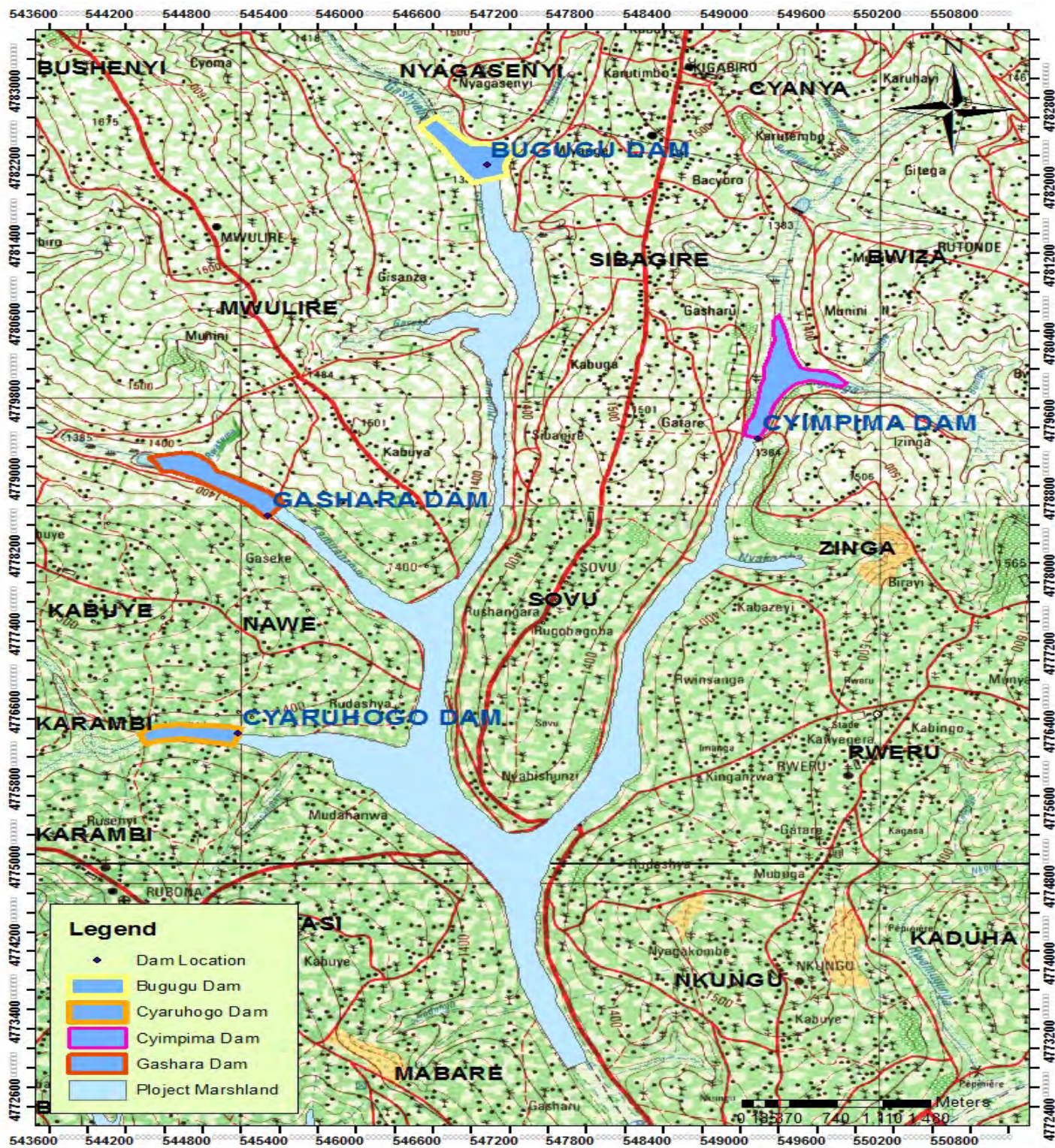


Figure 3: Location of irrigation facilities to be rehabilitated in Rwamagana

Table 4: Spillway and intake specification

Dam	Spillway specification				Intake specification
	Qin (m ³ /s)	Qout (m ³ /s)	Overflow water Depth hf (m)	Width (m)	Qmax (m ³ /s)
Cyimpima	80.3	9.71	1.09	4.0	0.152
Cyaruhogo	43.0	10.90	1.15	4.0	0.077
Gashara	101.6	22.10	1.42	4.0	0.178
Bugugu	89.2	14.70	1.43	6.0	0.130

Source: JST 2016

2.2.3. Typical cross-sections of proposed dam

Rehabilitation works will consist at rehabilitation of three existing dams at Bugugu, Gashara and Cyimpima marshlands and the construction of new dam at Cyaruhogo marshland. The figures below show cross sectional of proposed dams.

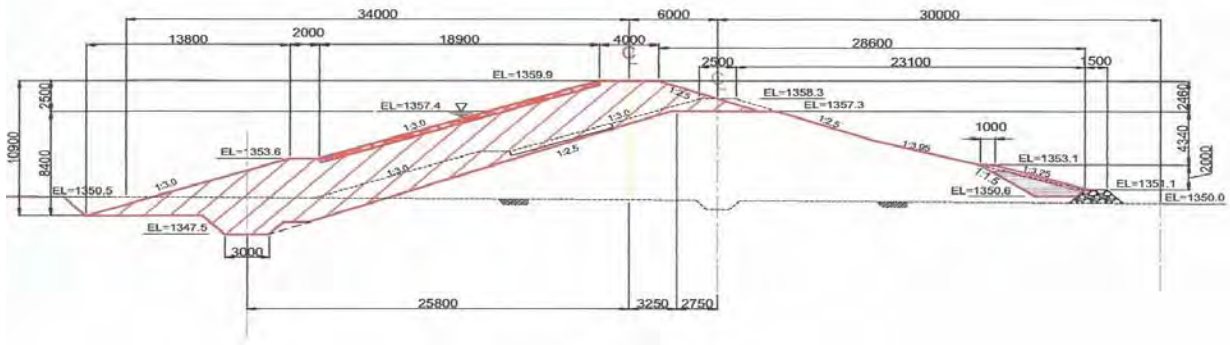


Figure 4: Cross section of Cyimpima dam

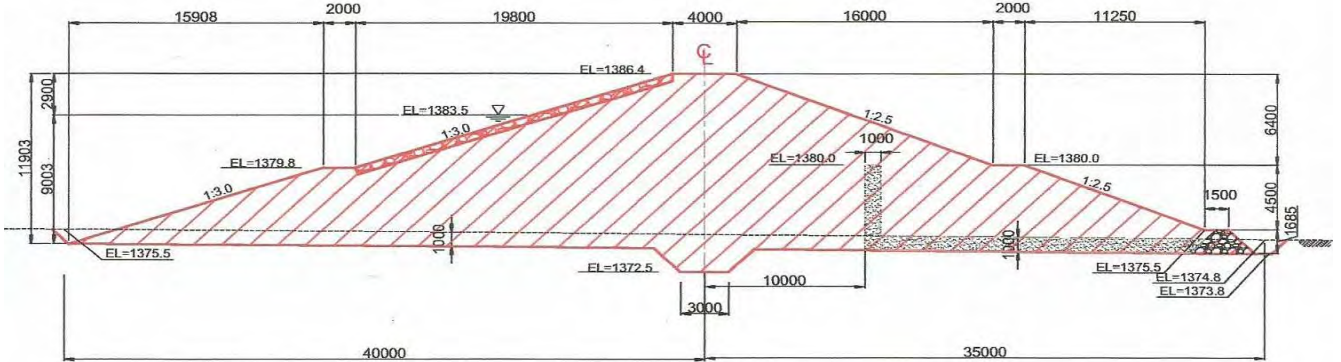


Figure 5: Cross section of Bugugu dam

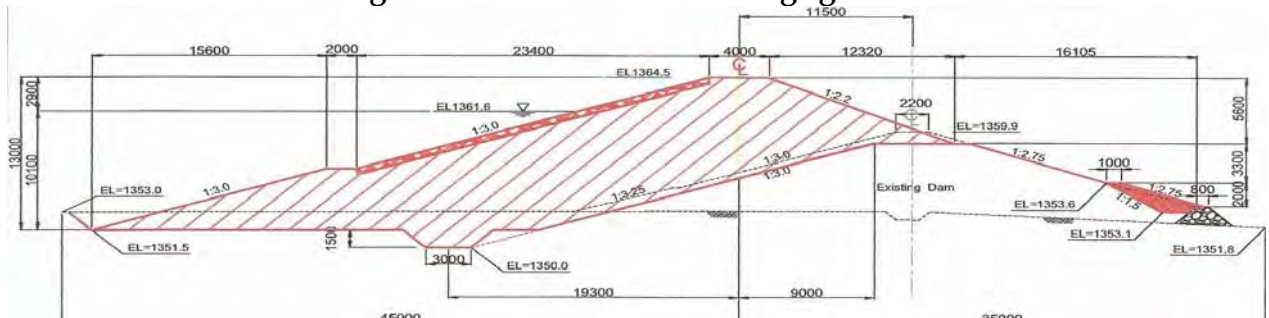


Figure 6: Cross section of Gashara dam

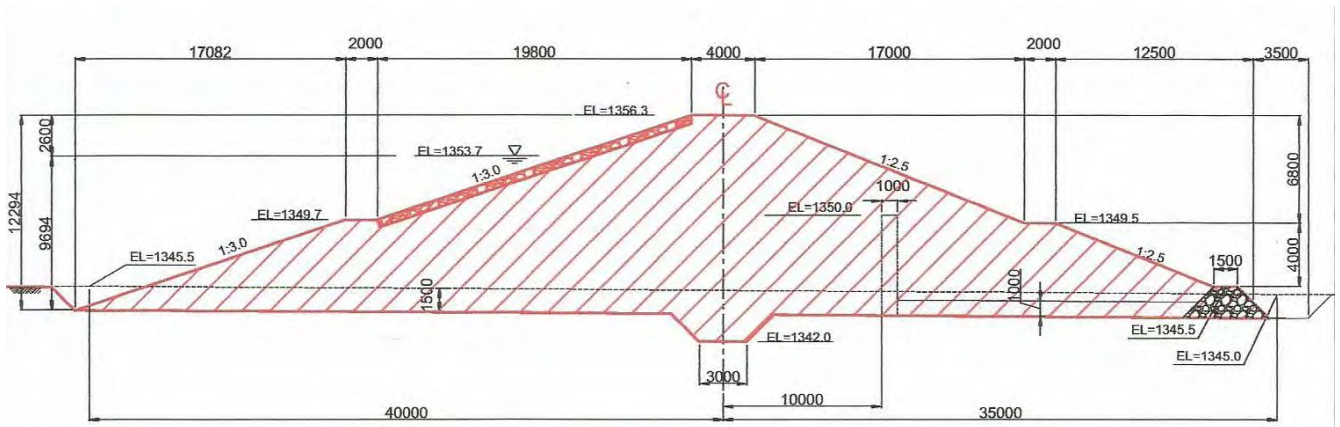


Figure 7: Cross section of Cyaruhogo dam

2.2.4. Design of main canals

In addition to dam rehabilitation, the project will also rehabilitate existing main canals within the existing alignment. Main canal length for rehabilitation (lining) is shown in table below.

Table 5: Main canal length for rehabilitation

Dam	Rehabilitation length (km)
Cyimpima	8.6
Cyaruhogo	2.5
Gashara	6.5
Bugugu	8.6
Total	26.2

Source: JST 2016

Canal type

At present, the concrete flume is deemed as a canal type for rehabilitation and the rectangle shape was selected for the following reasons.

- Construction speed should be fast, construction cost economical and constructed canal durable.
- Considering the existing earthen main canal of large cross sections in many cases, the canal type should be self-supported wall one.
- And in other case, the main canal is to be constructed by excavating soft weak soils. In the case, the canal type should be self-supported wall one too.

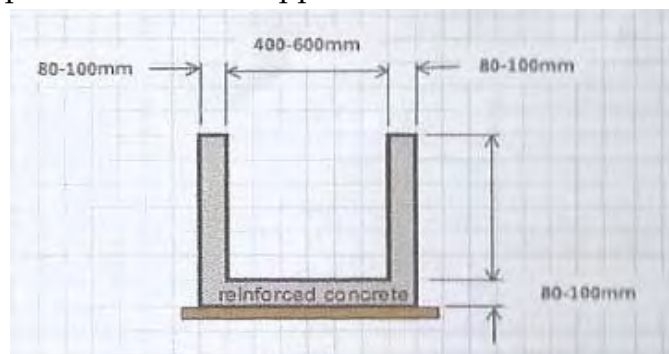


Figure 8: Design of main canal

Maintenance roads

Maintenance road will be constructed along the rehabilitated canal. Its width will be 2.0 m. However, if the existing road is running along the rehabilitated canal, this maintenance road will not be planned.

Cover

Concrete covers will be placed on the rehabilitated canal for canal crossings. Its interval will be 100 m interval principle. Therefore, bridges will not be planned in principle.

Turnouts

At present, farmers or group representative (Bugugu only) operate water intake from the main canal by opening pipe or canal bank. On the other hand, the main canal will be lined after the project. Therefore, turnouts should be constructed considering:

- From the viewpoints of water management, secondary canal system is effective.
- However, practical activity regarding the construction of secondary canal in the future is the major factor which determines the turnout system under the project.

2.2.5. Related structures

The following related structures will be designed along the main canals:

- Control logs (at group boundaries, intakes for secondary canals and end structures)
- Road crossings
- Drainage culverts
- Drops
- Shute structure
- Measuring structures
- End structures
- Slope protections

2.2.6. Access Roads

Access roads are to be constructed for transport of construction materials and vehicles. Existing roads are to be widened to 4 meter width, while new roads with 4 meter width are to be constructed to link construction sites and borrow pit and/or disposal site because most of candidate sites are less accessible without such improvement. Minimum spaces for passing each other dump trucks are to be designed. In rainy season, existing roads will become muddy and very difficult to transport. Hence, the roads shall be paved by gravelly laterite or crushed stones. In addition, one third of the whole road distance shall be repaved after the rainy season.

2.2.7. Land requirements

The table below summarizes key features related to rehabilitation works that will require land acquisition.

Table 6: Land requirement

Marshlands	Affected area	Nos of HHs		Land size (m2)	
		Private land	Government land	Private land	Government land
Cyimpima	a. Submerge		14		42,110
	b. Borrow pit		1		14,648
	c. Disposal		17		10,636

	d. Buffer	18	16	72,720	22,038
	Sub total I	18	48	72,720	89,432
	Sub total II*		56		
Bugugu	a. Submerge	4	19	36,389	35,900
	b. Borrow pit	3		48,898	
	c. Disposal	4		22,860	
	d. Buffer	3	2	23,074	9,852
	Sub total I	14	21	131,221	45,752
	Sub total II*		29		
Cyaruhogo	a. Submerge	8	113	52,029	74,524
	b. Borrow pit	8		30,329	
	c. Disposal	17		21,123	
	d. Buffer	11	1	17,440	5,628
	Sub total I	44	114	120,921	80,152
	Sub total II*		152		
Gashara	a. Submerge	12	35	12,616	86,929
	b. Borrow pit	4		32,628	
	c. Disposal				
	d. Buffer	14	6	38,642	9,064
	Sub total I	30	41	83,886	95,993
	Sub total II*		58		
Sub total I		106	224	408,748	311,329
Grand total*			295		720,077

Sources: JST, 2016

*Figures indicate actual number of PAHs because several farmers own/use both private and government lands which are to be affected

2.2.8. Construction material

The table below shows construction material for construction of different projects components

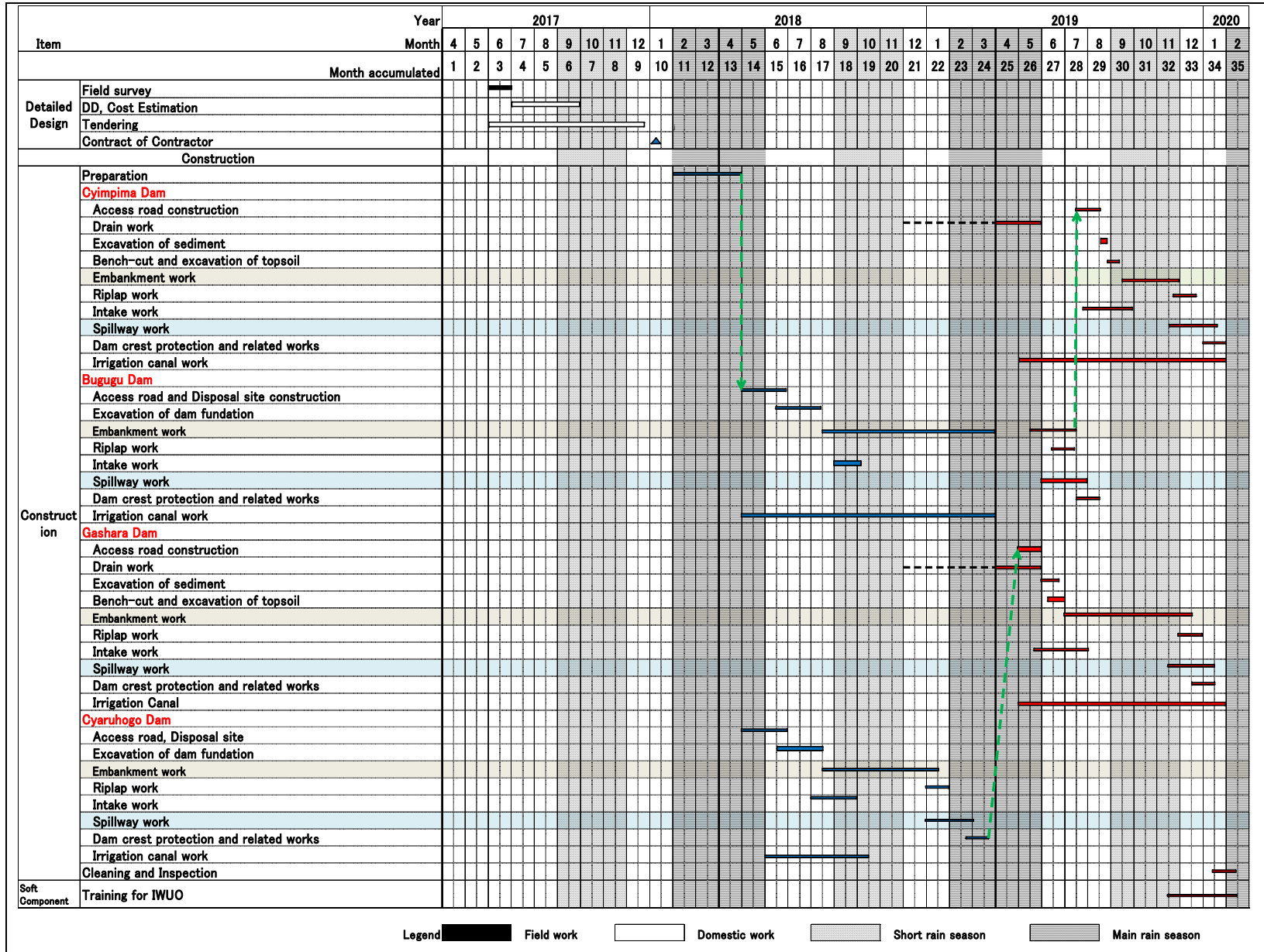
Table 7: Construction material

Category	Item	Spec
I. To be procured on site		
1.Steel	Reinforcing bar	Deformed reinforcing bar 12mm
1.Steel	Reinforcing bar	Deformed reinforcing bar 16mm
1.Steel	Reinforcing bar	Deformed reinforcing bar 25mm
1.Steel	Reinforcing bar	T=25mm, 2.45x1,225mm
2.Fabricated steel product	Nail	
2.Fabricated steel product	Corrugated galvanised sheet	
2.Fabricated steel product	Galvanised sheet	0.4mm
2.Fabricated steel product	Steel pipe	Φ75
3.Cement and Aggregate	Cement	Portland cement
3.Cement and Aggregate	Cement	Portland pozzolana cement
3.Cement and Aggregate	Sand	Fine aggregate
3.Cement and Aggregate	Gravel	Coarse aggregate
3.Cement and Aggregate	Gravel	
3.Cement and Aggregate	Crashed stone	For liprap
3.Cement and Aggregate	Crashed stone	For gabion or cage filled with stones
3.Cement and Aggregate	Lateric soil	
4.Wood	Timber	
4.Wood	Timber	50x75x3000

4.Wood	Timber	50x100x3000
4.Wood	Timber	75x100x3000
6.Oil	Gasoline	
6.Oil	diesel	
7.Others	RC pipe	Φ 400
7.Others	RC pipe	Φ 600
7.Others	HDPE pipe	Φ 20 PN10
7.Others	HDPE pipe	Φ 25 PN10
7.Others	HDPE pipe	Φ 50 PN10
7.Others	HDPE pipe	Φ 75 PN10
7.Others	HDPE pipe	Φ 110 PN10
7.Others	HDPE pipe	Φ 200 PN10
7.Others	HDPE pipe	Φ250 PN10
7.Others	PVC pipe	Φ 25
7.Others	PVC pipe	Φ 50
7.Others	PVC pipe	Φ 110
7.Others	PVC pipe	Φ 200
7.Others	Sluice valve	Φ 50
7.Others	Sluice valve	Φ 100
7.Others	Brick	
7.Others	Wooden latticed window	
7.Others	Wooden door	
7.Others	Steel window	
7.Others	Steel door	230 mm
7.Others	Project site board	3600x 1800
7.Others	Project site board	1800x 900
II. To be procured from Japan		
	Gate valve	Φ 150
	Gate valve	Φ 400
	Erastite	t= 20mm
	Screen	700x1000
	Slide gate	Φ 600
	Water sealing plate	W100x t5mm
	Water sealing plate	W300x t7mm
	Large sandbags	Φ 110(round shape) x 108
	Weep hole	Φ 55mm, flap valve type
	Steel pipe	Φ 600
	Steel pipe	Φ 400
	Steel pipe	Φ 150
Steel accessories	Flange Adapter	Φ 600
	Flange Adapter	Φ 400
	Flange Adapter	Φ 150
	Reducer	600A x 400A
	T-joint	400A x 200A
	90 degree elbow	150A
	Foothold hardware	153mm x Φ 19
	Air valve	Φ 25

Sources: JST, 2016

2.2.9. Tentative schedule of Rwamagana Project



Source: JST, 2016

CHAPTER THREE: POLICY, LEGAL AND REGULATORY FRAMEWORK

The Rehabilitation of Irrigation facilities in Rwamagana District will be implemented by Rwanda Agriculture Board under JICA funding. According to the Rwandan environmental policy and regulations, as well as the JICA guidelines on environment and social considerations, the project developer is requested to establish an overarching policy defining the environmental and social objectives and principles that guide the project to achieve sound environmental and social performance.

This chapter describes policies, laws, regulations and institutional framework that will govern the implementation of proposed project and the implementation of proposed mitigation measures. Both international and national regulations were reviewed in order to come up with a consolidated legal and regulatory framework to ensure that the project is implemented in compliance with national regulations and international standards.

3.1. National Policy Context

The Constitution of the Republic of Rwanda, adopted in June 2003 and revised in 2015, ensures the protection and sustainable management of environment and encourages rational use of natural resources. In consideration of the Constitution as amended to date, 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.

On the other hand, the organic law (article 67) requires that projects, programmes and policies that may affect the environment shall be subjected to EIA before obtaining authorization for implementation. Article 69 gives REMA legal authority to oversee the EIA process but the responsibility of review and approval of EIA report was handed to RDB.

3.1.1. Environmental Impact Assessment process

EIA process operates within and towards the global concept of sustainable development. It is intended to achieve benchmarks and embrace commitment to international environmental conventions agreed upon in Ramsar (1971), Vienna (1985), Montreal (1990), Rio (1992), Kyoto (1998), and Stockholm (2001) to all of which, Rwanda is a party. EIA also provides a framework for promotion of efficient decision-making in project approval. EIA enables implementation of environmental safeguards to mitigate significant negative impacts, avoid ecological damage and large-scale irreversible loss of natural resource. EIA is an invaluable tool for environmental management in a trans-boundary context, playing role in information dissemination between Rwanda and neighbouring countries and widening the scope of understanding of impacts beyond its borders. EIA process in Rwanda provides a context and basis for future international cooperation and conflict resolution concerning environmental impacts at a regional level.

Chapter IV of title II of the organic law n° 04/2005 of 08/04/2005 determining modalities of protection, conservation and promotion of environment in Rwanda regulates the EIA. In its article 67: Every project shall be subjected to EIA, before obtaining authorization for its implementation. This applies to programmes and policies that may affect the environment. Article 68 specifies the main points that an EIA must include. Article 69 stipulates that EIA shall be examined and approved by the Rwanda Environmental Management Authority or any other person given a written authorization by the Authority. Today this mandate was given to Rwanda Development Board (RDB) in the Government effort to facilitate sustainable investment in Rwanda.

Article 70 states that an order of the Minister having environment in his attributions establishes the list of projects for which the public administration shall not warrant any authorization without an EIA describing direct and indirect consequences of the project to the environment; moreover the Article 13 states that any soil development and exploitation project for industrial, urban organization as well as any research project or the one of exploitation of subsoil raw materials is subject to authorization issued through procedures determined by the order of the Minister concerned.

Currently the EIA approval process is done on line via RDB one stop centre and is done as follows:

- Project proponent /developer request EIA terms of reference by submission of project brief;
- RDB review the project brief and conduct field visit before issuance of terms of reference;
- Once terms of reference are approved and sent to the project developer, this one is allowed to hire one of the certified expert based on the list approved by Ministry of Natural Resources;
- The hired consultant conduct the EIA study and submit the EIA report to the developer and this one send the report to RDB if is satisfied with the report,
- RDB review the report and issues the EIA clearance letter with approval condition if is satisfied with the report. Once the conditions of approval are signed by the developer, then RDB issue the original certificate and the developer is allowed to start the project.
- If RDB is not satisfied with the report, the report is reject and the developer together with the consultant addresses comments issues by RDB,
- If the developer is not satisfied with RDB decision he/she can appeal to the Minister of natural resources having environment in his attribution..

3.1.2. Biodiversity and ecological conservation

The biodiversity conservation defines the objectives and priorities for the conservation and sustainable management of biodiversity. 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 revised and updated Rwanda National Biodiversity Strategy (NBS) of 2015 has a long-term vision which is in line with the Convention on Biological Diversity (CBD) strategic plan to 2020 and states that: “by 2040, national biodiversity be restored and conserved, contributing to economic prosperity and human well-being through delivering benefits essential for Rwandan society in general.” NBS as a ‘living document’, responsive, flexible and practical, including biodiversity conservation in economic decisions and turn it into a driver for national development. Relevant economic development sectors such as agriculture and animal resources, fisheries, forestry, mining and infrastructures will incorporate biodiversity conservation activities into their planning systems as well as in the annual budgets of upcoming years.

In addition to that, the project will comply with the ministerial order N°007/2008 of 15/08/2008 establishing the list of protected animal and plant species. Chapter II Article 2 of this order classifies protected animals in three categories as Mammals, birds, and reptiles.

The list is published in Appendix 1 of this ministerial order as follows:

- **Animals:** Gorilla, Chimpanzee, Black rhinoceros, Elephant, Roan antelope, Sitatunga, Lions, Leopard, Klipspringer, Buffalo, Cheetah, Zool mongoose, Cephalophus, Zoolseroal, Wild dog, Bushbuck, Hippopotamus, Burchell’s zebra **Birds:** Black-headed Heron, Cattle Egret, Grauer’s Swamp Warbler, Owls, all Lemoroids, Grey Crowned-Crane, wallow, Arrow-marked Babbler, Cape Robin-Chat, all pangolins, Vulture, Bee eater, Scimitar bills, Hamerkop, Sunbirds.
- **Reptile:** Tortoises (all species), Python, Crocodile, Viper.
- **Plants:** *Ficus thonningii*, *Prunus africana*, *Pentadesma reindersii*, *Myrianthus holstii*, *Thonningia sanguine*, *Hypoestetrifolia*, *Aloe sp.*, *Syzygiumguineense*, *Erythrinaabyssinica*, *Fagarachalybea*, *kigelia africana*, *Orchidaceae*, *Eulophias treptopetala*, *Eulophia horsafalli*, *Diaphananthe bilosa*, *Disaemili*, *Disperiskili manjarica*, *Euggelingia ligulifolia*, *Polystachyia hastate*, *Tridactyle anthomaniaca*, *Entandopheragmasp*, *Podocarpus ambarensis*, *Albizziasasa*, *Piptadenia africana*, *Podocarpus milinjianus*, *grandiflora*, *Strombosia scheffleri*. The Order specifies that the listed animals and plant species shall not be destroyed without permission of the competent authorities. None of these list plants are likely to be affected by the project.

3.1.3. Integrated Water Resources Management Policy (IWRMP)

The IWRMP is the latest development in Government’s consistent and continuous efforts to strengthen the water resources management sub-sector. It replaces the 2004 policy and has been necessitated by the ill-alignment between the 2004 policy and water law No. 62/2008, which embraced many modern and cutting-edge principles of sustainable water resources. Additionally, the government has been introducing reforms in the water sector that have

significantly changed the context for water resources management and rendered the 2004 policy out of date. With the promulgation of a law establishing the Rwanda Natural Resource Authority (RNRA) with the mandate to lead the management of natural resources across sectors, there is potential to achieve a coordinated approach to water resources management, in line with the integrated water resources management concept. In order to address the capacity limitations being faced by the sector, it will require concerted efforts in resource mobilisation, human resource development and institutional capacity building.

3.1.4. Mining and quarry Management

The construction irrigation facilities require some material including stones and sand. Therefore, the mining and quarry exploitation laws provide the process of acquiring quarries for mining activities, the licensing process and the environmental consideration in exploiting a quarry. Nevertheless the quarry component will be conducted by a contractor who will be required to fully respect strictly the process. Actually, an EIA Certificate is required for each quarry to be exploited. Thus, the contractor will be requested to acquire material from a certified mines and quarry and in respect to environmental requirements. It's therefore the responsibility of quarry/mines owner to develop and implement an EMP including Borrow Pits Closure Plan (BPCP). If the contractor open new query or borrow pits will be required to prepare and implement the BPCP before the handover the project facilities.

3.1.5. Irrigation Master Plan (IMP)

The IMP of 2010 provided Rwanda with a planning tool for rational exploitation of its soil and water resources, with an intension to increase crop production of both staple foods for local consumption and high-value products for export. It supports decision making by giving guidance on; (i) identifying the most favourable areas to establish irrigation water infrastructure;(ii) estimating the water stock that can be used for irrigation; (iii) prioritising distribution of irrigation water; (iv) identifying means of transporting water to selected sites; (v) recommending means of abstraction for the chosen type of water source; (vi) establishing irrigated agriculture in small-, medium- and large-scale projects on hillsides, marshlands and other topographically suitable areas; (vii) identifying options for upgrading the agricultural value chain through appropriate training and extension (especially promoting the use of inputs, introducing mechanisation, training in postharvest management and marketing and sales); (viii) recommending options for water harvesting and storage; (ix) proposing solutions for drainage and flood mitigation; (x) recommending locations and management for water storage and hydroelectric purposes; (xi) producing a plan map for the potential irrigation areas that could be irrigated by the different kinds of water resources by agro-climatic zone or even province level; and (xii) articulating the national policy options concerning the distribution of irrigation water.

With part of the rehabilitation of irrigation facilities in Rwamagana involving irrigation, the feasibility and technical designs shall need to follow guidance and these reference tools

recommended in the IMP in preparing an accurate project that fits in the nation holistic irrigation plan.

3.1.6. Integrated Water Resources Master Plan

The integrated Water Resource Master Plan focuses on conserving and protecting Rwanda's water, restoring its water reservoirs, ensuring efficiency and equity in allocation and use of water.

From public consultation with farmers and field visit in the four marshlands it's understood that the present infrastructure are very old and do not provide enough water for their crops and livestock especially during the longest dry season. The proposed projects intend to address this issue by upgrading the existing dams and increase water storages capacity but also construction of a new dam at Cyaruhogo marshland. This might be considered a contribution towards achieving one of the Master Plan strategy outcomes.

3.1.7. Agriculture development policy

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. To achieve sustainable development in agricultural sector, the policy emphasizes the need to adopt Integrated Pest Management (IPM) practices.

3.1.8. National biodiversity strategy and action plan

The rehabilitation of irrigation facilities in Rwamagana will have impact on flora and fauna especially in submerged areas. Therefore, it is critical to assess project impact in accordance with 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 and protected areas.

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. Although the Action Plan consists of urgent and priority actions, which are to be attained in a given period, it's not based on the actual status of these ecosystems.

3.1.9. Land acquisition and involuntary resettlement process in Rwanda

Land ownership in Rwanda is determined by the Organic law n°08/2005 of 14/07/2005 determining the use and management of land in Rwanda. It also institutes the principles that are respected on land legal rights accepted on any land in the country as well as all other appendages whether natural or artificial.

The Law provides the definitions of some key words:

- Construction area is an area purposely for human settlement, trade and industries, an area reserved for recreation and other basic activities of public utility.
- Area not for construction is an area reserved for agriculture, afforestation, grazing, reserved tourist places and recreational gardens.
- The ownership of land is determined by article 4, which announces that, any person or association with legal personality has the right over the land and to freely exploit it as provided for by this organic law in article 5 and 6.

Article 5 states that any person or association with legal personality that owns land either through custom, or who acquired it from competent authorities or who purchased it are allowed to own it on long term lease in conformity with provisions of this organic law. Article 6 of the Law determines that any person whether a Rwandan or a foreigner who invested in Rwanda, or an association with legal personality shall enjoy full rights of ownership of land reserved for residential, industrial, commercial, social or cultural and scientific services.

Regarding land rights, article 34, states that the State recognizes the right to freely own land and shall protect the land owner from being dispossessed of the land whether totally or partially, except in case of expropriation due to public interest. Furthermore, the lands law put the marshlands belong to the government and are leased to farmers. The private lands are on water catchments to be protected and the ownership will not be affected. Compensation process, eligibility criteria and assets valuation, entitlement matrix are detailed in RAP prepared for the project.

3.2. Institutional arrangement for the environmental management in Rwanda

The institutional framework for environmental management is currently enshrined in the Organic Law determining the modalities of protection, conservation and promotion of the environment in Rwanda, published in the official gazette RWA N° 9 of the 1st May 2005, particularly in its chapter III relating to the establishment of the institutions.

3.2.1. Ministry of Agriculture and Animal Resources (MINAGRI)

The ministry of agriculture and animal Resources is the leading government institution for agriculture and animal husbandry and its mission is to initiate, develop and manage suitable programs of transformation and modernization of agriculture and livestock to ensure food security and to contribute to the national economy. One of the key pillars of the ministry vision

is the transformation of Agriculture from subsistence to a productive high value; market oriented farming that is environmentally friendly and has an impact on other sectors of the economy.

The policy of MINAGRI is to increase animal production, modernize farming, reduce poverty, ensure food security and have surplus for the market. This will ultimately result in the increase of the standard of living of the population. The transformation of the animal resources industry can only be achieved if the constraints to animal production are reversed.

The Ministry has four priority programmes including:

- Agriculture and animal resource intensification;
- Research, technology transfer and professionalization of farmers;
- Value chain development and private sector investment;
- Institutional development and agricultural cross-cutting issues.

Therefore, the rehabilitation of irrigation facilities in Rwamagana District falls in the first priority

3.2.2. Ministry of Natural Resources (MINIRENA)

The Ministry of Natural Resources (MINIRENA) is responsible for developing land utilization policies (including surveying, land classification, land laws and land tenure); the development of environmental policies and procedures (including impact assessments), protection of natural resources (water, land, flora, and fauna), environmental legislation, biodiversity, and other environmental aspects. The chapter IV of the organic law on environmental protection, conservation and management, article 65, clearly calls for the need to subject projects to mandatory Environmental Impact Assessment. The article 65 further specifies that every project shall be subjected to EIA prior to its commencement. It shall be the same for programs, plans and policies likely to affect the environment. Specific details of projects referred to in this Article shall be spelt out by the order of the Minister in charge of environment. MINIRENA is one of the lead agencies / line Ministry as provided by the general guidelines and procedure for EIA.

- Provide information or advice to developers and EIA experts during EIA process,
- Participate as panellist at public hearings held during the conduct of EIA,
- Advise developers on the requirement for EIA (where relevant) before licensing their projects,
- Assist in inspecting and monitoring environmental compliance by ensuring that licensing terms and conditions are met, including those specified by REMA.

3.2.3. Rwanda Agriculture Board (RAB)

RAB will play essential role in the successful implementation of the project. RAB is entrusted with the implementation of agriculture and livestock policies and plans. The vision of RAB is to improve food security and livelihoods of all Rwandans by transforming agriculture from subsistence into modern farming through generating research and extension innovations that generate sustainable crop, animal husbandry and natural resource management. RAB has the mission of developing agriculture and animal husbandry through their reform, and using

modern methods in crop and animal production, research, agricultural extension, education and training of farmers in new technologies. Key responsibilities of RAB include the implement the national policy of agriculture and animal husbandry, contribution in determining policy in agriculture, animal husbandry, agricultural and animal husbandry research and technology and to provide farmers and consumers of agricultural products with information, techniques and services meant for improving their profession and supplying the internal market with increased and quality production thereby raising their agricultural and animal husbandry incomes.

3.2.4. Rwanda Environment Management Authority (REMA)

REMA was established in 2004 to act as the implementation organ of environment related policies and laws in Rwanda. REMA is also tasked:

- to coordinate different environmental protection activities undertaken by environmental promotion agencies;
- to promote the integration of environmental issues in development policies, projects, plans and programmes;
- to coordinate implementation of Government policies and decisions taken by the Board of Directors and ensure the integration of environmental issues in national planning among concerned departments and institutions within the Government;
- to advise the Government with regard to the legislation and other measures relating to environmental management or implementation of conventions, treaties and international agreements relevant to the field of environment as and when necessary;
- to make proposals to the Government in the field of environmental policies and strategies etc.

REMA is also responsible for monitoring the implementation of EMP, conduct inspection during implementation of project and issue clearance for environmental audit report when the project was implemented without EIA.

3.2.5. Rwanda Natural Resources Authority (RNRA)

RNRA is a national authority under the Ministry of Natural Resources, established in January 2011 by the n°53/2010 of 25/01/2011 that heads the management of promotion of natural resources which is composed of land, water, forests and mines. It is entrusted with supervision, monitoring and to ensure the implementation of all issues relating to promotion and protection of natural resources. 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;
- making a follow up and supervising activities relating to mining and quarry and to promote investment and mining value addition in Rwanda;
- Initiating research and study on water resources and to publicize the results there from;
- Instituting regulations, guidelines and appropriate mechanisms for management, use and conservation of water resources and ensuring their implementation;
- establishing cooperation and collaboration with other regional and international institutions with the aim of harmonizing performance and relations on matters relating to the management of natural resources.

In relation to Rwamagana project, Rwanda Natural Resource Authority is the key stakeholders because in addition to the water resources management, issues the water abstraction permit and lead the land acquisition process through District land bureau.

3.2.6. Rwanda Development Board (RDB)

RDB was created by organic law n° 53/2008 of 02/09/2008. It has a mission of improving the well-being of all Rwandans by fast-tracking development, catalysing sustainable economic growth, and creating prosperity for all. This a one stop institution bringing together several government bodies in Rwanda focused at promoting investment in Rwanda. Initially the responsibility for reviewing and approving EIA reports was entrusted to REMA, this duty has now been transferred to the newly created RDB where a department of EIA has been created and tasked with review and approvals of all EIA reports for proposed projects and programmes before they are approved for implementation. The Key responsibility of EIA department in RDB is to:

- Receive and register EIA applications (project briefs) submitted by developers;
- Identify relevant lead agencies to review project briefs and provide necessary input during screening,
- Review project briefs and determine project classification at screening stage,
- Transmit Project Briefs to relevant Lead Agencies and concerned Local Governments to provide input on Terms of Reference (ToR),
- Publicize Project Briefs and collect public comments during development of ToR,
- Receive EIA documents submitted by a developer and verify that they are complete,
- Transmit copy of EIA reports to relevant lead agencies, local governments and communities to review and make comments,
- Review EIA reports and make decision on approval, organize and conduct public hearings, appoint an officer from Authority to chair public hearings, receive public comments and compile public hearing reports,

- Appoint the technical committee and its representative to the technical committee,
- Forward EIA documents (EIA report and Public Hearing Report) to the technical committee,
- Chair the Executive Committee which makes final decision on approval of a project,
- Communicate decision on whether or not a proposed project is approved,
- Issue to developers EIA certificate of authorization if their projects are approved.

3.2.7. Local Governments

Generally, decentralized entities are responsible for the implementation of laws, policies, strategies, objectives and programmes relating to protection, conservation and promotion of the environment in Rwanda. Article 61 of the environmental organic law state that in the framework of conservation and protection of the environment, decentralized entities are particularly responsible for:

- ensuring activities related to better management of land, especially controlling soil erosion and tap rain water;
- afforestation, protection and proper management of forests;
- efficient management of rivers, lakes, sources of water and underground water;
- efficient management and effective use of swamps;
- Protection and proper management of reserved areas, historical sites, endangered animal and plant species.

Under the general guidelines and procedure for EIA, Local Governments including Rwamagana district and its respective sectors are tasked to perform the following functions:

- At the request of RDB, review project priefs so as to advise on Terms of Reference,
- Provide information or advice to developers and EIA experts when consulted during EIA process,
- At the request of RDB, review EIA 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.
- Facilitate the land acquisition process through Land bureau office;
- Plan and complaints resolutions.

3.3. International legislative and policy framework

In addition to national environmental legislations, Government of Rwanda is also a party to a number of regional and international conventions and protocols on environment. Therefore, the project of rehabilitation of irrigation facilities in Rwamagana will be implemented in compliance with international policy and regulations. Those include World Bank safeguards Policies and JICA Environmental and Social Considerations.

3.3.1. JICA guidelines on Environmental and Social Considerations

The project rehabilitation of irrigation facilities in Rwamagana district will be funded by the Government of Japan through JICA. It is therefore, critical to ensure that the project is implemented in compliance with JICA Environmental and Social Consideration. JICA encourages host country governments, including local governments, borrowers, and project proponents, to implement the appropriate measures for environmental and social considerations when engaging in cooperation activities. At the same time, JICA provides support for and examinations of environmental and social considerations in accordance with the guidelines.

The guidelines cover five schemes: (1) Loan aid, (2) Grant aid (excluding projects executed through international organizations), (3) Preliminary studies of grant aid undertaken by MOFA, (4) Technical cooperation for development planning, and (5) Technical cooperation projects.

- **Objectives of JICA guidelines**

The objectives of the guidelines are to encourage project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavours to ensure transparency, predictability, and accountability in its support for and examination of environmental and social consideration

- **Key principles of JICA guidelines**

Key principles of JICA guidelines on environmental and social considerations can be summarized as follows:

1. Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.
2. Examinations must be endeavoured to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis; these must be conducted in close harmony with the economic, financial, institutional, social, and technical analyses of projects.
3. The findings of the examination of environmental and social considerations must include alternatives and mitigation measures, and must be recorded as separate documents or as a part of other documents. EIA reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impacts.
4. For projects that have a particularly high potential for adverse impacts or that are highly contentious, a committee of experts may be formed so that JICA may seek their opinions, in order to increase accountability.

- **Responsibility of JICA in EIA process**

While project proponents etc. take the initiative to deal with the environmental and social considerations of projects, JICA provides support for and examinations of the environmental and social considerations that project proponents etc. implement in accordance with Sections 2 and 3 of the guidelines, depending on the nature of cooperation projects. Project proponents are required to incorporate the output of environmental and social considerations studies into project planning and decision-making processes. When JICA provides support for and examinations of environmental and social considerations, JICA examines the requirements that must be met.

- **Categorization of projects and JICA guidelines**

JICA classifies projects into four categories according to the extent of environmental and social impacts, taking into account an outline of project, scale, site condition, etc.

Category A: Proposed projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. Projects with complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible impacts, are also classified as Category A. These impacts may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors, projects that have characteristics that are liable to cause adverse environmental impacts, and projects located in or near sensitive areas.

Category B: Proposed projects are classified as category B if their potential adverse impacts on the environment and society are less adverse than those of category A projects. Generally, they are site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily. The rehabilitation of irrigation facilities in Rwamagana can be classified as category B projects.

Category C: Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society.

Category FI: Proposed projects are classified as Category FI if they satisfy all of the following requirements: JICA's funding of projects is provided to a financial intermediary or executing agency; the selection and appraisal of the sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding (or project appraisal); and those sub-projects are expected to have a potential impact on the environment.

- **Impacts to be assessed**

The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local

conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. Items to be addressed in the specific project are narrowed down to the needed ones through the scoping process.

In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational. The life cycle impact of a project period is also considered. Various kinds of relevant information are needed in order to assess impacts on the environment and local communities. There are, however, uncertainties in predicting such impacts caused by the incomplete understanding of impact mechanisms and the limited information available. Therefore, if the scale of uncertainty is considered to be large, project proponents etc. provide environmental and social considerations that include preventive measures as much as possible.

3.3.2. 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 IBRD focuses on middle income and creditworthy poor countries, while IDA focuses on the poorest countries in the world. In addition to the IBRD and IDA, three other institutions are members of the WBG: the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA) and the International Centre for Settlement of Investment Disputes (ICSID).

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 ten are known as the “Safeguard Policies” and include:

- Environmental Assessment (OP 4.01);
- Physical Cultural Resources (OP 4.11);
- Disputed Areas (OP 7.60);
- Forests (OP 4.36);
- Indigenous Peoples (OP 4.10);
- International Waterways (OP 7.50);
- Involuntary Resettlement (OP 4.12);
- Natural Habitats (OP 4.04);

- 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. Depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts, the Bank will classify the proposed project into one of the categories (A, B, C). 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. The most relevant policies to the rehabilitation of irrigation facilities in Rwamagana District:

- **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 EIA report is therefore subject to disclosure to the general public.

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

- (a) **Category "A" Projects:** An EIA 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;
- (b) **Category "B" Projects:** Although an EIA 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;
- (c) **Category "C" Projects:** No EIA 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.

- **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. 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. All natural habitats have important biological, social, economic, and existence value. Important habitats may occur in tropical humid, dry, and cloud forest; temperate and boreal forest; Mediterranean-type shrub lands; natural arid and semi-arid lands, mangrove swamps, coastal marshes, and other wetlands; estuaries, sea grass beds, coral reefs, freshwater lakes and rivers; alpine and sub alpine Environments, including herb fields, grasslands, and paramos; and tropical and temperate grasslands.

Therefore, the natural habitats policy is applicable to the proposed project within as it may have potential adverse impacts on the river, wetlands and the catchments area. These ecosystems support varying degrees of natural complexities of flora and fauna.

- **Involuntary Resettlement (OP 4.12)**

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. In the project site, there are no affected communities that require to be resettled since the area to be developed is already largely under cultivation. The Rwamagana Project is designed in a way that avoids physical resettlement. However, some trees and crops will be affected and compensated. In addition to that, both marshland and private land will be submerged at planned dam reservoir site and the current users will need new land for farming.

- **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 are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices.

During environmental screening process of a project, Category A or B projects are subject to the provisions of this policy especially since they might involve significant excavations, demolition, and movement of earth, flooding, or other environmental changes that could affect physical cultural resources site recognized nationally. Information from the study field investigations,

public consultation with local stakeholders, records from knowledgeable cultural institutions and desk review indicated that the project intervention area does not currently possess such cultural heritage. It is a marshland and has for quite some time been used for agriculture with no monuments, graveyards, religious set-ups or other cultural heritage in it.

- **Safety of Dams- OP/BP- 4.37**

For the life of any dam, the owner is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam, irrespective of its funding sources or construction status. There are serious consequences if a dam does not function properly or fails. World Bank refers to the International Commission on Large Dams (ICOLD) a non-governmental International Organization which provides a forum for the exchange of knowledge and experience in dam engineering and distinguishes between small and large dams.

(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.

None of the four dams to be rehabilitated or constructed for into large dam and will be required to follow Bank requirements for small dams. For small dams, generic dam safety measures designed by qualified engineers are usually adequate.

3.3.3. EAC protocol on environment and natural resources

This Protocol applies to the East Africa Partner States' cooperation in the management of the environment and natural resources within their jurisdiction including trans boundary ecosystems and natural resources. In regard to article 3 of this Protocol, it is a protocol of general application and shall apply to all activities, matters and areas of management of the environment and natural resources of the Partner States, including the following: (i) sustainable environment and natural resources management; (ii) management of trans boundary resources; (vi) management of water resources.

3.3.4. Framework Convention on Climate Change

This convention takes into account the fact that climate change has trans-boundary impacts. The basic objective of this convention is to provide for agreed limits on the release of greenhouse gases into the atmosphere so as to prevent the occurrence of climate change. It also aims to prepare countries to minimize the impact of climate change, should it occur.

3.3.5. Convention on Biological Diversity

The convention on biological diversity has three goals. These are:

- Conservation of biodiversity;
- Sustainable use of the components of biodiversity; and

- Fair and equitable sharing of the benefits arising from the use of genetic resources. Rwanda has ratified this convention and all project developer is urged to implement the convention during project implementation.

Based on the above assessment of legal and institutional framework both national and international, the consultant can conclude that the rehabilitation of irrigation facilities in Rwamagana District has a comprehensive legal and regulatory framework that can enable the project implement in sustainable manner. However the consultant recommend to implement the proposed project in consider of both national laws and policies but also international policies and standards especially the JICA guidelines on environmental and social considerations.

CHAPTER FOUR: ENVIRONMENTAL AND SOCIAL BASELINE DATA

The objective of EIA is to ascertain environmental and socio-economic baseline conditions and then assess the impacts as a result of the proposed project of rehabilitation of irrigation facilities in Rwamagana District during various phases of the project cycle. In order to understand the existing environmental and socio-economic conditions baseline data has been collected, compiled and analysed for the following:

- Socio-economic environment (demography, livelihood, income socio-economic etc.)
- Physical environment(Land and soil-water-air & climate);and
- Ecological environment (flora and fauna);

The information presented in this chapter has been collected from various sources. Majority of data have been collected from field visits and surveys, laboratory tests and from secondary data available in different reports. Formal and informal discussions were held with the local people, project affected people and local government/non-government organisations that provided very useful information for preparation of this report. Information on project facilities, size, magnitude and cost of the construction activities of the project have been taken from the draft preliminary design report of August 2016 and information provided by JST.

Therefore, this chapter provides information on the physical, biological and socio-economic elements of the project area which shall be used as benchmarks for future monitoring. The area considered for assessment of baseline conditions is Rwamagana district in general and specific baseline data were collected for project sites and their vicinity including marshlands, hillsides and marshlands users.

4.1. Socio-economic baseline data for Rwamagana district

For a better understanding of socio-economic setup of the project area, it's critical to assess the socio-economic profile of the district. Therefore, this section describes demography of Rwamagana population including size and spatial distribution of the population, socio-cultural characteristics of the population, and educational characteristics of the population, economic activity characteristics of the population, household characteristics, housing characteristics, and access to socio-economic infrastructures. At district level, data were obtained through secondary data available at district, the third and fourth integrated living condition survey (EICV 3 and EICV4) and the 4th Rwanda Population and Housing Census (PHC4).

4.1.1. Population size, spatial distribution, and structure

According to the PHC4, Rwamagana is the least populated district in Eastern province with about 313 thousand inhabitants, representing 12% of the total resident population of the province. Two districts which have high population density (Inhabitants/km²) are Rwamagana (460 inhabitants/km²) and Ngoma (388 inhabitants/ km²).

Furthermore, PHC4 have enumerated 313,461 residents in Rwamagana, which represents 24.7% of the total population of the Eastern province (259,5703 residents). The population of Rwamagana is predominantly female; 159,854 are women corresponding to 51% of the total population. Females are predominant in almost all sectors of the district except in Muhazi (44.3%). Kigabiro is the mostly populated sector with over 30 thousands residents. They represent 10.4% of the total population of the district. The least populated sector is Nzige

(15,504 inhabitants). This represents 4.9% of the total resident population of Rwamagana.

On spatial distribution, Rwamagana population is predominantly rural whereby 91.4% of the resident population (313,461 inhabitants) lives in rural areas and only 8.6% lives in urban areas. Kigabiro is the most urbanized sector of Rwamagana with 55% of its population residing in urban areas. It is followed by Karenge (22.2%) and Gishari (7.7%). The table below presents the distribution of the resident population of the district by sector, sex and density.

Table 8: Distribution of population in Rwamagana district by sector, sex and density

Sectors	Both sexes	Male	Female	% of female	Population share (% of the total population)	Density (inhabitants/km ²)
Rwanda	10,515,973	5,064,868	5,451,105	51.8		415
Eastern Province	2595703	1258090	1337613	51.5		274
Rwamagana district	313,461	153,607	159,854	51	100	460
Fumbwe	21,682	10,467	11,215	51.7	6.9	493
Gahengeri	23,517	11,459	12,058	51.3	7.5	373
Gishali	23,033	11,088	11,945	51.9	7.3	511
Karenge	22,755	11,065	11,690	51.4	7.3	359
Kigabiro	32,730	16,206	16,524	50.5	10.4	867
Muhazi	29,505	16,444	13,061	44.3	9.4	512
Munyaga	16,207	7,479	8,728	53.9	5.2	390
Munyiginya	16,980	7,991	8,989	52.9	5.4	531
Musha	21,145	10,122	11,023	52.1	6.7	472
Muyumbu	24,242	11,978	12,264	50.6	7.7	482
Mwulire	21,829	10,451	11,378	52.1	7	394
Nyakaliro	20,196	9,916	10,280	50.9	6.4	404
Nzige	15,504	7,441	8,063	52	4.9	387
Rubona	24,136	11,500	12,636	52.4	7.7	434

Source: PHC 4, 2012 (NISR)

Furthermore, the population of Rwamagana is mostly young. 65% of the resident population of Rwamagana is under 25 years old, as shown by the age pyramid, reflecting the high level of fertility in the recent past. The elderly (60 years and above) represents 5% of the total population of the district.

4.1.2. Socio-cultural characteristics of the population

Rwamagana hosts few foreigners and only 353 residents are foreigners (out of 313,461 residents). Christianity is the predominant religion in Rwamagana district 91.4% of the total resident population. Protestants represent 39.5%, Catholics are 40.2%, Adventists are 10.9% and Jehovah witnesses are 1.0. Muslims represent 3.1% of the total resident population of the district, 1.5% of the resident population declared to be without religion.

In regard to marital status, the percentage of married and the never married people were the same in Rwamagana district (45.2%) at the time of census. Also, the percentage of widowed was the same as the percentage of separated persons (0.7%). 7.0% were widowed, while separated and divorced are (7.0 %). At the sector level, two sectors with high percentages of currently married people are Nyakaliro (48.7%) and Fumbwe (47.7%). Kigabiro sector has the highest

percentage of the never married persons (51.2%) while Gishari has the highest percentage of widowed persons (8.5%).

4.1.3. Educational characteristics of the population

School attendance among Rwamagana residents varies across education levels. It is very low (26%) for preschool-age population (3-6 years), high (95.5%) for primary school-age population (7-12 years), and low (68.7%) for secondary school- age population (13-18 years). School attendance varies also across sectors where by preschool-age varies from 26% in Fumbwe to 44.6% in Muhazi, primary school-age varies from 90% in Gahengeri to 95.5% in Nyakaliro and secondary school; it varies from 68.7% in Fumbwe to 80.9% in Muhazi.

The net and gross attendance rates in secondary education are below 50% in Rwamagana district. This means that more than a half of children who are supposed to be attending secondary school are not actually attending both gross and net attendance rates in secondary are greater for males than for females. There are also variations by sector where net attendance rate is 30.9% in Kigabiro sector while it is 16% in Munyiginya sector.

4.1.4. Labour force in Rwamagana population

The official working age in Rwanda is 16 and above. In Rwamagana, 74.7% of the residents aged 16 and above are in the labour market- either working or looking for a job (economically active). Labour force participation is more intense among males (77.6%) than among females (72.2%); in rural areas (74.1%) than in urban areas (69.4%). The labour force participation varies greatly in Eastern province: from 70.5% in Bugesera to 81.0% in Ngoma.

Labour force participation is around 40% at age of 16 (official entry age into labour market) and around 70% at age of 65 (official age for retirement). Labour force participation is intense among residents aged 25- 60 with more than 60% of the population in the labour market. The census identified some gender disparity is remarkable as males' contribution to labour force is greater than females one at all age groups.

In Rwamagana district, 3.0% of the total population into labour market was unemployed during the week preceding the census. Unemployment rate was high for females than for males (3.6% Vs 2.3%). In Rwamagana district, unemployment rate (UR) was higher in urban areas (4.7%) than in rural areas (2.8%). The figure below presents the labour force rate in Rwamagana by age and sex.

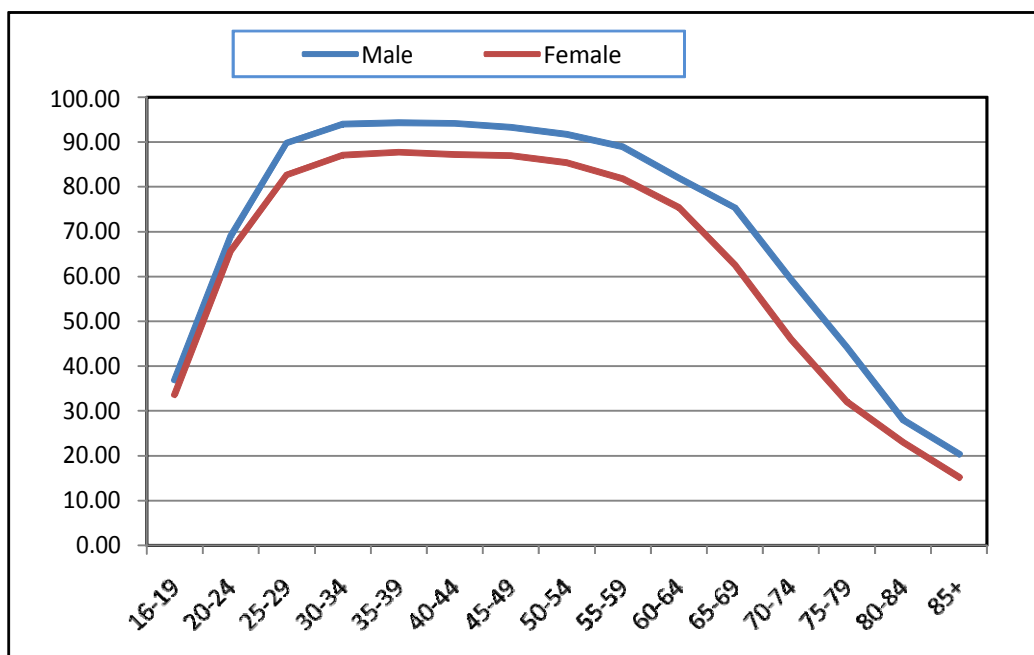


Figure 9: Labour-force participation rate in Rwamagana by age group and sex

4.1.5. Households characteristics

The average household size in Rwamagana district is 4.1 persons. Household size varies from 3.9 persons in Kigabiro to 4.4 persons in Fumbwe. While at the national level, 28.7% of private households are headed by women, the high percentages of households headed by women are found in the sectors of Munyaga (36.7%), Muhazi (36.6%) and Munyiginya (35%), while small ones are in Karengwe (24%), Nyakaliro (24.6%).

4.1.6. Standards of living of Rwamagana population

The poverty line defines a level of household consumption per adult below which a household is deemed to be poor. Rwanda uses a basic need approach to measuring poverty. In this report, households are classified as poor or non-poor based on consumption per adult equivalent compared with a total poverty line of 159,375 Frw or an extreme poverty line of 105,064 Frw, in January 2014 prices.

The poverty line used here is set with reference to a minimum food consumption basket, which was judged to offer the required number of calories required for a Rwandan who was likely to be involved in physically demanding work, along with an allowance for non-food consumption. An extreme poverty line was also set as the cost of buying the food consumption basket if nothing was spent on non-food at all; this line corresponds to Frw 83,000 and the poverty line corresponds to Frw 118,000.

Poverty in Rwanda in 2013/14 is lowest in the three districts of Kigali City. Its incidence is notably low in Kamonyi, Rwamagana and Kayonza. The greatest concentrations of poverty in Rwanda are in the South and the West, including districts of Gicumbi and Burera from Northern Province. The regional variations of extreme poverty follow similar patterns. According to EICV4, 70% of the population in Rwamagana district is identified as non-poor, 25% as poor (excluding extreme-poor) and 5% as extreme-poor.

4.1.7. Vulnerable groups

Groups that are considered particularly vulnerable by the Government of Rwanda are children under five years old, elderly people aged 65 and over, and people with disabilities. The

government delivers a core set of social protection programmes through the Ministry of Local Government (MINALOC), supported by a number of complementary initiatives delivered by other ministries. The main programme run by MINALOC, and a flagship of the Economic Development and Poverty Reduction Strategy, EDPRS 2008–2012, is the Vision 2020 Umurenge Programme (VUP) which contains three pillars: VUP public works, VUP direct support, and VUP financial services. The three pillars represent public works for the poor who are able to work, cash transfers for very poor households without labour capacity, and financial services such as the Ubudehe Credit Scheme. Rwamagana has 5.4% of people with a major disability. This percentage is above the national average of 4.5%. The district with the most people with a major disability is Burera, with 8.2%.

4.1.8. Housing and energy

The main wall material of dwellings are classified as follows: mud bricks, mud bricks covered with cement, tree trunks with mud, tree trunks with mud and cement, oven-fired brick, and other unspecified material. According to EICV3, in Rwamagana, 51% of households use mud-covered tree trunks as their wall material, ahead of mud bricks covered with cement (20%) and mud bricks (12%). At national level, 35.2% of households have mud-covered tree trunks as their wall material while in urban areas the figure is only 17.1% and 38.3% in rural areas. It is clear that Rwamagana district is still below the rural area average in terms of improving wall construction material.

The primary sources of energy used for lighting by households are categorised as follows: electricity, oil lamp, firewood, candle, lantern, battery, and other unspecified sources. In Rwamagana district, 10% of households use electricity as their main source of lighting; this ranks the district among the 10 districts in the 6–21% interval for households using electricity for lighting and it is above the rural average. On average, the urban areas have 46.1% of households using electricity as the main source of lighting while it is only 4.8% in rural areas and 10.8% at the national level.

4.1.9. Distance to key socio-economic facilities/service

Walking distance to basic services can be considered an indicator of both provision and coverage of such services and the remoteness of households' dwellings. The basic services were categorised into food market/shop, primary schools, secondary school, and health centres. Rwamagana is classified among 12 districts with a mean walking distance to a primary school within the interval of 21.6 to 28 minutes. The mean walking distance to primary school in Rwamagana district is 26.6 minutes and 40% of households are between 30 and 59 minutes from a primary school. This walking distance to a primary school in Rwamagana is above the mean distance in rural areas, which is 28.6 minutes. The mean walking distance to a primary school is 19.4 minutes in urban areas, while it is 27.2 minutes at national level.

4.1.10. Economic activity and income sources

According to EICV3, the overall employment rate is 84% of the resident population aged 16 years and above in Rwamagana district; the unemployment rate is 0.3% and the economic inactivity rate is 16%. Rwamagana district is ranked 11th last of all districts by employment rate. Most people aged 16 years and above in Rwamagana have independent farmer as their main job (68%); this is followed by wage

non-farmer (13%), independent non-farm (10%) and wage farm (6%).

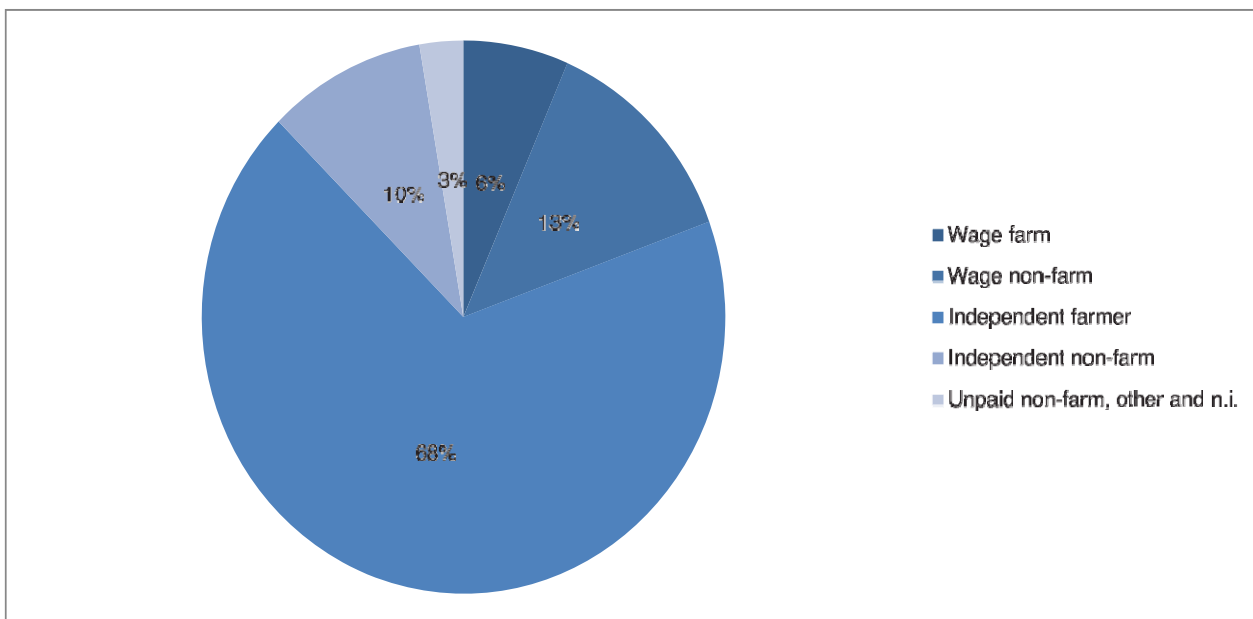


Figure 10: Employment types (usual main job) in Rwamagana

Based on all persons aged 16 and above usually working, the following figure presents the industry of usual main jobs in Rwamagana. Agriculture is shown as the main industry for 76% of the population aged 16 and above, followed by trade with 8%.

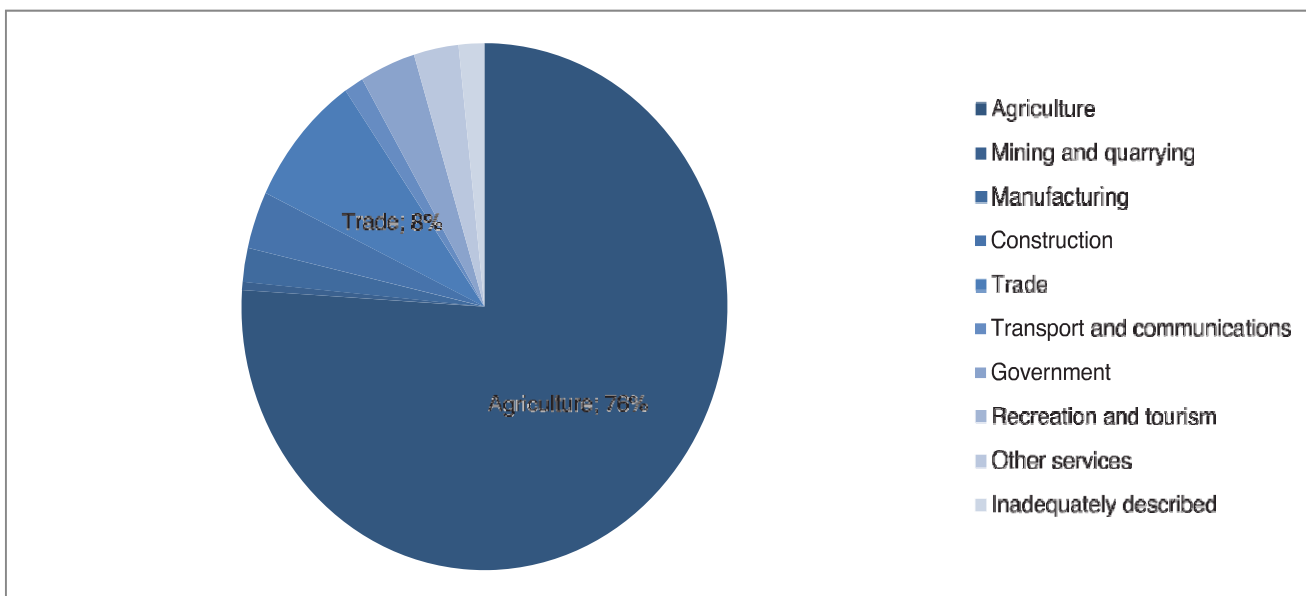


Figure 11: Industry of usual main jobs in Rwamagana

4.1.11. Source of income

This section focuses on five main components of income: agricultural income, wage income, business income, rent income, and income from transfers.

Household agricultural income: this component is first divided into agricultural income (income from land cultivation) and livestock income. Unless otherwise specified, this report sums the two components into one agricultural component. It includes revenues from sale of crops, processed crop products, livestock products and other agricultural products, own

consumption of food and non-food products, and the revenues from renting out livestock and sale of small animals. The income aggregate deducts costs on crop inputs, inputs used for processing crop products, and expenditure on livestock and the cost of renting land. Within the costs, the income aggregate includes the depreciation of land and agricultural equipment. The depreciation rate is equal to 0.2 per annum.

- **Wage income:** this includes cash and in-kind revenues received from farm and non-farm work. In-kind payments include food and other agricultural products, provision of house and other benefits received for the work.
- **Non-farm self-employment (business):** this includes income received net of labour and other inputs.
- **Income from rents:** this includes actual rents received from renting out livestock, agricultural equipment and land (rent and sharecropping), as well as imputed rental value of owner-occupied dwellings.
- **Transfers:** transfers include remittances received (cash and in-kind) and other private transfers. It also includes public transfers. Private transfers received from dowry and sales of assets and land are excluded.

The EICV3 results shows that at the national level agriculture contributes the largest share of a household’s income (46%), followed by wage income (25%), business income (i.e. self-employment), transfers, and rents. The following Figure presents the household income shares in Rwamagana district. It shows that household income is driven by agriculture (42%), followed by wage income (22%), business income (21%) and rents (10%). The smallest contributor to household income in Rwamagana district is public transfer income, with 0.2%.

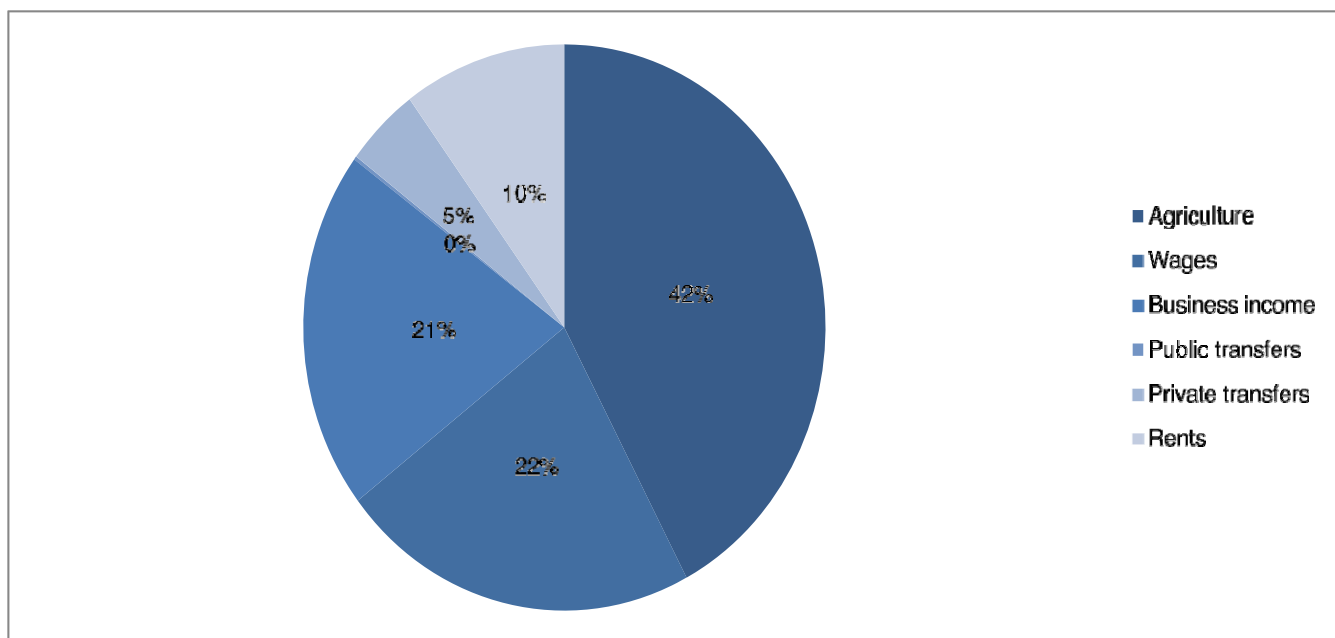


Figure 12: Household income shares in Rwamagana

4.2. Socio-economic profile of project affected persons/project beneficiary

This section describes the socio-economic conditions of project beneficiaries or project affected persons so as to set up the baseline that will be used in the evaluation of project impact. The consultant team used a team of surveyors to collect baseline data on socio-economic conditions of farmers who are using marshlands to be rehabilitated including rice farmers, vegetable

growers and other who are using the marshlands for non-irrigated crops like suit potatoes and maize growers.

4.2.1. Population, sample size, data collection and analysis techniques and methods

The Environmental Impact Assessment (EIA) and Resettlement Action Plan (RAP) for the proposed project of rehabilitation of irrigation facilities in Rwamagana conducted on project beneficiaries and project affected people.

- **Population selection**

Purposes methods was used to determine the population since the 1019 household used as project beneficiary did not give an indication of characteristics of the said population. Since the proposed project aim at promoting irrigation rice as the priority crop in the four marshlands, and based on the fact that the project impact shall be measured mainly on the improvement of rice farmers. Initial the total number of rice farmers in the marshlands was estimated at 1019 and this number was considered as total population for the survey purposes.

- Cyaruhogo: 453
- Cyimpima : 252
- Gashara : 185 and;
- Bugugu : 129

- **Sample size**

As the population were large, the consultant has preferred to use sample from the whole population and the field results were estimated to the whole population. According to the Research Advisors (2006) ¹ accessed on, <http://www.tools4dev.org/wp-content/uploads/Sample-size-table.jpg>/retrieved on 20th September, 2016, the total sample size for this study were 716 households having parcel land in one of the four mentioned marshlands. As recommended by sampling technique, 453 households for Cyaruhogo marshland were estimated to 300 (< 450) population size to get exact sample size, 256 (>250) households for Cyimpima were estimated to 500 population size, 223 (<250) for Gashara were estimated to 200 population size and also 127 (<250) households for Bugugu were estimated to 200 population size. The consultant has used a margin error of $\pm 3\%$ or ± 0.03 for reducing bias for the study results and meets the sampling standards for the population less than 1000 population size.

- **Sampling technique**

The consultant has applied sampling without replacement, it is in that context the whole targeted sample were not met only 70.20% to total sample were assessed and remaining 29.80% were absent during the whole period of interview. For selecting and determining the sample from whole population systematic sampling were used as the consultant has a list of all household with land in each mentioned marchland.

Table 9: Households interviewed by marshlands

Marshlands	Estimated current users	Sample size	Users reached
Cyaruhogo	413	289	224

¹ Most statisticians agree that the minimum sample size to get any kind of meaningful result is 100. If your population is less than 100 then you really need to survey all of them. The rules of thumb are perfectly acceptable for most basic surveys, sometimes you need to sound more “scientific” in order to be taken seriously. In that case you can use the table. Simply choose the column that most closely matches your population size. Then choose the row that matches the level of error you’re willing to accept in the results.

Cyimpima	256	241	218
Gashara	223	169	158
Bugugu	127	119	116
Total	1019	818=80.27%	716=87,53%

Source: BESST Ltd, 2016

- **Data collection and analysis techniques and methods**

Data were collected using questionnaire completed by surveyors who recording the answer given by the interviewee during data collection interview period. After data collection data were summarized in form of tables as descriptive statistics and cross tabulations for assessing the level of agreement for each item assessed in each marshland.

4.2.2. Profile of respondents and socio-economic activities

For each household one person was interviewed and provided information about the whole household member. The figure below illustrates respondent main occupation.

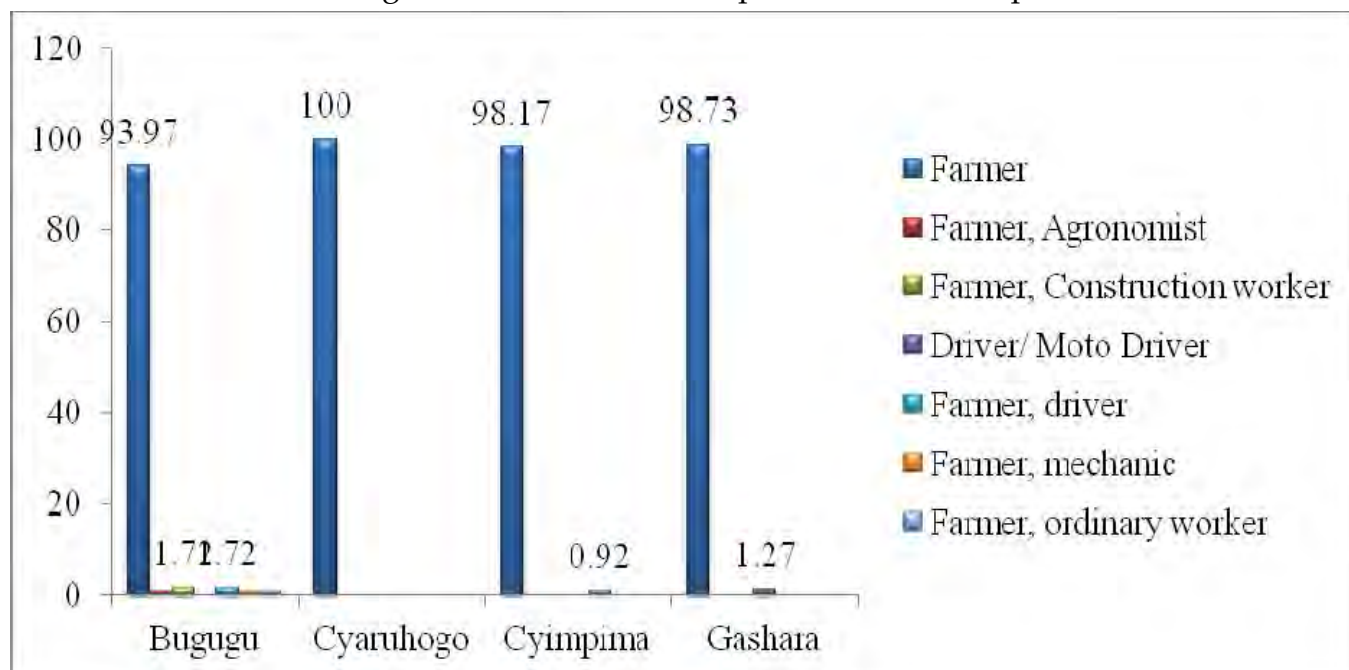


Figure 13: Occupation of respondents

From the above table, it is clear that more people in all four marshlands are farmers, 93.97% in Bugugu marshland, 97% in Cyaruhogo and 98.17% in Cyimpima and 98.73% in Gashara marshland. The field assessment revealed that the main income generating activity is field crop which represents 98.28% in Bugugu, 93.93% in Cyaruhogo, 97.71% in Cyimpima and 97.47% in Gashara.

The second main activity that provide income is livestock which represents 1.8% in Bugugu, 0.89%, in Cyimpima, 2.53%) in Gashara and 2.3 in Cyaruhogo. Other income source activities include agricultural labour in cell, Agricultural labour in town, construction worker, transportation (driver), government employee, remittance from Kigali, remittance from abroad and any other with periodic income.

- **Annual income**

The annual income was estimated based on response provided by respondent who has income generation activity like agricultural labour in cell, agricultural labour in town, construction worker, transportation (driver), government employee, remittance from Kigali, remittance from abroad and any other with periodic income. Only a few number of respondent provided their annual income due to the nature of their main activities. To have the real annual income we used the income from rice selling since most of farmers are involved in rice farming and they are growing rice twice year though the coverage in season A depend on the availability of water. Since there was no reliable data to compare the two seasons we adopt to consider them equally.

Table 10: Annual income for households

Name of the Marshland	Number of farmers	Total production in kg/season	Total cost of produce in Frw/season	Total investment in Frw	Total benefit in Frw	Average annual income ¹
CYIMPIMA	256	293,804	69,043,940	46,641,385	22,402,555	175,020
BUGUGU	127	160,325	37,676,375	26,892,250	10,784,125	169,829
CYARUHOGO	739	575,397	135,218,295	94,727,395	40,490,900	109,583
GASHARA	223	224,170	52,679,950	34,359,850	18,320,100	164,306
Total	1345	1,253,696	294,618,560	202,620,880	91,997,680	154,684

Source: BESST Ltd, 2016

- **Religious adherence**

The respondents are into three religion of preference where people from Bugugu marshland 29.31% are Catholic, 61.21% are Protestant, 8.62% are Muslim, in Cyaruhogo marshland 33.48% are Catholic, 61.61% are Protestant, 4.91% are Muslim, in Cyimpima marshland 30.73% are Catholic, 63.30% are Protestant, 3.67% are Muslim and in Gashara marshland are 41.77% Catholic, 52.53% are Protestant, 5.06% are Muslim.

- **Cooperative membership**

In Rwanda cooperative or association play a big role as a tool for capital accumulation and small businesses development. The assessment confirmed this tendency whereby 99.14% households are members in Bugugu Cooperative, 99.55% in Cyaruhogo, 99.08% in Cyimpima and 100% in Gashara marshland.

- **Households size**

The findings show that the average household mean size is varying from 4.7 to 5.2. In Bugugu the average household size is 5.2, in Cyaruhogo are 4.7, in Cyimpima are 5.1 and in Gashara are 4.8. This does not differ a lot to the household size in the rest of district.

- **Vulnerability**

During baseline survey, vulnerability was considered and during project implementation this group of people should be given a special attention. Were considered as vulnerable people living with disability, orphan and people above 65 years old

The vulnerability is not at high level in the assessed households, it is at 2.30% in Bugugu, 2.19% in Cyaruhogo, 4.44% in Cyimpima and 2.91% in Gashara. Detailed list of vulnerable people is

¹ For annual income we multiplied one season income by two season

presented as appendix 5. The table below presents number of vulnerable people identified in project area by marshlands and nature of vulnerability.

Table 11: Vulnerable people by marshland

Site/ Type of Vulnerability	Disability	Old	Orphan	Others
Bugugu	11	2	1	0
Cyaruwego	5	12	6	0
Cyimpima	33	11	2	1
Gashara	14	8	0	0
Subtotal	63	33	9	1
Grand Total				106

Source: BESST Ltd, 2016

4.2.3. Asset and economic survey (Land Use & Land Tenure)

This section describes assets and economic activities and other development features of households. Here the main focus was made on the nature of housing, economic activities, type of crops, quantity produced per year and quantity produced annually, size of lands and average annual or monthly income from the grown crops or any other economic activity produced.

- **Characteristics of household residential land**

The findings show that residential lands are located on hillsides and no residential house found in marshlands or in area to be submerged. The house walls are mostly made in wood and mud in Bugugu (68.10%), Cyimpima (88.53%) and Gashara (49.37%) rather than Adobe bricks and Burnt Bricks. Adobe bricks is at level of 23.28% of the houses in Bugugu, 55.80% in Cyaruwego, 10.09% in Cyimpima and 49.37% in Gashara and Burnt Bricks is at 1.72% in Bugugu, 43.75% in Cyaruwego, 1.38% in Cyimpima and 1.27% in Gashara. The preferable roof type in households is iron sheet at 93.10% in Bugugu, 99.11% in Cyaruwego, 98.62% in Cyimpima and 100% in Gashara. Some households are not owned their residential land, only 83.05% in Bugugu, 81.70% in Cyaruwego, 98.44% in Cyimpima and 90.51% in Gashara owned residential land. The remaining households live in grouped settlement where the land is registered to government or are renting the house they are living in.

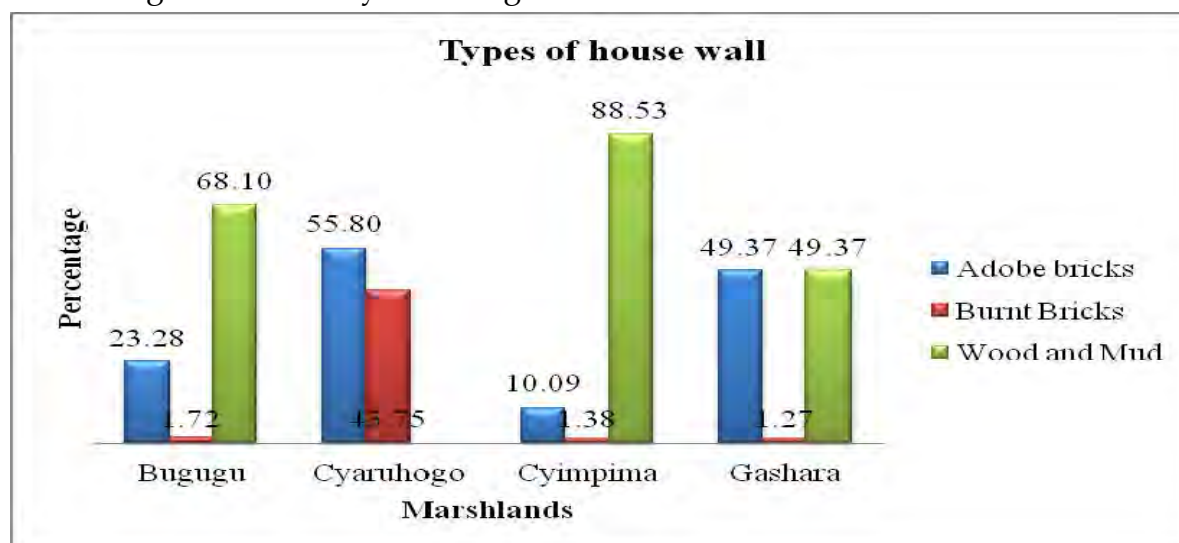


Figure 14: Type of house wall for the households

4.2.4. Characteristics of household farming land

The survey revealed that most of farmers have land in both hillsides and marshland 96.6% for Bugugu, 99.1% in Cyaruhogo, 97.2% in Cyimpima and 89.9% in Gashara. Only few households have farming land in dame site (flooded areas), only 0.86% for Bugugu, 0.45% for Cyaruhogo, 1.38% for Cyimpima and 11.39% for Gashara marshland. All farmers who have land in area to be submerged and in the marshlands were identified separately so as to assess potential impact and results are presented in the chapter on social impact assessment.

- **Farming land in marshland**

The assessment shows that the most preferred crop by farmers in marshland is Rice (Paddy) as it is grown by 98.3% of households in Bugugu, 99.6% in Cyaruhogo and 78.1% in Cyimpima. The means of irrigation are gravity (canal), manual and rain fed crops. The main rain fed crop is maize and some vegetables. Rice is grown twice per year but the favourable cropping season for rice paddy is season B¹ (71 respondents in Bugugu, 232 respondents in Cyaruhogo, 96 respondents in Cyimpima and 142 respondents in Gashara). And a larger quantity of farming outcomes mainly rice paddy are sold to the farmer Coop/Union (confirmed by 142 respondents in Gashara, 212 respondents in Cyimpima, 231 respondents in Cyaruhogo and 66 respondents in Bugugu marshland).

Though the marshland is mainly used to grow rice, some farmers are growing other crops and the figure below present the use of the land in the marshlands by crop and by owned land and but it is worth to note that farmers change crops by season.

- **Hillside land above F.W.L (Land that will not be affected)**

Data shows that most of households have cropping land in hillsides that is 47.41% for Bugugu, 54.38% in Cyaruhogo, 56.42% Cyimpima and 55.70% in Gashara. It is clear that, the most developed crop in hillside is beans (incl. soya) and banana. The land in hillsides is owned by farmers all of them have land titles. The private to be affected were identified separately and results are presented in impact assessment.

- **Farming land in flooded area**

Using the questionnaire it was not easy to identify farmers in area to be submerged and the consultant used GIS expert to identify farmers who have land in the area in Cyimpima, Bugugu and Gashara farmers are mostly growing rice on the land to be submerged up stream of the dam. In Cyaruhogo the land to be submerged is owned by government but the land is leased to one farmer who in turn has farming contract with 121 farmers who are growing maize, sweet potatoes, soybeans and vegetables.

4.2.5. Living and Health Condition of households

- **Source of energy**

The study results show that firewood is the main source of energy for cooking with 93.62%, the second is charcoal at 5.87%, other sources of income (not mentioned) at 0.81% and the last is kerosene at 0.44% from all households assessed. The main source of household energy for lightening is battery light (54%), the second is kerosene lamp (22.8%), the third is solar battery system (9.8%), the forth are other sources not stated by respondents (9.6%), the fifth is electricity

¹ Season B means the season that start in February to end in June

(8.5%), the sixth is candle (2.6%), 1.7% do not have any source of lighting, 1.3% are using Nuru light, and the last are these using telephone light (0.4%).

- **Source of domestic water**

The main source of water for domestic use in rainy season in general is spring (38.92%) and to get water in rainy season takes time less than 30 minutes (48.16%), between 31-60 minutes (43.65%) and more than one hour (8.19%). In the other case, the main source of water for domestic household use in dry season is spring (59.17%), and it takes time between 31 and 60 minutes (50.19%), less than 30 minutes (50.19%) and more than one hour (11.64%).

- **Medical issues**

The study revealed that the main medical issue affecting households in four marshland (Bugugu, Cyaruhogo, Cyimpima and Gashara) is malaria (55.79%), Diarrhea (17.81%), Stomach problems (11.61%), Respiratory problems (5.44%), others (not stated) (4.55%), eye infections (3.81%), STIs/HIV/AIDs (0.93%), and Problems during pregnancy/child birth (0.06%). It was also revealed that 100% of households' members have health insurance known as « Mutuelle de santé¹» Mutual Health insurance.

4.2.6. Accident and Safety

The findings show that only 31.03% of respondents in Bugugu, 29.46% in Cyaruhogo, 9.17% in Cyimpima and 0.63% in Gashara have observed traffic accident in their village. Gashara it's like none saw the traffic accident only 0.63% of respondents other (99.37%) were not. The main² cause of traffic accident in the villages is bicycle (41.99%), the second is Motorcycle (34.31%), the forth is vehicle (14.67 %.)

4.2.7. Perception on the proposed Project

This study shows that, based on the consideration of all respondents, this project is very good (87.83%), relatively good (8.71%), moderate (3.40%) and the remaining percentage is appreciating the project relatively. The reason which makes farmers to appreciate project are linked to the expected solutions they will get and attributes for improving their social economic development conditions. They believe that once the rehabilitation is completed they will be able to grow rice twice per year and they will be able to use all the land in the marshland. Furthermore they are expecting to increase production and get employment during construction.

¹ This is government medical insurance scheme whereby all citizens contribute in advance a certain amount of money to cover medical expenses and when is sick, the scheme cover 90% of the total medical bill. Government also put some money in the insurance fund.

² It important to note that If two means of transport means such as a car and a bicycle and a car, the main cause of accident is defined by the conductor who is found guilty

4.3. Physical environment baseline data

The physical environment assessed in the present environment and social impact assessment study include geological formation and soil, hydrology and water resources, climate and weather conditions and land use set up in project area.

4.3.1. Physiography and land use of District

The project of rehabilitation of irrigation facilities in Rwamagana is located in the lowlands of the East. The lowlands are dominated by a depression of the relief, generally undulating between 1500-1100 m of altitude. Land use and land covers patterns are important in environmental impact assessment study from the point of view that land use describes the present use such as agriculture, settlement, etc. and land cover, describes the material on it such as forest, vegetation, rocks or building etc. Land uses details of the district have been compiled from various sources and results so obtained are presented in the following table.

Table 12: Land use details of Rwamagana

S. No.	Land Use	Area (Km2)	Percentage (%)
1	Agriculture Land	473.6	68.69
2	Residential	27	3.97
3	Commercial	8.8	1.27
4	Savannahs	1.1	0.16
5	Water bodies (lakes/Streams)	35	5.16
6	Plantations eucalyptus and Pinus	33.3	4.92
7	Roads, marginal lands, wetlands	109.2	15.83
	Total	688	100

Source: EICV 3

The National Institute of Statistics of Rwanda (NISR) reveals that the mean size of land cultivated per household in Rwamagana is 0.7 ha. Even though it is below the national average, Rwamagana has also 78% of cultivating households that cultivate under 0.9 ha of land. Regarding soil protection against erosion on one hand, statistics unveil that the percentage of land that has been reported as protected against soil erosion in district is 86%. Around 78% of cultivated land nationally is reported as being protected against erosion. On the other hand, the percentage of the land irrigated is 5.5% (3% at national level). The percentage of agricultural households incurring expenditure on chemical fertilizer by in Rwamagana is 30.5% (national average is around 29%).

Agriculture sector is dominated by banana plantations which is the most grown crop in Rwamagana. Other seasonal crops include mainly rice plantations in the wetlands surrounding various lakes found in this area (Muhazi, Mugesera, Sake and Nyabarongo River). Additional, beans, maize, potatoes and different vegetables are grown in the district.

In addition to crops, livestock is another important source of income and food for agricultural households. 70% of all households in Rwamagana District raise some type of livestock. Livestock comprising mainly cattle keeping on one side and goats, sheep, pig, hen and rabbit breeding is common practice in Rwamagana District. Figures below illustrate the land use in the

project area.



Figure 15: Rice and vegetables in marshlands



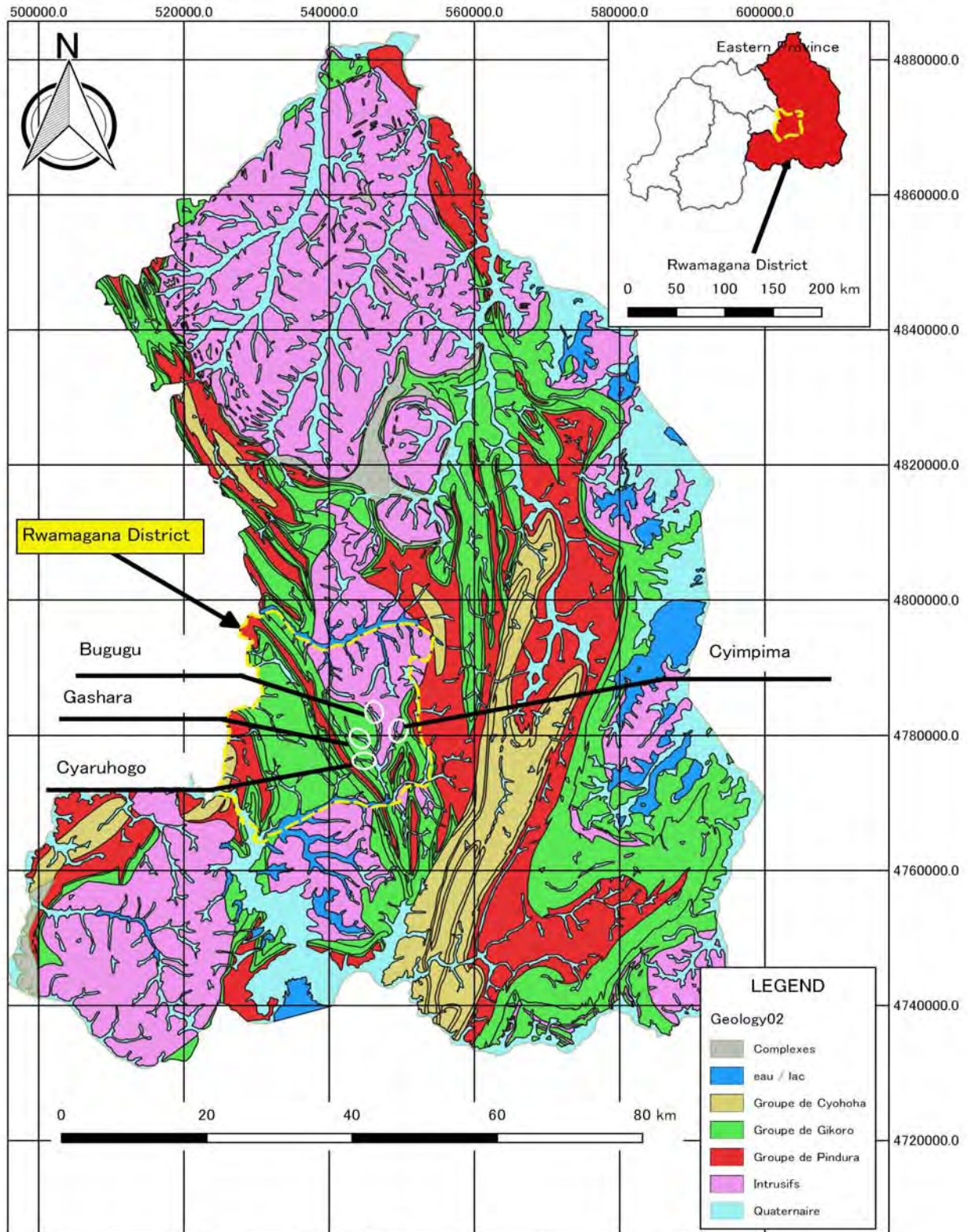
Figure 16: Forest, woodlands and banana on hillsides

4.3.2. Geology and soils

According to geological map of Rwanda(Office Rwandais des mines et géologie, OGMR), Rwanda has a complex geological history which presents itself in varied topographic profiles from the mountainous Northwest to the glass land of Akagera in the East. The oldest rocks of Rwanda are the Paleoproterozoic migmatites, gneisses and mica schists overlain by the Mesoproterozoic Kibaran Belt. The folded and metamorphosed sediments of the Kibaran Belt are primarily schists and quartzites introduced by granites and cover most of Rwanda, including Rwamagana. In general, the district is underlain by granitic and meta-sedimentary rocks. The degree of metamorphism undergone by the sediments is generally low level. Pelitic rocks appear as sericitic schists or phyllites.

Rwamagana project area is underlain by Precambrian age rock of the Rwandan Super group that occupies most of the country. These rocks were emplaced during the lower Proterozoic Kibaran Orogeny of mountain building processes. According to the geological maps of Rwanda two stratigraphic groups of mid-proterozoic age are found in the vicinity of the project area. These units are folded about NNW-SSE trending fold axes, with the Bulimbi formation in the core of a syncline east of the site on higher terrain above the Urukaryi valley. The older sequence of Nduba, Musha and Nyabugogo formations are exposed sequentially on moving west, with the Musha formation underlying the valley floor and the Nyabugogo

formation underlying much of the more elevated country either side of the valley.



Geology map in Eastern Province, Rwanda

The soils encountered at different project areas vary from road to road. Generally the soils identified along the feeder roads are: red silt; silt with chocolate colour, lateritic gravelly with chocolate colour, blackish

lateritic gravelly, reddish lateritic gravelly, black hard clay, red silt, black silt, natural red laterite, natural lateritic gravel, natural chocolate lateritic, gravel red silt, gravel red lateritic, yellow gravel lateritic, gravel black silt, natural red silt, natural black gravel lateritic, red lateritic gravel, natural red lateritic gravel and black clay. It could be concluded that the soil in the area is a mixture of red gravels, silt and clay at different percentage.

4.3.3. Assessment of soil quality in the project area

The analyses was done on parameters recommended by the TORs and other relevant for irrigation project including pH, EC, T-N, CEC, EC, K, avail.P and heavy metals. The main objective of detailed soil survey was to determine whether the soil of the marshland is suitable for the rice production and predicts possible impacts to be screened for irrigation and crop production, with focus on:

- potential residual salinity or acidity resulting from high hydrostatic level of water in the aquifer may lead to excessive irrigation requirement or poor drainage;
- puddles of water likely to occur due to an excessive or poor irrigation water management;
- commercialization of agricultural inputs and produce may lead to mobile sources of water pollution (agrochemicals including fertilizers and pesticides) ;
- high concentrations of nitrate in the drinking water, particularly in underground water source;
- Predict potential risks of land use mismanagement and subsequent soil degradation.

Different soil units have been classified using the main international and regional soil classification systems in use in Rwanda (world soil classification FAO, soil taxonomy and « INEAC systems (National Agriculture Institute of Congo). The main constraints and potential degradation of the marshland have been described and recommendations for development and sustainable production for rice have been proposed taking in account soil properties, flooding control and mitigation as well as appropriate soil fertility practices. The results have been used for the production of soil and soil suitability (fertility) maps.

✓ Soil survey methods

Pits and profiles have been dug and described according to international and regional guidelines and protocols (Sys et al, FAO world map system and soil taxonomy). The survey is divided into 5 phases: the campaign preparation; field investigations, soil analysis, results compilation, interpretation and evaluation, survey report.

Land survey preparation: Land survey has been prepared using data collected through relevant information (Google earth maps, topographic and CPR soil maps) and Pits have been dug using a soil auger for core sampling at 0- 30 cm depth. Each pit is geo-located with a Garmin GPS (Oregon 600 and ETREX 30). The core samples are put side by side to reproduce their position in the soil. A photo of the pit illustrates the description.

Selection of samples sites: Three spots were selected for each site, 12 soil pits in total from four different marshlands, Gashara, Bugugu, Cyimpima and Cyaruhogo. The map below shows the

location of samples taken in reservoir, marshland upstream and marshland downstream. The map below shows the location of sample sites.

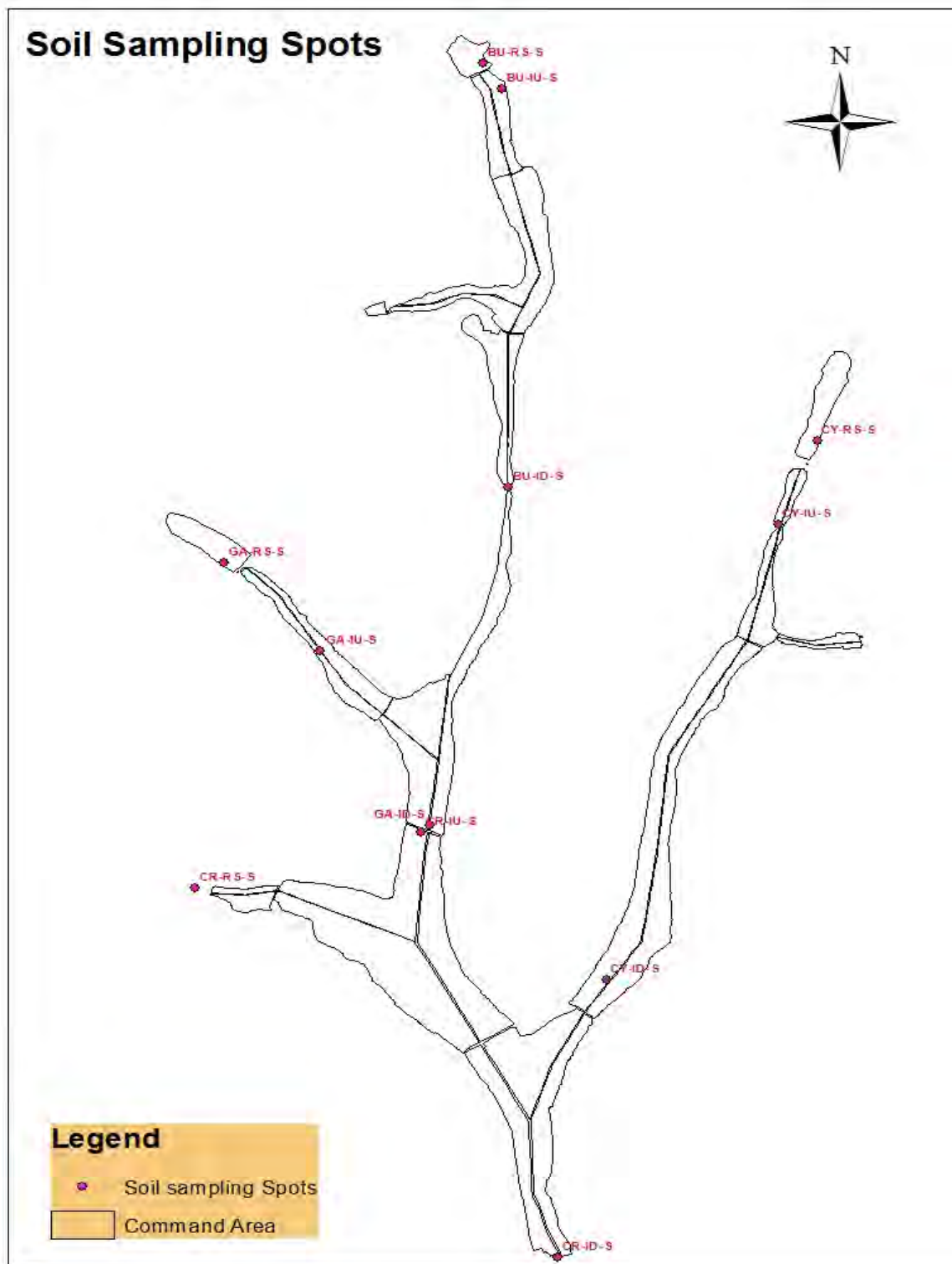


Figure 17: Location of sampling points



Figure 18: Soil sampling

- **Results of laboratory test**
 - **Cyimpima marshland**

In this site, 3 dominant types of soil were investigated in the irrigated area. These are: umbric gleysol, humic cambisols and mollic gleysol type of soil. Umbric gleysol is presumably occurring in the North-Eastern part of the Cyimpima irrigated area as well as the Eastern part of the same irrigated area. Generally, Cyimpima irrigated area is dominated by mollic gleysol type of soil. The results from laboratory analysis have shown that the soils were generally acidic (5.03-5.76), medium CEC (21.60 - 37.60 Cmol+/kg), moderately available Phosphorous (37.55 - 46.72ppm), very low total nitrogen (0.17-0.28%) and very low Potassium (0.06-0.14 Cmol/kg). On the other hand, the electrical conductivity results fall below the range of tolerance (105.3 -185.9 us/cm) which is a good indication of non-saline soils due to leaching of runoff in the area. Therefore, the soils are suitable for rice cultivation.

Table 13: Physico-chemical characteristics of Soil in Cyimpima site

X	Y	Code	pH _w	EC in dS/m	%TN	Avai..P in ppm	K in Cmol/kg	CEC Cmol+/kg
548927	4778840	CY-IU-S	5.03	0.18	0.17	37.55	0.06	36.40
549185	4779446	CY-RS-S	5.43	0.11	0.25	40.11	0.09	37.60
547789	4775555	CY-ID-S	5.76	0.12	0.28	46.72	0.14	21.60

Source: UR/CAVM, 2016

- **Bugugu**

In Bugugu marshlands, 2 dominant types of soil were investigated in the irrigated area. These are: Humic feral soils and Mollic Gleysol type of soil. Humic feral soils are presumably occurring in the

North-Eastern part of the Bugugu irrigated area as well as the Eastern part of the same irrigated area .generally Bugugu irrigated area is dominated by Mollic Gleysol type of soil. The results from laboratory analysis have shown that the soils were generally acidic (4.2 - 4.93), Medium CEC (26- 33.60 Cmol+/kg), Moderately available Phosphorous (29.57 - 48.64 ppm), very low total nitrogen (0.36 -0.42%) and very low Potassium (0.05-0.12 Cmol/kg)on the other hand the electrical conductivity results falls below the range of tolerance (36.73 -263.8.9 us/cm) which is a good indication of no-saline soils due to leaching of runoff in the area. Therefore the soils are suitable for rice cultivation.

Table 14: Physico-chemical characteristics in Bugugu site

X	Y	Code	pH	EC in dS/m	%TN	Avail.P in ppm	K in Cmol/kg	CEC Cmol+/kg
547094	4781977	BU-IU-S	4.93	0.36	0.42	29.57	0.05	33.60
546969	4782160	BU-RS-S	4.2	0.86	0.36	48.64	0.12	26.00
547135	4779107	BU-ID-S	4.67	0.26	0.42	36.23	0.06	28.80

Source: UR/ CAVM, 2016

- Gashara Marshlands

In Gashara marshlands 2 dominants types of soil were identified in the irrigated area. These are: humic cambisols and mollic gleysol type of soil. Humic cambisols is presumably occurring in the South west part of the Gashara irrigated area and generally Gashara irrigated area is dominated by mollic gleysol type of soil. The results from laboratory analysis have shown that the soils were generally acidic (4.96 - 5.35), Medium CEC (25.20 - 30.80 Cmol+/kg), moderately available Phosphorous (32.56 - 45.21 ppm), very low total nitrogen (0.2 -0.67%) and very low Potassium (0.04-0.13Cmol/kg)on the other hand the electrical conductivity results falls below the range of tolerance (32.26 -55.23 us/cm) which is a good indication of no-saline soils due to leaching of runoff in the area. Therefore, the soils are suitable for rice cultivation.

Table 15: Physico-chemical characteristics in Gashara site

X	Y	Code	pH	EC in dS/m	%TN	Avail.P in ppm	K in Cmol/kg	CEC Cmol+/kg
545893	4777928	GA-IU-S	5.06	0.36	0.25	33.22	0.05	30.80
545256	4778566	GA-RS-S	5.35	0.32	0.20	45.21	0.13	25.20
546619	4776668	GA-ID-S	4.96	0.55	0.67	32.56	0.04	26.00

Source: UR/CAVM, 2016

- Cyaruhogo Marshland

In Cyaruhogo marshland, two dominants types of soil were investigated in the irrigated area. These are: Humic cambisols and Mollic Gleysol type of soil. Humic cambisols is presumably occurring in the North West part of the Cyaruhogo irrigated area. Cyaruhogo irrigated area is dominated by Mollic Gleysol type of soil. The results from laboratory analysis have shown that the soils were generally acidic (4.15- 5.17), medium CEC (24.40- 40.40 Cmol+/kg), moderately available Phosphorous (27.73 - 40.43 ppm), very low total nitrogen (0.17 -0.31%) and very low Potassium (0.01-0.09 Cmol/kg)on the other hand the electrical conductivity results falls below the

range of tolerance (69.91 -132.3 us/cm) which is a good indication no-saline soils due to leaching of runoff in the area. Therefore the soils are suitable for rice cultivation.

Table 16: Physico-chemical characteristics of Soil in Cyaruhogo site

X	Y	Code	pH	EC in dS/m	%TN	Avail.P in ppm	K in Cmol/kg	CEC Cmol+/kg
546558	4776620	CR-IU-S	4.15	0.95	0.31	27.73	0.01	24.40
547466	4773557	CR-ID-S	4.66	0.13	0.28	39.71	0.09	33.60
545057	4776221	CR-RS-S	5.17	0.69	0.17	40.43	0.09	40.40

Source: UR/CAVM, 2016

The soil acidity problem can also be mitigated by choosing a crop (s) that best grow in a given range of soil pH values rather than by trying to change the soil pH. For example, some crops are grown specifically to provide organic residues that strongly attract Al^{3+} ions in the soil solution to the surfaces of decaying organic matter, where they are tightly held. These green manure crops hence provide organic residues needed to stimulate such soil/ plant interactions and thereby reduce the level of Al^{3+} ions in the soil solution. All sensitive crops can then be grown following the green manure crop. This type of interaction can enhance the ability of low-income families to meet their food needs, especially where limestone availability and cost factors constrain attempts to adjust the soil pH.

Available Phosphorus (P) was in the moderate range and also needs to be enhanced. However, the 'ideal level of phosphorus' to be applied in a soil is also dependent on the crop to be grown. Possible sources of phosphorus include phosphate rock (PR) deposits, which has about 30% P_2O_5 (citrate soluble) and 48% CaO. Others include water-soluble fertilisers such as single superphosphate (SSP), which has 21% P_2O_5 (water soluble), 9%S; triple superphosphate (TSP), which has 43-46% P_2O_5 ; and diammonium phosphate (DAP). However, the different sources of P have varying amounts of plant-available phosphorus. Locally available phosphate rocks (PR) can offer a cheap source of P to smallholder farmers who are likely to use little P fertilisers due to high cost of imported fertilisers. However, PR has a low solubility; hence it is ground to powder form so as to increase its surface area. It is then applied as broadcast to enhance reactivity and consequently increase plant uptake. Its solubility increases with decreasing pH, hence it is applied to low pH soils (pH < 5.0) to maximize benefits. Its rate of application is also crop dependent and for rice the recommended rate is as follows:

- Urea: 100 kg/ha ,
- NPK,17,17,17:200kg/ha and
- Organic manure: 10 t/ha.

The soils also had weak exchangeable Potassium (K) concentrations which also need to be mitigated. Where the transformation rate of K provides inadequate soil solution K, then this can be supplemented by addition of a water-soluble K fertiliser to plants, such as Muriate of Potash (MoP), which has about 60% K_2O . The rate of potassium uptake varies with plant growth stage

and season, hence frequent light applications of potassium may offer more advantages compared to a heavy dressing applied every few years.

Comprehensive land husbandry approach should be initiated to conserve ecosystem, soil and water conservation. The silt trap-zone around the Cyimpima reservoir site and Bugugu reservoir site which are prone to erosion issues can serve as a filter and control in coming silts from watershed .It has three components, namely; the silt trap –grass zone, the silt trap-shrub zone and the silt trap- tree zone.

✓ **Heavy metals concentration in 4 marshlands**

In addition to physico-chemical characteristics of the soil in the project area, heavy metals were also assessed. The objective of this study was to investigate the heavy metal concentrations present such as (Cu, Cr and Zn) in four marshlands. Twelve samples were collected and analysed in the laboratory where by heavy metal ions in the soil samples were extracted by Acid mixture (IN HCL/1NH₂SO₄ according to Perkins (1970) concentration of Cu ,Cr and Zn in the extractants and were then determined by atomic absorption spectrophotometry (GBC,AVANTA).

Table 17: Heavy metal concentrations in soils from four sites

Site	Code	X	Y	Heavy Metals results (Parts per million(ppm))			Critical heavy metal values(ppm)		
				Cr	Cu	Zn	Cr	Cu	Zn
		Coordinates							
Cyimpima	CY-IU-S	548927	4778840	30.30	0.41	6.33	50-200	50	300
Cyimpima	CY-RS-S	549185	4779446	30.3	0.34	4.43	50-200	50	300
Cyimpima	CY-ID-S	547789	4775555	51.52	0.34	5.19	50-200	50	300
Gashara	GA-IU-S	545893	4777928	30.80	0.03.	18.85	50-200	50	300
Gashara	GA-RS-S	545256	4778566	36.36	0.14	9.61	50-200	50	300
Gashara	GA-ID-S	546619	4776668	37.88	0.31	8.35	50-200	50	300
Bugugu	BU-IU-S	547094	47819777	46.97	0.37	5.95	50-200	50	300
Bugugu	BU-RS-S	546969	4782160	66.67	0.41	4.94	50-200	50	300
Bugugu	BU-ID-S	547135	4779107	39.39	0.41	7.09	50-200	50	300
Cyaruhogo	CR-IU-S	546558	4776620	54.55	0.27	20.38	50-200	50	300
Cyaruhogo	CR-ID-S	547466	4773557	66.67	0.41	15.88	50-200	50	300
Cyaruhogo	CR-RS-S	545057	4776221	56.06	0.34	14.18	50-200	50	300

Source: UR/CAMV, 2016

Above results shows that the contamination levels of Cr, Cu, and Zn at four marshland sites is very low and much lower than critical levels. Therefore, we recommend farmers to apply organic fertilizers to their paddy fields.

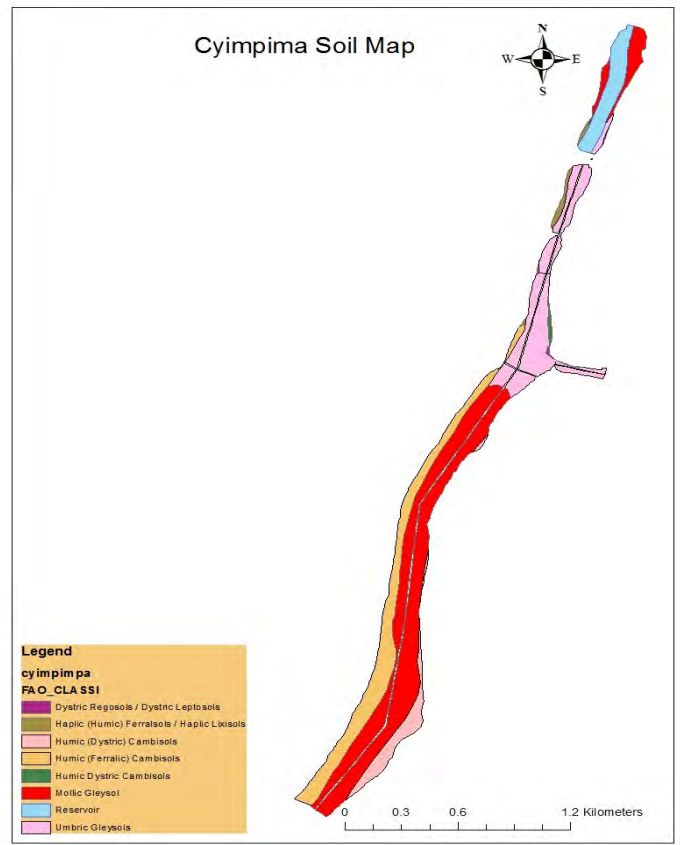
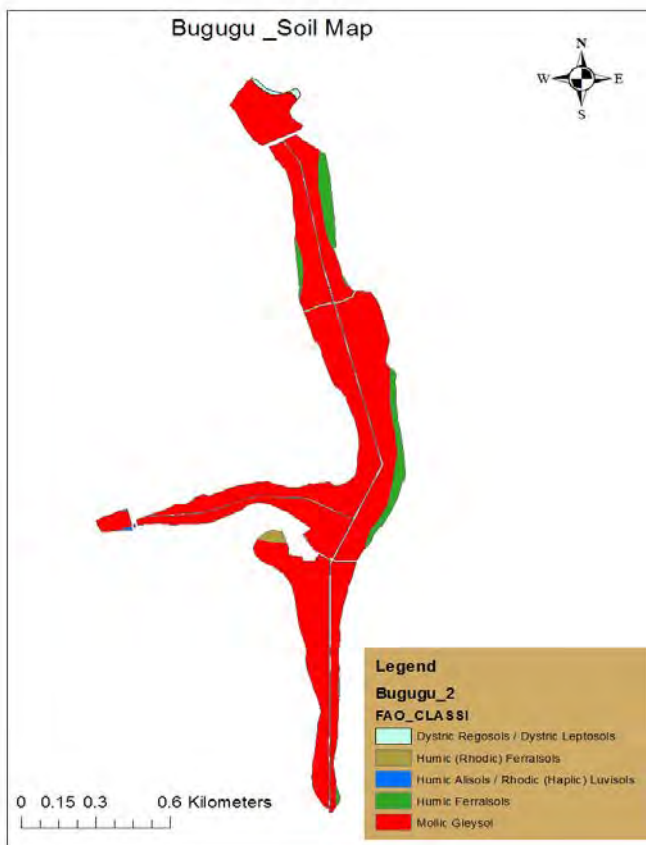
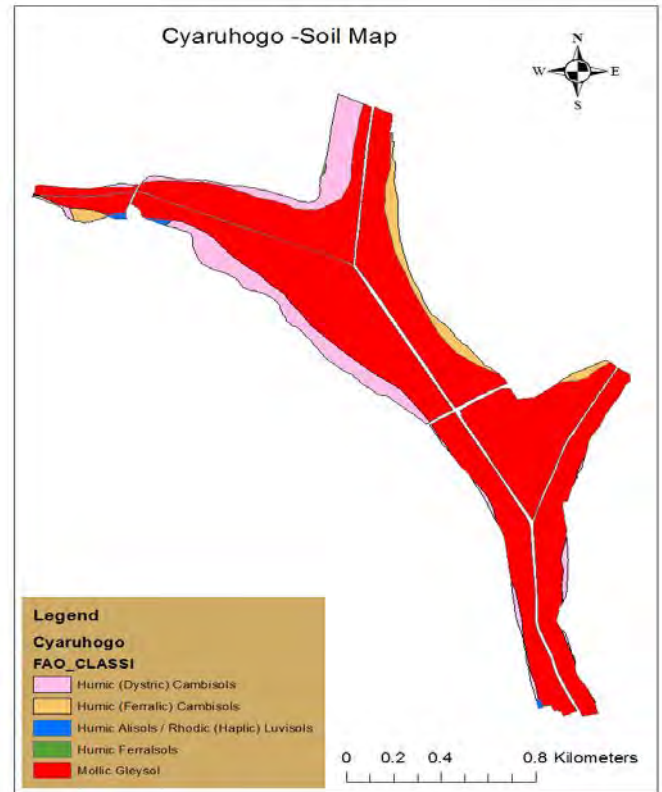
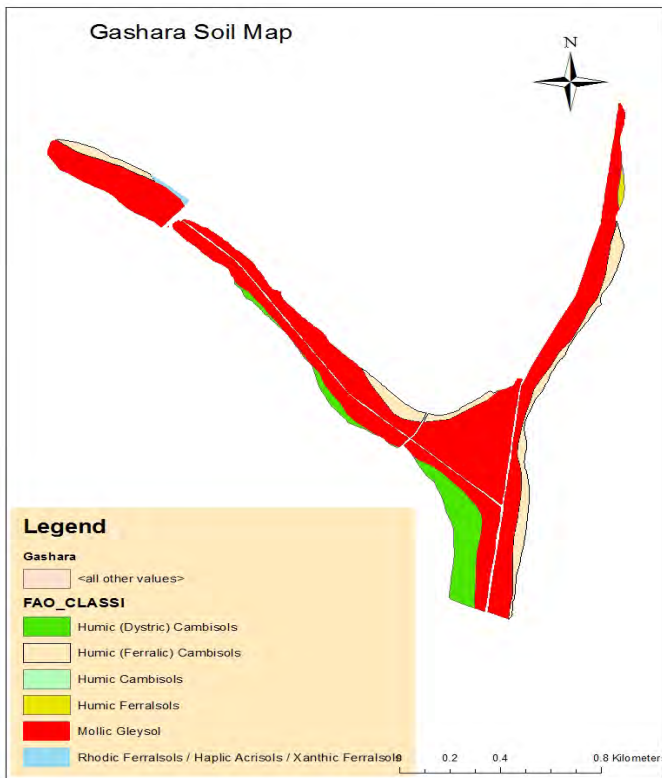


Figure 19: Soil maps of the four marshlands

These map shows that mollic grey sols are dominant in the four marshlands followed by umbric gleysol and humic ferralsols all favourable to rice.

4.3.4. Climate and weather conditions

Among all other physical factors, climate is the most important factor-influencing environment especially for irrigation projects. Climate and weather conditions play a vital role in determining the evolution of landforms (erosion, soil characteristics), availability of water resources, types of flora and fauna (ecological diversity), the productivity of ecosystems as well it has an influence on the pollution loads on the environment. Rainfall, temperature, and winds are the principal climatic components that serve to transport, disperse various forms of pollution into the atmosphere and on the ground. The characteristics of these climatic components (temperature, rainfall) are averaged for comparatively longer period to establish a general pattern in the project area.

Rwamagana district has a tropical climate with almost uniformly temperatures and humidity, and moderate rainfall. Seasonal variations in temperature are slight. The temperature is never too high. The following table depicts the climatic condition at Kigali which is about 40 km from project area.

Table 18: Meteorological data near project sites

Climate data for Kigali, Rwanda				
Month	Average High (°C)	Average low (°C)	Precipitation (mm)	Avg. precipitation days (≥ 0.1 mm)
Jan	26.9	15.6	76.9	11
Feb	27.4	15.8	91.0	11
Mar	26.9	15.7	114.2	15
Apr	26.2	16.1	154.2	18
May	25.9	16.2	88.1	13
Jun	26.4	15.3	18.6	2
Jul	27.1	15.0	11.4	1
Aug	28.0	16.0	31.1	4
Sep	28.2	16.0	69.6	10
Oct	27.2	15.9	105.7	17
Nov	26.1	15.5	112.7	17
Dec	26.4	15.6	77.4	14
Year	26.89	15.73	950.9	133

Source: Rwanda Meteorological service

Rainfall: The average annual rainfall in Rwamagana district is generally around 1100 mm. The rainfall pattern is erratic with no fluctuation in average annual rainfall and rainfall intensity. Rains are insignificant between June and September whilst high precipitation occurs during April and May. Humidity is relatively high, averaging 72 per cent from October through May, and 57% for the drier months of June to September. The eco-zone’s climatic characteristics of the area are as flows:

- Long rainy -from March to May. This period receive about 40-60% of the total annual precipitation;
- Long dry- from mid-June to mid-September;
- Short rainy-from September to late December; and
- Short dry from late December to mid-March.

Temperature: Mean annual temperature around Rwamagana District fairly constant throughout the year is 20°C. Diurnal- fluctuations in the temperature are more pronounced and may vary by as much as 10 to 12°C from the maximum daily to the minimum daily temperature. The temperature varies 0.5°C with every 100 m change in altitude, with the minima of 16.8 °C, and the maxima of 28.6 °C (Kente, 2007). Historical weather for Kigali is reported by a nearby weather station 643870 (HRYSR) which is at latitude: -1.96, longitude: 30.1 and an altitude of 1491 m. Highest temperatures are recorded during the dry months of July to September and the coolest months March to May.

4.3.5. Climate and Hydrological conditions of the project area

Water environment consists of water resources such as streams, lakes, estuaries, water use, and quality. Understanding the water quality is essential in preparation of EIA and to identify critical issues with a view to suggest appropriate mitigation measures for implementation. Water availability is essential in the project area for construction and drinking. It is anticipated that water will be available for above purposes in project area.

- **Climate and weather Conditions**

The Cyimpima, Bugugu, Cyaruhogo and Gashara projects area are located in the Lake Mugesera basin, part of the Akagera basin. The climate of the project area on the northern shore of Lake Mugesera is dominated by the April and November rains. The seasonal rainfall is characterised by two wet seasons from March to May and from October to December displaying a bimodal pattern whereby monthly rainfall varies from 119 mm in March, 162 mm in April declining through to 9.3 mm in July. The annual rainfall for Cyimpima, Bugugu, Cyaruhogo and Gashara the command areas are 931 mm with annual dependable rainfall of 772 mm. On average 71% of the annual total rainfall falls during the wet seasons. The dependable rainfall varies from 74 mm in February, peaking to 123 mm in April, and declining to 90 mm/month in May and from 50 mm in September rising to 88 mm in November. It is less than 20 mm during the dry season; often with little rainfall from June through to August.

This seasonal pattern determines the annual variation of all climatic parameters. The minimum cloud cover is observed during the month of November. The high maximum and low minimum monthly temperatures are observed in September and November respectively; relative humidity is at its minimum in July and sunshine duration at its maximum in June. From August to October average temperature reaches a maximum because of high day maxima and limited night cold; wind speed is also at a maximum. In August/September and January to May, the daily variation

of temperature is low. Relative humidity is high in April and November. Sunshine duration is short in November and wind speed is low in April.

- **Rainfall**

The rainfall variability in Rwanda is mainly due to orographic effects. Hence, altitude variation plays a major role. The variation of rainfall with altitude was analysed based on data obtained from RNRA for various stations.

Table 19: Monthly rainfall availability and annual rainfall

ID	Station	Station Name	Years of Record	Annual Rainfall	Altitude
1	BICUMBI	5111500	1986 – 1993	857.7	1520
2	MUREHE	5111600	1975- 1993	895.6	1500
3	BUTAMWA	5112200	1980 – 1982	935.6	1400
4	KARAMA PLATEAU	5113100	1961 – 1981	838.2	1403
5	GIKORO	5115500	1981 – 1990	956.1	1650
6	MUSHA	5115600	1948-1949; 1951- 1992	834.7	1650
7	KIGALI AERO	5116100	1971 -2004	977.4	1490
8	MASAKA	5116500	1965-1990;1992	988.7	1550
9	RUBIRIZI	5116600	1958-59;65-75;79-92	931.1	1450
10	NYAMATA	5117200	1962 – 1973;76;78;87-88;90 – 93	1016.3	1428
11	MUSASA	5120500	1986-1992	1238.5	2000
12	RUHUHA	5121500	1973-80;87 – 93	956.2	1400
13	RWAMAGANA		1930-1994;2010-2012	992.6	1550
14	RWINKWAVU		1954-1994	824.8	1757

Source: Rwanda Natural Resources Authority, IWRM department

The variation of annual rainfall with the altitude is depicted in the above table. The correlation is very weak with 78 per cent of unexplained variation. This might be due to the convectional type of rain which at times could be dominant in the tropics and the presence of the lakes nearby.

- **Rainfall station selection**

Three rainfall stations can be selected for this project area because of their proximity. These are Rwamagana, Rwinkwavu and Kigali stations. The rest of the stations are located further away from the project area, and their degree correlation with the selected three stations is very small. In general, the farther apart the stations are, the lower will be their degree of correlation

Table 20: Geographic coordinates of the selected rainfall stations

Ser. No.	Rainfall Station	Lat.	Long.	Altitude,masl
1	Kigali Airport Station	1°0'57"S	30°0'7"E	1490
2	Rwinkwavu	1°0'58" S	30°0' 38" E	1420
3	Rwamagana	1°0' 55" S	30°0' 20" E	1535

Source: BESST Ltd 2016

- **Monthly rainfall**

The mean monthly rainfall at all four dam sites is shown in following table.

Table 21: Monthly rainfall

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall, mm	75.83	101.54	130.69	168.49	109.42	22.74	16.35	35.68	69.04	103.24	122.25	93
SD, mm	34.31	52.25	44.42	53.89	44.08	26.91	26.27	26.21	34.08	40.38	50.03	36.4
CV, mm	0.48	0.52	0.35	0.33	0.41	1.16	1.55	0.73	0.52	0.39	0.43	0.4

Source: MINIRENA, Rwanda Meteorological Service

- **Availability of Climate data**

Kigali climate station is the closest primary climate station to the project area; this is a class 1 type station recording rainfall, temperature, sunshine hours duration, humidity, wind speed and pan evaporation. The availability of climate data for this climate stations is presented in the following table.

Table 22: Climate data for Kigali station

Month	Min Temp	Max. Temp	Humidity	Wind Speed	Sunshine Hrs	Piche Evap.	Pan Evap.
	°C	°C	%	m/s	hr	mm	mm
Jan	15.32	26.74	76.89	2.4	4.55	91.84	97.18
Feb	15.47	27.14	75.31	2.56	4.71	80.35	106.06
Mar	15.45	26.71	78.82	2.63	4.46	80.16	125.82
Apr	15.79	25.96	82.58	2.3	4.36	68.84	144.89
May	15.89	25.71	79.59	2.52	4.65	86.31	157.88
Jun	15.03	26.21	68.23	2.57	7.32	120.37	138.9
July	14.77	26.86	59.88	2.72	7.37	148.22	117.07
Aug	15.66	27.82	60.44	2.97	6.37	148.07	103.72
Sep	15.6	27.91	68.61	3.06	5.59	117.68	110.61
Oct	15.6	27.04	75.05	2.93	5.17	88.04	113.69
Nov	15.28	25.93	81.01	2.62	4.6	72.92	109.73
Dec	15.26	26.18	79.15	2.98	5.04	80.78	112.17

Source: MINIRENA, Rwanda Meteorological service

- **Surface water resources in the project area**

The project area lies within the natural drainage basin of Lake Mugesera, which is fed by the following rivers for Cyimpima is Rubindi stream, Gashara is Kamiranzovu stream, Bugugu is Rwamurinzi, stream and Cyaruhogo is Cyaruhogo stream later joins Rubindi stream before it drains to Lake Mugesera (*see map below*) the measure base flow measured at Cyaruhogo dam site is 1.7l/s. More flow measurements have to be conducted to assess the peak flows for all four dam sites.

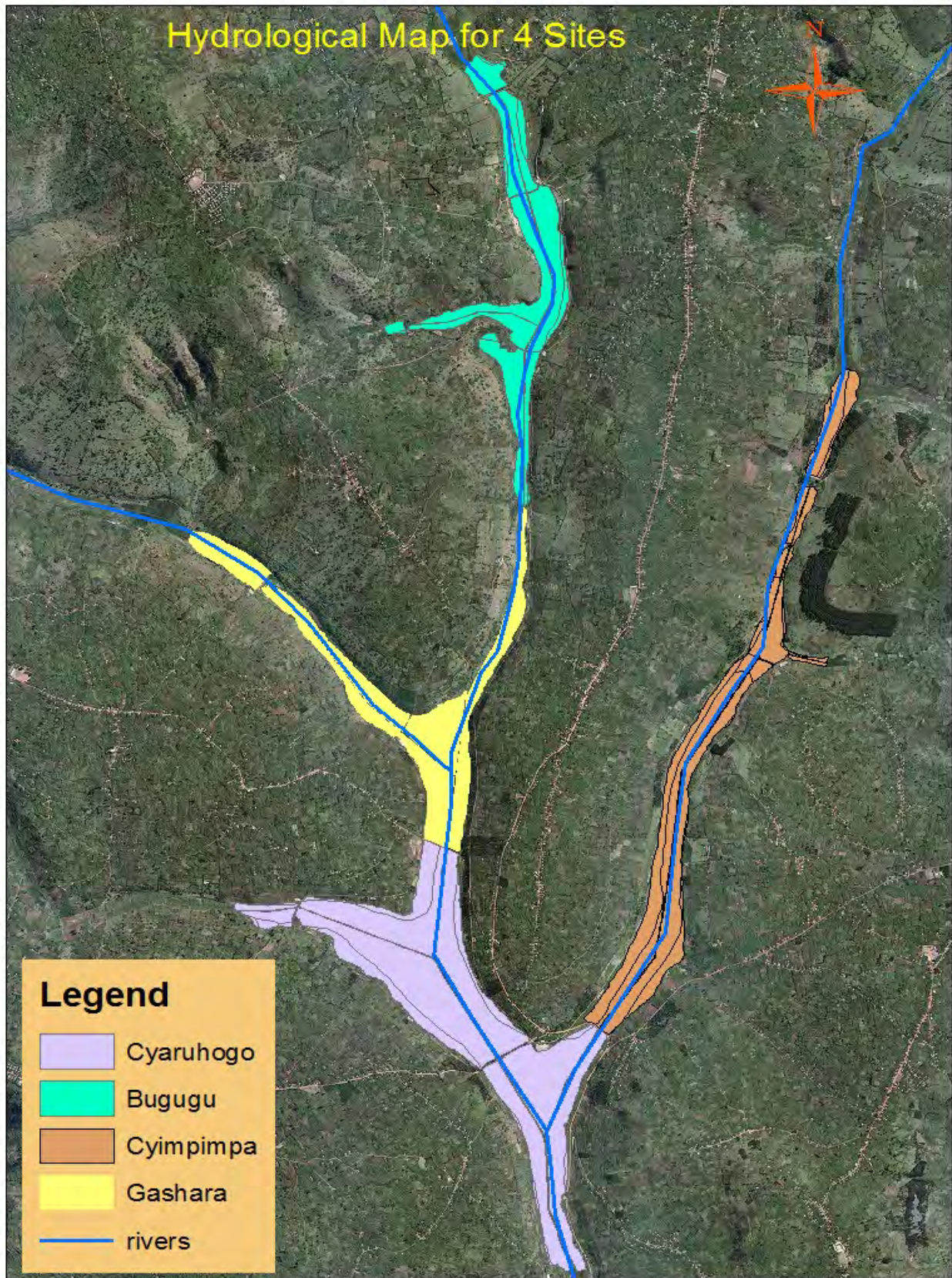


Figure 20: Hydrological maps of project area

Lake Mugesera is located 10km downstream of the four dam sites for all four respected Marshlands. The Lake is gauged at Rubago. The gauging station was established in 1972. The Lake level rises to a height of 2.39 meters above a datum which is not stated. However, if one takes the 1337 masl as the datum, then the Lake level rises to a maximum of 1339.39 masl.

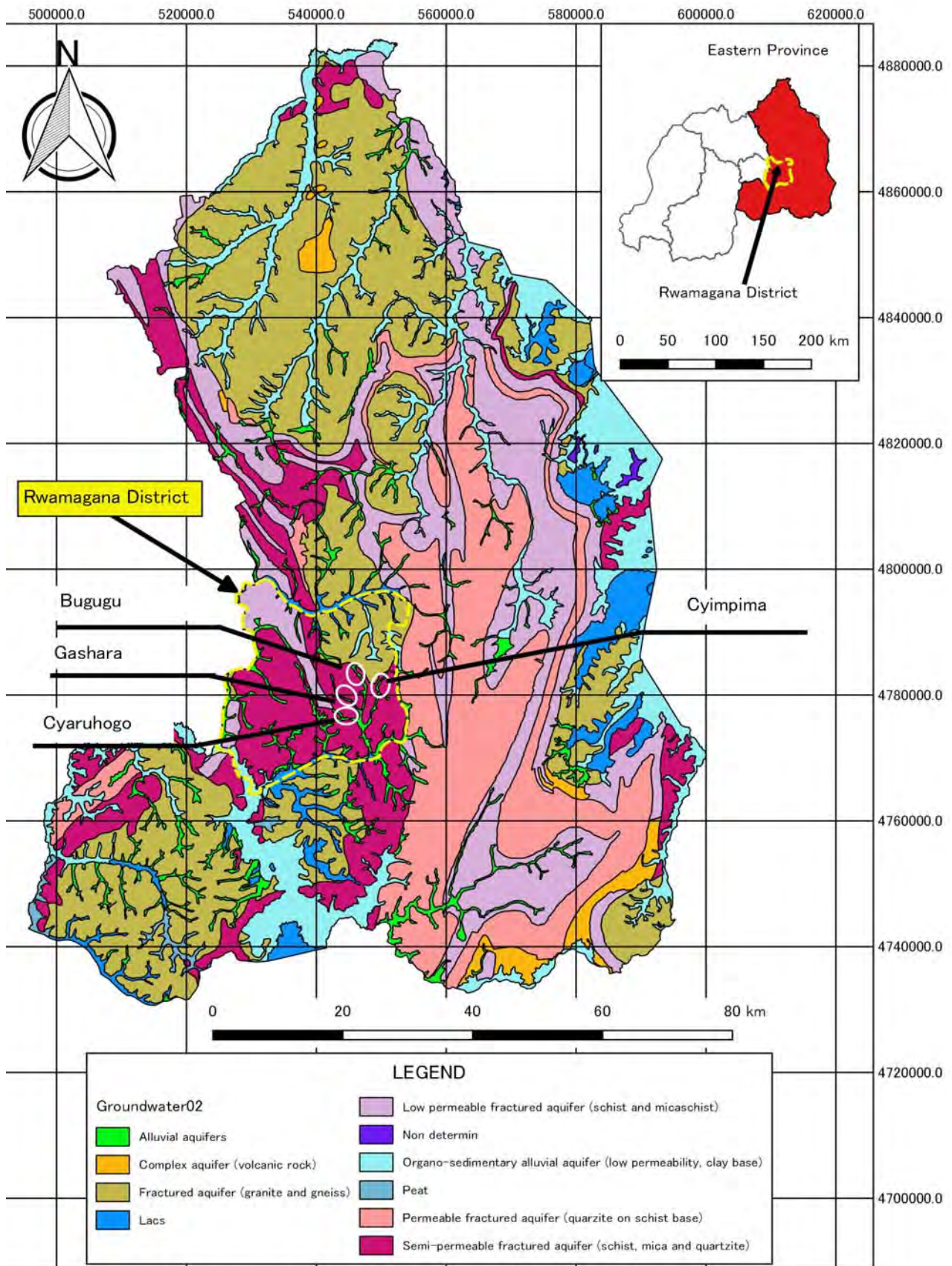
Table 23: Reservoir Capacity and Catchment Area

Dam	Unit	Cyimpima	Gashara	Bugugu	Cyaruhogo
Catchment area designed	Km ²	15.3	26.5	13.9	7.7
Dam Capacity	M ³	540,000	380,000	35,000	No existing Dam

Source: JST, 2016

- **Underground water potential**

All four marshlands have significant potential of subsurface flow (Underground water) which is justified by the growth health of rice crops and it is always replenished or recharged by continuous spring flows from the upstream of for all marshlands which have relatively of 6 l/s as minimum flow. This was measured during dry season.



Groundwater map in Eastern Province, Rwanda

Source: JST, 2016

- **Sediment estimate**

Sediment yield data for small hilly watersheds are rarely available. Sediment yield of small mountainous catchments in Africa are often in the order of 1500 ton/km²/year where there is a potential for erosion to take place. Underestimation of sediment yield could result in filling of useful storage of reservoirs in few years. The HR Wallingford (2004) guidelines for predicting sedimentation in small dams is given by the following equations:

$$S_y = 0.0194 * \text{Area}^{-0.2} \text{MAP}^{0.7} \text{Slope}^{0.3} \text{SASE}^{1.2} \text{STDR}^{0.7} \text{VC}^{0.5}$$

S_y the sediment yield (t/km²/year)

Area the catchment area (km²)

MAP Mean Annual Precipitation (mm)

Slope River Slope from the catchment boundary to the dam

SASE Signs of Active Erosion (score from catchment Characterisation)

STDR Soil Type and Drainage (Score from Catchment Characterisation)

VC Vegetation Condition (Score from catchment characterisation)

SASE, STDR and VC are estimated from the table hereunder:

Table 24: Catchment characterization form

Factor	Extreme	Score	High	Score	Normal	Score	Low	Score
Soil Type and Drainage	No Effective Soil Cover, either rock or thin shallow Soil	40	Poorly drained compacted Soils, much ponding on soil surface after heavy rain	30	Moderately well drained medium-textured soils, some ponding on soil surface	20	Well drained course-textured soils, little ponding on soil surface after heavy rains	10
Vegetation Condition over Whole Catchment	Little effective plant Cover ground bare or very sparse cover	40	<u>Fair cover</u> > 50 % of catchment is cultivated with annual crops	15	<u>Good Cover</u> 20 - 50% of catchment is cultivated with annual crops	10	<u>Excellent cover</u> <20% of catchment is cultivated with annual crops	5
			< 30% of catchment is under good grass cover or protected forest cover	15	30 - 60% of catchment is under good grassland or protected forest cover	10	> 60 % of catchment is under well-maintained grassland and/or protected forest cover	5

Factor	Extreme	Score	High	Score	Normal	Score	Low	Score
Signs of Active Soil Erosion	Many actively eroding gullies (dongas) draining directly into dam and/or water courses, active undercutting of river banks along main water course	40	Some actively eroding gullies draining directly into dam and/or water courses; moderate undercutting of river banks along main water courses	20	Few actively eroding gullies draining directly into dam and/or water courses; little undercutting of river banks along main watercourses	10	Not actively eroding gullies (dongas) draining directly into dam and/or watercourse ; no undercutting of riverbanks along main watercourses	5

Source: BESST Ltd, 2016

The table below present sediment yield in four marshlands calculated during design studies.

Table 25: Sediment transport computation for four sites

Parameter	A _{rea}	M _{AP}	S _{lope}	S _{ASE}	S _{TDR}	V _C	S _y	S _y
Unit	Km ²	Mm	-	-	-	-	t/km ² /year	m ³ /km ² /yr
Cyimpima	15.3	1,036	80/4620 =0.017	10	20	15	212.7	177.2≈180
Cyaruhogo	7.7	1,036	322/3850 =0.084	10	20	15	395.6	329.7≈330
Gashara	26.5	1,036	278/8100 =0.034	13	20	15	235.6	196.3≈200
Bugugu	13.9	1,036	130/4550 =0.029	20	20	15	350.1	291.7≈300

Source: JST 2016

4.3.6. Assessment of water quality in project area

- Irrigation water

Sustaining agricultural production and agro-food processing is dependent on quality water supplies. Irrigation requires good quality water in order to prevent damage to sensitive crops from pesticides, salts, and trace metals. In the long term, low sodicity in irrigation waters is necessary to maintain soil structural stability. In a comprehensive study, the principal components which are analysed are the following:

- Nutrients

- Salinity and major ions
- Metals
- Bacteria and Total Suspended Solids
- Pesticides

Nutrients are a concern for irrigation conveyance systems and receiving water bodies. Excess nutrients, such as nitrogen and particularly phosphorus, can cause eutrophication of water bodies. The resulting excessive growth of aquatic macrophytes and algae can cause aesthetic issues for recreation and drinking water, difficulty in conveyance of water for irrigation or industrial purposes, and declines in oxygen concentrations that can result in fish kills and loss of biodiversity; that is eutrophication. In addition, nitrate (NO₃), nitrite (NO₂), and ammonia (NH₃) can be toxic to humans and other organisms. Nitrate from agricultural sources has been identified as a major threat to ground water supplies worldwide.

Pesticides are a concern from a human and an aquatic health perspective. Studies have found that a variety of human health problems including cancers, neurological disorders, reproductive problems, and behaviour and developmental concerns may arise from continued exposure to low doses of pesticides. Moreover, most pesticides have only had toxicological studies completed on a single active ingredient, but are commonly applied in mixtures, which may have synergistic effects.

Pathogenic bacteria, such as Vero toxigenic serotypes of *Escherichia coli* and enterococci, can cause a wide array of human health problems and can also jeopardize the safety of water for irrigation, livestock watering, and recreation.

The objectives of this report is to assess the monitored surface water quality at Four different marshlands water stream in order to assess the quality of source water that will be used for irrigation in the planned project.

The water of from the reservoir sites, stream, and irrigation water and spring water has been analysed in Laboratory for a number of chemical parameters which can be used for assessment of water quality. The samples of water have been collected and analysed by University of Rwanda, CAVM. Samples were collected during the dry period August 2016 and were analysed next day after collection.

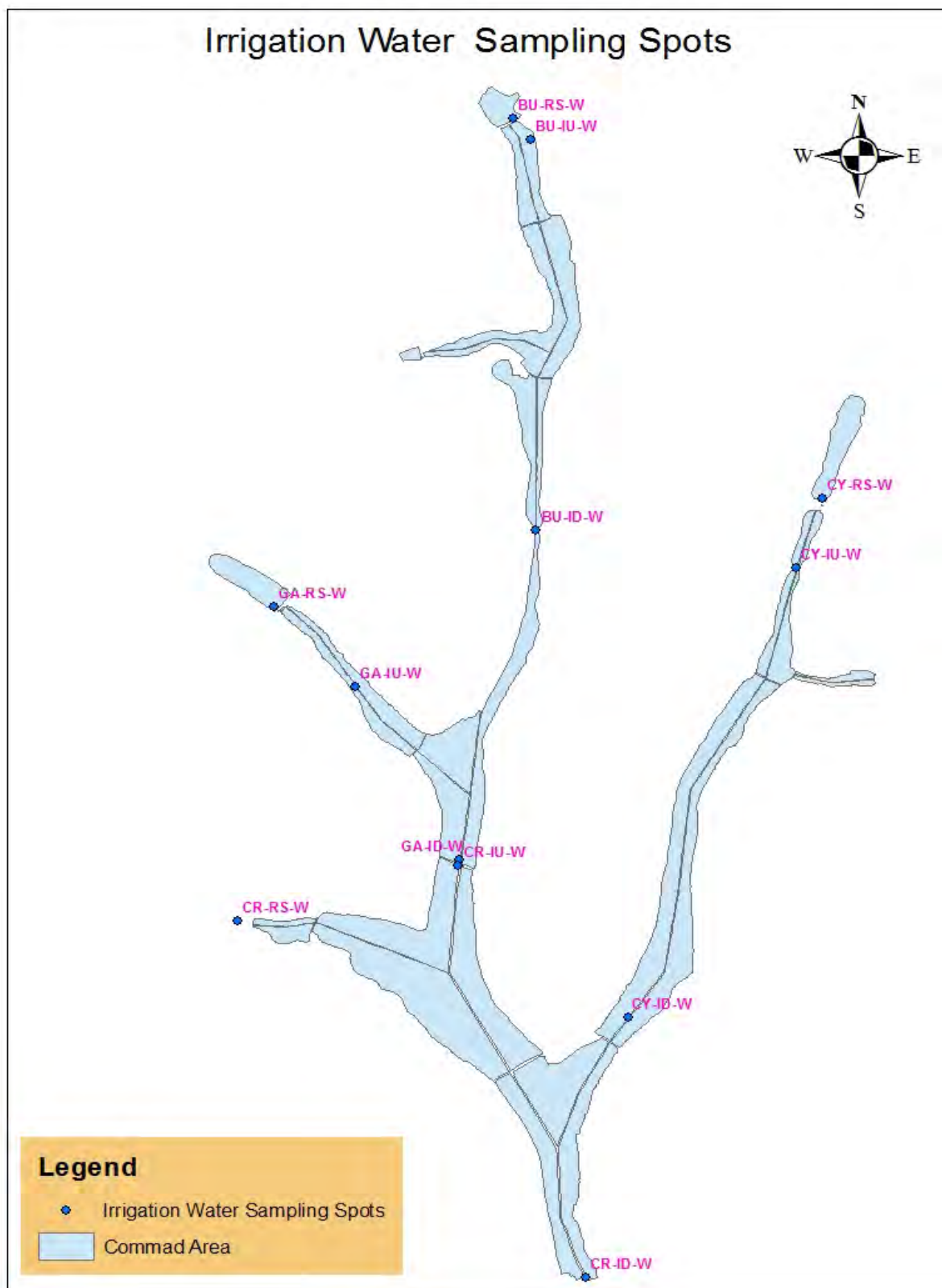


Figure 21: Location of irrigation water samples

The main parameters used to assess the quality of water for irrigation are shown in table below as provide by FOA guidelines.

Table 26: FAO standards for irrigation water

Quality parameters	Units	Use Range in Irrigation
pH		6.0-8.5
EC	dS/m	0 -3
ToC	°c	0-30
BOD5	mg/l	0-7
Nitrates	mg/l	0-10
TDS	mg/l	0-2000
TSS	mg/l	-
Tot P	mg/l	0-2
Tot Coliforms	CfuX 10/ml	100
COD	mg/l	-
OC	mg/l	-
Hardness	mg/l	0-500
Grease and Oils	mg/l	

Source: FAO paper 29 - Water Quality for Agriculture, Rome, 1976

The Guidelines for interpretation of water quality for irrigation are provided in FAO paper 29 - Water Quality for Agriculture, Rome, 1976. The admissible values are presented in table above. The summary of the results of chemical analysis and quality assessment are presented in table below. The results indicate that the water can be used for irrigation without any restrictions in all sites.

Table 27: Summary of the water quality assessment for all sites

• **Gashara marshland**

S/N	Analysed Parameters	Units	Laboratory results by Sample			Water quality Guidelines, FAO 29		
			Reservoir	Up-stream	Down-stream	Units	Use Range in Irrigation	Restriction
1	pH		6.79	6.64	6.85		6.5-8.4	No
2	EC	dS/m	0.20	0.21	0.26	dS/m	0 -3	No
3	ToC	°c	21.2	21.5	22.2	°c	0-30	No
4	BOD5	mg/l	2.32	3.79	4.29	mg/l	0-7	No
5	Nitrates	mg/l	51.67	39.27	26.87	mg/l	0-30	-
6	TDS	mg/l	386	688	598	mg/l	0-2000	No
7	TSS	mg/l	327	299	257	mg/l	Absent	-
8	Tot P	mg/l	11.56	11.6	14.22	mg/l	Absent	-
9	Tot Coliforms	Cfu X 10/ml	2	4	5	Cfu X 10/ml	100	No
10	COD	mg/l	62.2	115.5	88.8	mg/l	Absent	-
11	OC	mg/l	23.33	43.33	33.33	mg/l	Absent	-
12	OM	mg/l	40.23	74.71	57.47	mg/l	Absent	-
13	Hardness	mg/l	283.33	283.33	266.67	mg/l	0-500	No
14	Grease &Oils	mg/l	0.12	0.11	0.11	mg/l	0-5	No

- **Cyimpima Site**

S/N	Analysed Parameters	Units	Laboratory results by Sample			Water quality Guidelines, FAO 29		
			Reservoir	Up-stream	Down-stream	Units	Use Range in Irrigation	Restriction
1	pH		6.25	6.61	6.79		6.5-8.4	No
2	EC	dS/m	0.32	0.27	0.50	dS/m	0-3	No
3	ToC	°c	22.1	21.7	22.1	°c	0-30	No
4	BOD5	mg/l	1.4	2.19	3.98	mg/l	0-7	No
5	Nitrates	mg/l	20.67	14.47	22.73	mg/l	0-30	-
6	TDS	mg/l	1120	390	1206	mg/l	0-2000	No
7	TSS	mg/l	127	720	163	mg/l	Absent	-
8	Tot P	mg/l	10.33	13.8	9.98	mg/l	Absent	-
9	Tot Coliforms	CfuX10/ml	1	2	4	Cfu X 10/ml	100	No
10	COD	mg/l	115.5	106.6	97.7	mg/l	Absent	-
11	OC	mg/l	43.33	40	36.67	mg/l	Absent	-
12	OM	mg/l	74.71	68.97	63.22	mg/l	Absent	-
13	Hardness	mg/l	208.33	250.00	250	mg/l	0-500	No
14	Grease &Oils	mg/l	0.11	0.01	0.1	mg/l	0-5	No

- **Bugugu**

S/N	Analysed Parameters	Units	Laboratory results by Sample			Water quality Guidelines, FAO 29		
			Reservoir	Up-stream	Down-stream	Units	Use Range in Irrigation	Restriction
1	pH		6.34	6.59	6.54		6.5-8.4	No
2	EC	dS/m	0.20	0.36	0.30	dS/m	0-3	No
3	ToC	°c	22.1	21.8	22	°c	0-30	No
4	BOD5	mg/l	2.28	2.71	3.18	mg/l	0-7	No
5	Nitrates	mg/l	16.53	43.40	14.47	mg/l	0-30	-
6	TDS	mg/l	414	1152	376	mg/l	0-2000	No
7	TSS	mg/l	277	986	206	mg/l	Absent	-
8	Tot P	mg/l	12.10	10.95	12.55	mg/l	Absent	-
9	Tot Coliforms	CfuX 10/ml	1.1	3	2.6	Cfu X 10/ml	100	No
10	COD	mg/l	80	168.8	124.4	mg/l	Absent	-
11	OC	mg/l	30	63.33	46.67	mg/l	Absent	-
12	OM	Mg/l	51.72	109.2	80.46	mg/l	Absent	-
13	Hardness	mg/l	216.67	341.67	233.33	mg/l	0-500	No
14	Grease &Oils	mg/l	0.11	0.13	0.13	mg/l	0-5	No

- Cyaruhogo site

S/ N	Analysed Parameters	Units	Laboratory results by Sample			Water quality Guidelines, FAO 29		
			Reservoir	Upstream	Downstream	Units	Use Range in Irrigation	Restricti on
1	pH		6.68	6.72	6.62		6.5-8.4	No
2	EC	dS/m	0.21	0.30	0.65	dS/m	0-3	No
3	ToC	°c	21.2	21.9	21.9	°c	0-30	No
4	BOD5	mg/l	1.67	1.96	5.92	mg/l	0-7	No
5	Nitrates	mg/l	14.47	43.4	39.27	mg/l	0-30	-
6	TDS	mg/l	476	980	968	mg/l	0-2000	No
7	TSS	mg/l	107	1424.7	267	mg/l	Absent	-
8	Tot P	mg/l	9.7	11.15	9.72	mg/l	Absent	-
9	Tot Coliforms	CfuX 10/ml	1.5	1.8	5	Cfu X 10/ml	100	No
10	COD	mg/l	195.5	80	80	mg/l	Absent	-
11	OC	mg/l	73.33	30	30	mg/l	Absent	-
12	OM	Mg/l	126.4	51.72	51.72	mg/l	Absent	-
13	Hardness	mg/l	258.33	266.67	291.67	mg/l	0-500	No
14	Grease &Oils	mg/l	0.13	0.14	0.13	mg/l	0-5	No

Source: UR/CAVM, 2016

- Water quality assessment from spring for domestic purposes

The water samples from all water springs used mainly for drinking purposes were collected from four marshlands namely Bugugu, Cyaruhogo, Cyimpima and Gashara has been analysed in Laboratory for a number of physical, chemical and biological parameters which can be used for assessment of water quality. The samples were collected during the dry period August 2016 and were analysed next day after collection. The results of analysis were compared to the range provided by World Health Organisation (WHO) guidelines.

Table 28: WHO standards for drinking water

S/N ^o	Analysed Parameters	Units	Use Range in Domestic Potable water
1	pH		6.5-8.4
2	EC	dS/m	0-3
3	Nitrates	mg/l	150
4	TDS	mg/l	0-2000
5	Total hardness	mg/l	500
6	F-	mg/l	0.6-1.2
7	SO ₄	mg/l	150
8	Coliforms bacteria	CfuX/ml	100
9	Chloride	mg/l	500
10	Fe	mg/l	1-3
11	Mn	mg/l	0.1-0.5

Source: World Health Organisation guidelines, third edition on admissible values

- Sampling Methodology

Water samples were collected from the middle of the stream in triple-rinsed polyethylene bottles for nutrients, metals and ions. Water samples for metals were acidified to a pH < 2 with nitric acid, while the nutrients were acidified with sulphuric acid in the field, bacteria samples were taken to check the Coliform Bacteria for all water samples collected from different marshlands.

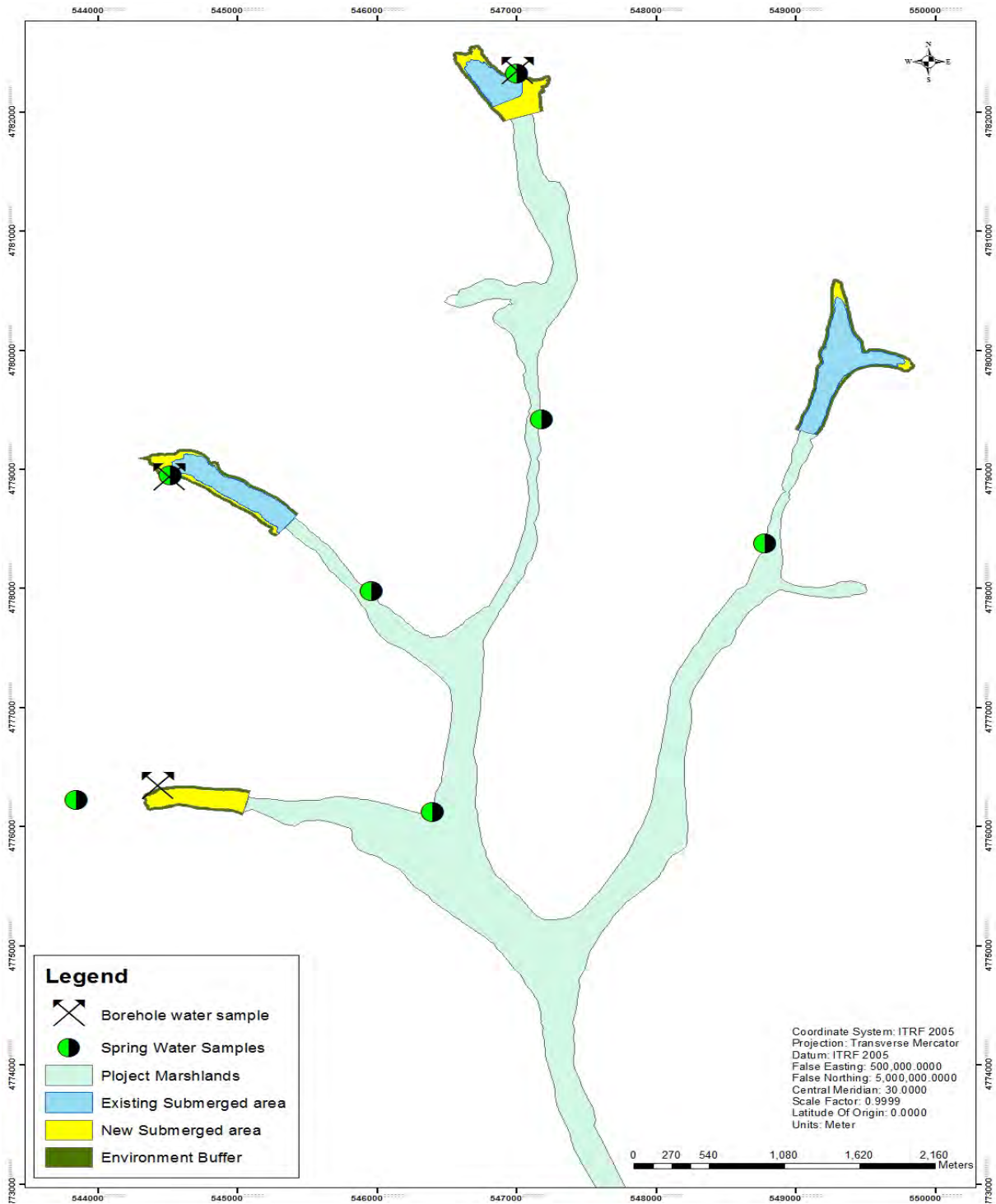


Figure 22: Location of drinking water sampling points



Figure 23: Sample collection from spring water

Water quality analysis

The sample was analysed for a small range of variables, including nutrients, ions, physical variables, metals (pesticides were not analysed).

- PH.

The pH balance of a water supply describes how acidic or alkaline it is. The acidity (or alkalinity) of a water supply can affect plant growth, irrigation equipment, pesticide efficiency and drinking water. The balance of positive hydrogen ions (H⁺) and negative hydroxide ions (OH⁻) in water determines its pH level. The pH scale goes from 0 to 14, and a pH of 7 is neutral. Water with a pH below 7 is acid and water with a pH above 7 is alkaline.

Electrical Conductivity: Electrical conductivity measures the ability of a solution to conduct an electrical current, which is directly related to the concentration of dissolved salts in solution. Excess salts in the plant root zone can cause moisture stress as salts increase the amount of energy plants must expend in order to take up water. In addition, individual ions can have deleterious effects. For example, sodium from sprinkler irrigation can be directly toxic and cause defoliation of sensitive plants.

Total Dissolved Solids: Total dissolved solids (TDS) are related to EC and therefore, have very similar patterns. These are a measure of the sum of all the ions present in a sample of water and represent the total salt content of the water. The total salt concentration of the tested water is one of the most important pieces of information presented in the water analysis report. High levels of soluble salts can induce physiological drought in the plant. Plant roots may have an adequate water supply, but are unable to absorb the water due to osmotic pressure.

Total suspended solids (TSS) can negatively impact fish spawning habitat and clog irrigation equipment. Total suspended solids can also be a source of contaminants such as metals, nutrients, and bacteria.

Chloride (Cl-) toxicity is the most common kind of specific ion toxicity for irrigation because Cl- moves readily in the solution and can accumulate in plant leaves. In addition to accumulation by transpiration, Cl- can be directly absorbed by leaves, which can be an issue for sprinkler irrigation. Therefore, recommended guidelines are lower for sprinkler irrigation than surface irrigation.

Sulphate can contribute to salinity problems, but also can benefit crops by increasing fertility.

Total Hardness is the name for the amount of calcium and magnesium in water. By convention hardness is given as amount of CaCO₃ although it actually measures magnesium as well. Hard water used for irrigation can have a beneficial effect on soils provided that sodium levels in the water are not too high. **Calcium** and **magnesium** can offset the effects of sodium in the soil. Normally magnesium levels in soils are about half that of calcium. If magnesium levels are above calcium levels this may be a problem for plants because it may induce deficiencies of potassium and calcium particularly if these are already low. High sodium levels may have a similar effect

Alkalinity is a measure of the buffering capacity of a solution and is a sum of the concentrations of carbonates, bicarbonates, and hydroxides. A combination of high pH and high alkalinity may cause changes in the pH of the growing medium and some trace element deficiencies, especially for plants in small containers with low volumes of substrate. High levels of carbonates and bicarbonates can also cause blockages in irrigation equipment or precipitation of calcium and magnesium ions, thereby increasing SAR.

Sulphate occurs naturally in numerous minerals and is used commercially, principally in the chemical industry. The existing data do not identify a level of sulphate in drinking water that is likely to cause adverse human health effects.

Iron is found in natural fresh waters at levels ranging from 0.5 to 50mg/litre. Iron may also be present in drinking water as result of use of iron coagulants or corrosion of steel and cast iron pipes during water distribution there is no noticeable taste at iron concentrations below 0.3 mg/litre, and concentration of 1-3 mg/litre can be acceptable for people drinking anaerobic well water.

Manganese: Manganese is naturally occurring in many surface water and ground water sources; particularly in anaerobic or low oxidation conditions and this is the most important source of drinking water. It was noted that concentration below 0.1 mg/litre are usually acceptable to consumers, although this may vary with local circumstances. The main parameters and their corresponding World Health Organisation(WHO) standards used to assess the quality of water of springs for domestic purposes are shown in table below and results indicate that the **water can be used for domestic purposes without any restrictions**

Table 29: Drinking water laboratory test results

N0	Analysed Parameters	Unit	Laboratory Results per site	Water quality Guidelines, WHO
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			Cyaruhogo	Gashara	Cyimpima	Bugugu	Units	Use Range in Domestic Potable water	Restriction
1	pH		5.11	5.25	5.13	5.14		6.5-8.4	No
2	EC	dS/m	0.24	0.18	0.10	0.18	dS/m	0 -3	No
3	Nitrates	mg/l	18.60	26.87	7.53	8.27	mg/l	150	No
4	TDS	mg/l	864	36	378	642	mg/l	0-2000	No
5	Total hardness	mg/l	123.33	131.67	121.67	130	mg/l	500	No
6	F-	mg/l	0.34	0.33	0.27	0.32	mg/l	0.6-1.2	No
7	S04	mg/l	42.44	38.57	44.78	43.26	mg/l	150	No
8	Coliforms bacteria	CfuX/ml	1.2	1.0	1.1	1.1	CfuX/ml	100	No
9	Chloride	mg/l	11	14	19	22	mg/l	500	No
10	Fe	mg/l	0.8485	0.8182	0.9394	1.0303	mg/l	1-3	No
11	Mn	mg/l	0.101	0.1347	0.107	0.1189	mg/l	0.1-0.5	No

Source: UR/CAVM, 2016

✓ **Additional water quality test for potential source of domestic water**

Additional water quality was conducted in potential water source that shall be used to replace water source that are likely to be submerged after construction. Laboratory results show that the quality of water is unacceptable range and can be used as source of domestic water. The table below show results of 5 samples taken in springs and drilled water.

Table 30: results of additional water quality test

S/N	Parameters	Unit	Cyaruhogo Drilled	Gashara Drilled	Cyaruhogo Spring water	Bugugu Drilled	Gashara Spring water	WHO standards
1	PH		6.01	5.97	5.94	6.01	6.11	6.5-8.4
2	Conductivity	dS/m	0.28	0.16	0.26	0.25	0.22	0 -3
3	Total Dissolved Solids	mg/l	140	79	131	125	110	0-2000
4	Total Hardness	mg/lCaCO ₃	94	36	96	62	36	500
5	Fluoride	mg/l	Not detected	Not detected	0.05	0.21	Not detected	0.6-1.2
6	Chloride	mg/l	44.9	31.4	51.2	42.9	40.1	500
7	Manganese	mg/l	0.087	0.064	0.014	0.035	0.011	0.1-0.5
8	Iron	mg/l	0.46	0.93	0.03	0.21	0.02	-
9	Sulfates	mg/l	9	6	3	6	3	-
10	F.Coliform ^{*1}	Cfu/ 100ml	7x10 ²	<1x10 ⁰	<1x10 ⁰	1x10 ²	2x10 ²	100
11	E. Coliform ^{*1}	Cfu/ 100ml	3x10 ¹	<1x10 ⁰	<1x10 ⁰	<1x10 ⁰	<1x10 ⁰	100
12	Nitrates	mg/l	26.80	51.02	17.53	33.06	25.09	150

Source: UR/CST,2016

Note: *1: Value of E. Coliform and F. Coliform is just reference value and cannot be compared with others, because the additional water samples were not analysed within a day from sampling.

The summary of the results of chemical analysis and quality assessment are presented in table above. The results indicate that the **water can be used for irrigation without any restrictions in all three sites.**

4.4. Biological environment baseline data

4.4.1. Methodology

The ecological survey followed 3 main steps. The first step consisted of desktop work. During this phase, a literature review was undertaken. Species lists, species databases and existing documents and previous studies for Rwanda were consulted to get information on species occurrence especially in the study area and wetlands of Rwanda. As output, a list of species that occur, or could occur, in the study area based upon their habitat affinities and ranges were established. The second step consisted of field survey where data on species occurrence and diversity were collected based on standard survey methods as per animal taxa and recorded on pre-designed datasheets. The last step consisted of data entry, processing, analysis and report writing.

One reconnaissance route (recce) was established in each site (marsh) and it was designed in a way that covers most representative areas within each site. The length of the reconnaissance routes varied according to the size of the site. Each reconnaissance route and data was recorded using a GPS for mapping purpose.

For recording data on birds, two methods were used. The first method consisted of point counts where observation points were established at an interval of 200 meters along the reconnaissance route. At each point observers waited for 3 minutes to allow birds to settle down and then record all sightings and calls of birds for a period of 10 minutes (Sutherland, W. 2000). The observers then moved on to the next point and repeated this same process. The second approach consisted of opportunistic sampling where all bird species seen or heard at different times of the day were recorded. For bird species identification, we used the identification keys provided by Stevenson & Fanshawe (2002).

Regarding, Amphibians and reptiles, Visual Encounter Sampling (VES) approach was used. According to this approach each amphibian reptile encountered along the reconnaissance trail were recorded. In case the species was not identified at place, a description of the species was made and photographs were taken for further identification.

For fish species observation and local community consultation was used to provide the vernacular name of species which we cross-checked to find their equivalent in English and their species names in different reports and fish database in Rwanda. The nomenclature of amphibians followed Channing & Howell (2006), that of reptiles except chameleons Spawls et al. (2002).

For surveying mammals, survey team walked along the existing human and animal paths. All signs of mammals were recorded. These include animal sighting, animal voices and other signs including dung, footprint or spoor, hairs, digging and nests. The nomenclature of species followed that of African Mammals of Kingdon (1997).

For insects, a 1 meter-radius circular plot was established at each 200-meter interval along the reconnaissance route. Insects were captured using sweep netting and direct searching approach.

Captured insects were stored in jars containing ethanol to facilitate further identification. Given the diverse nature of insect class, the identification was limited to the level of order.

For assessing the conservation status of each species, we used the IUCN Red List of Threatened Species, version 2016-1 (IUCN, 2016). Any endangered or listed species on IUCN red list were highlighted and brought to the client attention.

4.4.2. Findings of flora survey

Data were collected along 5 established reconnaissance trails (See Figure 16). Animal Species recorded are birds, amphibians, and insects. Reptiles and mammals were not encountered during the field survey. However, the information presented here was obtained from community members that were interviewed. Some few plant species were also recorded. In all sites surveyed, rice and other food crops such beans, sweet potatoes, Cassava, etc. were the most dominant.

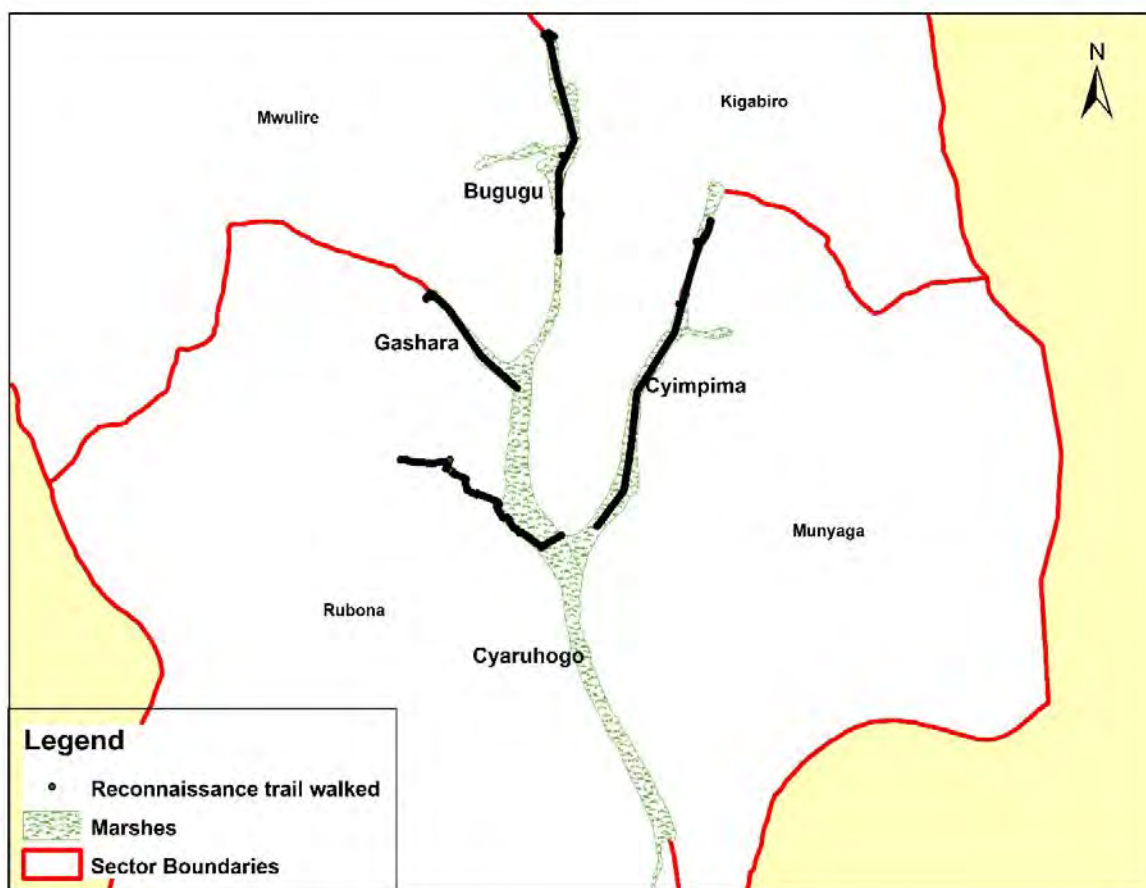


Figure 24: Reconnaissance trails

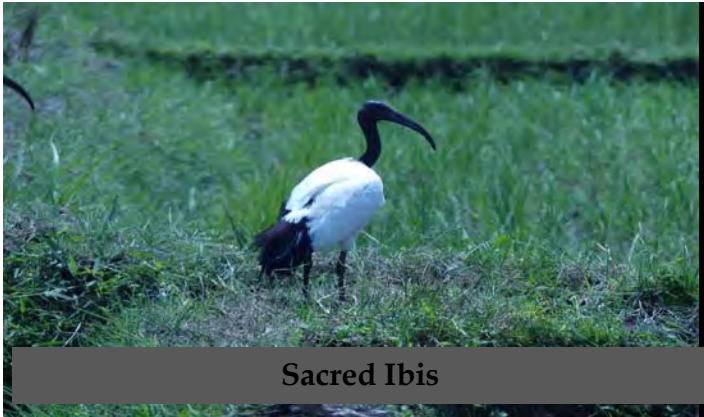
a) Cyaruhogo marshland

Birds: 14 species of birds were identified. They were grouped in 5 orders and 11 families.

Table 31: Birds species in Cyaruhogo marshland and conservation status

Common Name	Vernacular Name	Scientific Name	Order	Family	IUCN Conservation status
Pied Crow	Igikona	<i>Corvus albus</i>	Passeriformes	Corvidae	Least Concern
Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Pelecaniformes	Threskiornithidae	Least Concern
Hamerkop	Sarupfuna	<i>Scopus umbretta</i>	Pelecaniformes	Scopidae	Not assessed
African Wattled Lapwing	Inkurakura	<i>Venellus senegallus</i>	Charadriiformes	Charadriidae	Not assessed
Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Charadriiformes	Charadriidae	Least Concern
Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Pelecaniformes	Threskiornithidae	Least Concern
Cattle Egret	Inyange	<i>Bubulcus ibis</i>	Pelecaniformes	Ardeidae	Least Concern
Pied Kingfisher	Murobyi	<i>Ceryle rudis</i>	Coraciiformes	Alcedinidae	Least Concern
Spickled Mousebird	Umusure	<i>Colius striatus</i>	Coliiformes	Coliidae	Least Concern
Slender-Billed weaver	Isandi	<i>Ploceus pelzelni</i>	Passeriformes	Ploceidae	Not assessed
African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Passeriformes	Motacillidae	Least Concern
Malachite Kingfisher	Murobyi	<i>Corythornis cristatus</i>	Coraciiformes	Alcedinidae	Least Concern
Green Sandpiper		<i>Tringa ochropus</i>	Charadriiformes	Scolopacidae	Least Concern
Common Bulbul		<i>Pycnonotus barbatus</i>	Passeriformes	Pycnonotidae	Least Concern

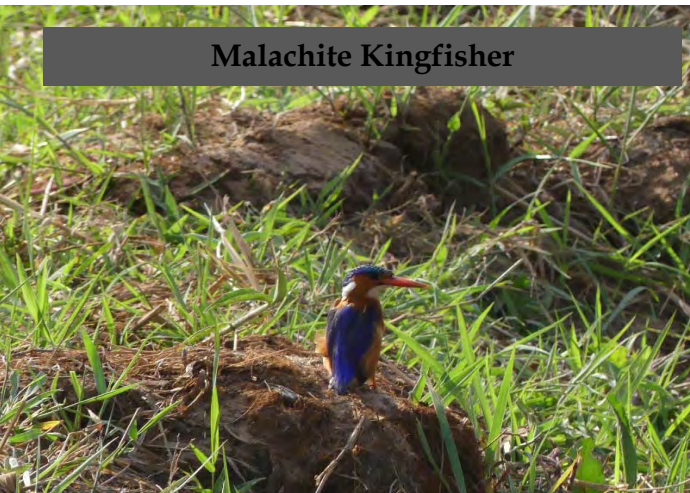
Source: BESST Ltd, 2016 & IUCN List



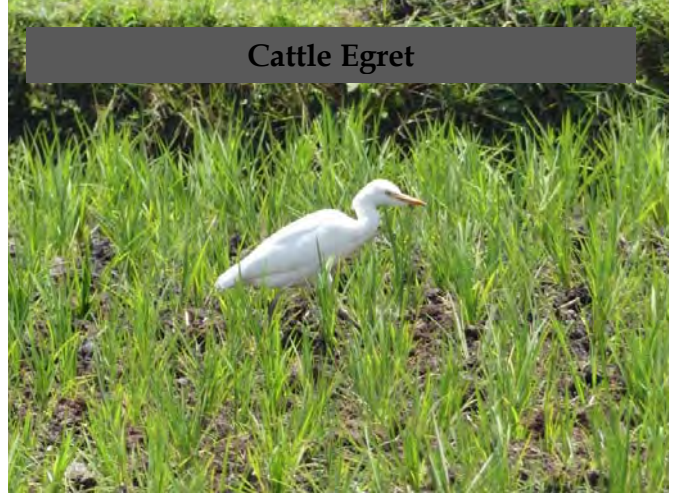
Sacred Ibis



African Wattled Lapwing



Malachite Kingfisher



Cattle Egret

Figure 25: Images of some birds found in project area

- **Amphibians:** Only 2 species of amphibians were found. Those are *Ptychadena mascareniensis* and *Afrixanus quadrivittatus*. The first species was observed at several locations in Cyaruhogo Mash. It is difficult to say that those are the only species found in this area since the sampling was done in mornings and afternoons only. Some amphibian species are known to be nocturnal. However, given that the ecosystem is mostly disturbed, it is difficult to find other species. These 2 species are adapted to ecosystem disturbance.



Ptychadena mascareniensis



Afrixanus quadrivittatus

Figure 26: Some amphibian species in the project areas

Insets: Several insect species were found in Cyaruhogo. However, given that the identification was limited to the level of order; several species were grouped in orders.

Table 32: Insect recorded in Cyaruhogo marshlands

Common name	Order	No. of species
Dragonfly	Odonata	3
Cicada	Homoptera	2
Butterfly	Lepidoptera	2
Grasshoppers	Orthoptera	2
Praying Mantis	Dictyoptera	1
Lacewing	Neuroptera	2

Source: BESST Ltd, 2016

Flora: Cyaruhogo Marsh is dominated by rice plantation. In some zones which are not irrigated rice is planted only during the rainy season and during the dry season, rice is replaced by other food crops such as Irish potatoes, beans, maize, etc. Moreover, some natural plant species are found at some few locations. These include Water Hyacinth (*Eichhornia crassipes*) found in water ponds, *Mangifera indica*, *Erythrina abyssinica*, *Lantana camara*. Other plant species found around Cyaruhogo marsh include: *Grevillea robusta*, Bamboo (*Arundinaria alpina*), *Acacia sieberana*, *Euphorbia tirucalli* (Umuyenzi) and *Dracaena afromontana* (Umuhati).



Erythrina abyssinica



Some bamboos

Figure 27: Some flora species in Cyaruhogo area

b) Gashara Marshland

In Gashara marshland, data were collected on one reconnaissance trail and covered a distance of 2.3 km. Species found are summarized in the sections below.

- **Birds:** A total of 12 bird species were found in Gashara marshland. They were grouped into 7 orders and 9 families.

Table 33: Birds species identified in Gashara marshland and their conservation status

Common Name	Vernacular Name	Scientific Name	Order	Family	IUCN Conservation status
Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Pelecaniformes	Threskiornithidae	Least Concern
African Wattled	Inkurakura	<i>Venellus senegallus</i>	Charadriiformes	Charadriidae	Not assessed

Lawping					
Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Charadriiformes	Charadriidae	Least Concern
Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Pelecaniformes	Threskiornithidae	Least Concern
African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Passeriformes	Motacillidae	Least Concern
Malachite Kingfisher	Murobyi	<i>Corythornis cristatus</i>	Coraciiformes	Alcedinidae	Least Concern
African Harrier Hawk	Ikizu	<i>Polyboroides typus</i>	Accipitriformes	Accipitridae	Least Concern
Common Grey-Headed Sparrow	Igishwi	<i>Passer griseus</i>	Passeriformes	Passeridae	Least Concern
Arrow-Marked Babbler	Ikijwangajwan ga	<i>Turdoides jardineii</i>	Passeriformes	Leiothrichidae	Least Concern
Long-Toed Lapwing	Inkurakura	<i>Vanellus crassirostris</i>	Charadriiformes	Charadriidae	Least Concern
Yellow-Billed Stork		<i>Mycteria ibis</i>	Ciconiiformes	Ciconiidae	Least Concern
Speckled Pigeon	Inuma	<i>Columba guinea</i>	Columbiformes	Columbidae	Least Concern

Source: BESST Ltd,2016



Figure 28: Birds species found in the marshlands

- **Amphibians:** Only one amphibian species was found in Gashara (*Ptychadena mascareniensis*). This species is the most common and abundant in all 4 sites surveyed. It is characteristic of disturbed wetlands.

Insects: 11 species of insects were found belonging to 6 orders

Table 34: Insects species found in Gashara marshland

Common name	Order	No. of species
Locusts	Orthoptera	1
Bees	Hymenoptera	1
Grasshoppers	Orthoptera	2
Butterfly	Lepidoptera	2
Beetle	Coleoptera	2
Dragonfly	Odonata	2
Lacewing	Neuroptera	1

Source: BESST Ltd, 2016

Flora: Gashara marshland consists of only rice plantation. No other natural plant species or food crop species were found within the marshland. However, some species are found in areas around the marshland. These include: *Eucalyptus sp.*, *Euphorbia tirucalli*, *Chassalia subochreatea*, *Acacia sieberana*, *Lantana*, *Eichornia crassipes*, *Musa sp.*, *Carica papaya*, *Coryza sumatrensis*, *Coryza sumatrensis*, *Xyris Valida* and *Erythrina abyssinica*.

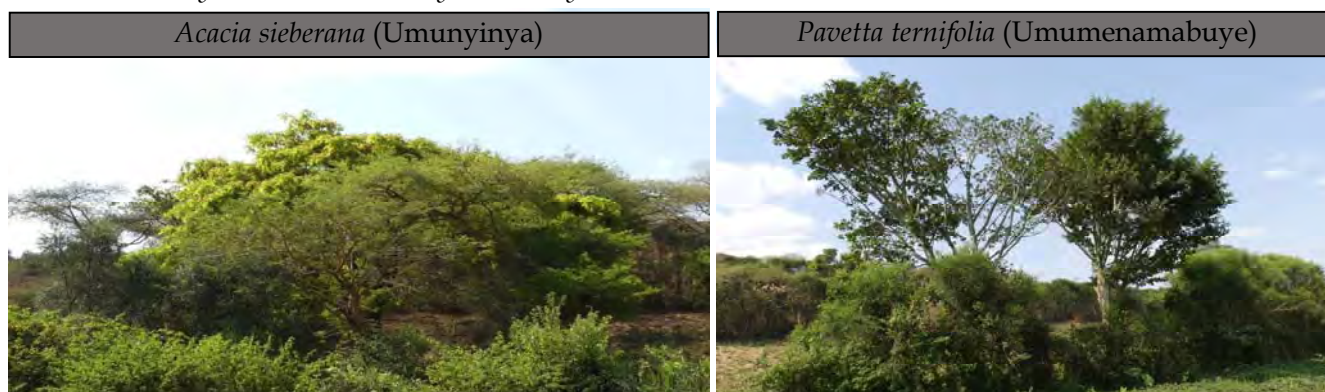


Figure 29: Flora species found in Gashara area

c) Bugugu Marshland

Data were collected along one reconnaissance trail which covered a distance of 3.14 km. Species found are summarized in the sections below.

- **Birds:** As for the previous sites, birds were the most dominant species observed in Bugugu marsh. A total of 11 bird species were found. They belong to 6 orders and 9 families.

Table 35: Birds species in Bugugu marshland and conservation status

Common Name	Vernacular Name	Scientific Name	Order	Family	IUCN Conservation status
Pied Crow	Igikona	<i>Corvus albus</i>	Passeriformes	Corvidae	Least Concern
Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Pelecaniformes	Threskiornithidae	Least Concern
Hammerkop	Sarupfuna	<i>Scopus umbretta</i>	Pelecaniformes	Scopidae	Not assessed

African Wattled Lawping	Inkurakura	<i>Venellus senegallus</i>	Charadriiformes	Charadriidae	Not assessed
Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Charadriiformes	Charadriidae	Least Concern
Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Pelecaniformes	Threskiornithidae	Least Concern
Cattle Egret	Inyange	<i>Bubulcus ibis</i>	Pelecaniformes	Ardeidae	Least Concern
African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Passeriformes	Motacillidae	Least Concern
Pied Kingfisher	Murobyi	<i>Ceryle rudis</i>	Coraciiformes	Alcedinidae	Least Concern
Black kite	Sakabaka	<i>Milvus migrans</i>	Accipitriformes	Accipitridae	Least Concern
African Open-Billed Stork		<i>Anastomus lamelligeru</i>	Ciconiiformes	Ciconiidae	Least Concern

Source: BESST Ltd, 2016

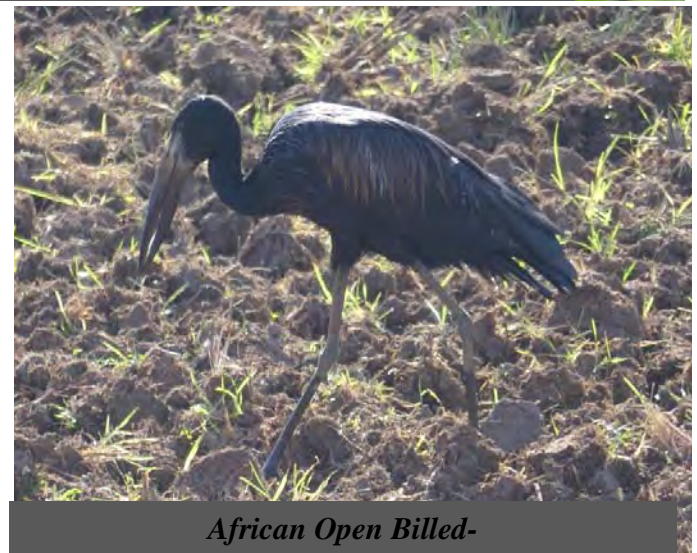
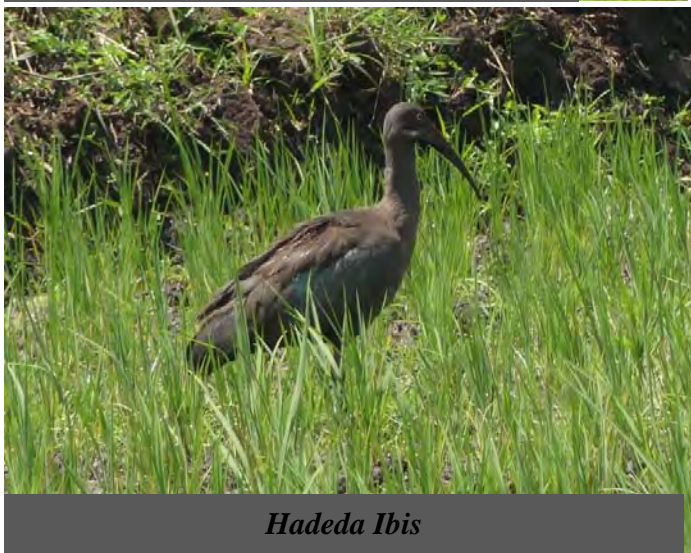


Figure 30: Birds species found in Bugugu area

- **Amphibians:** Two amphibian species were found: *Ptychadena mascareniensis* and *Amietophrynus kisolensis*.



Figure 31: Amphibians found in Bugugu

- **Insects:** 8 species of insects were found belonging to 4 orders

Table 36: Insects species found in Bugugu marshland

Common name	Order	No. of species
Dragonfly	Odonata	2
Butterfly	Lepidoptera	2
Grasshoppers	Orthoptera	2
Lacewing	Neuroptera	2

Source: BESST Ltd 2016

Flora: Rice is the dominant plant species found in Bugugu marshland. In addition, some plant species are found in areas around the marshland including: *Eucalyptus sp.*, *euphorbia tirucalli*, *acacia sieberana*, *Musa sp.*, *Lantana camara*, *Eichornia crassipes*, *Grevillea robusta*, *Pavetta ternifolia*, *Mrkhamia lutea*, *Tithonia diversifoliam*, *Ancanthus pubescens*, *Erythrina abyssinica*, *Xyris Valida*, and *Pennisetum purpureum*.

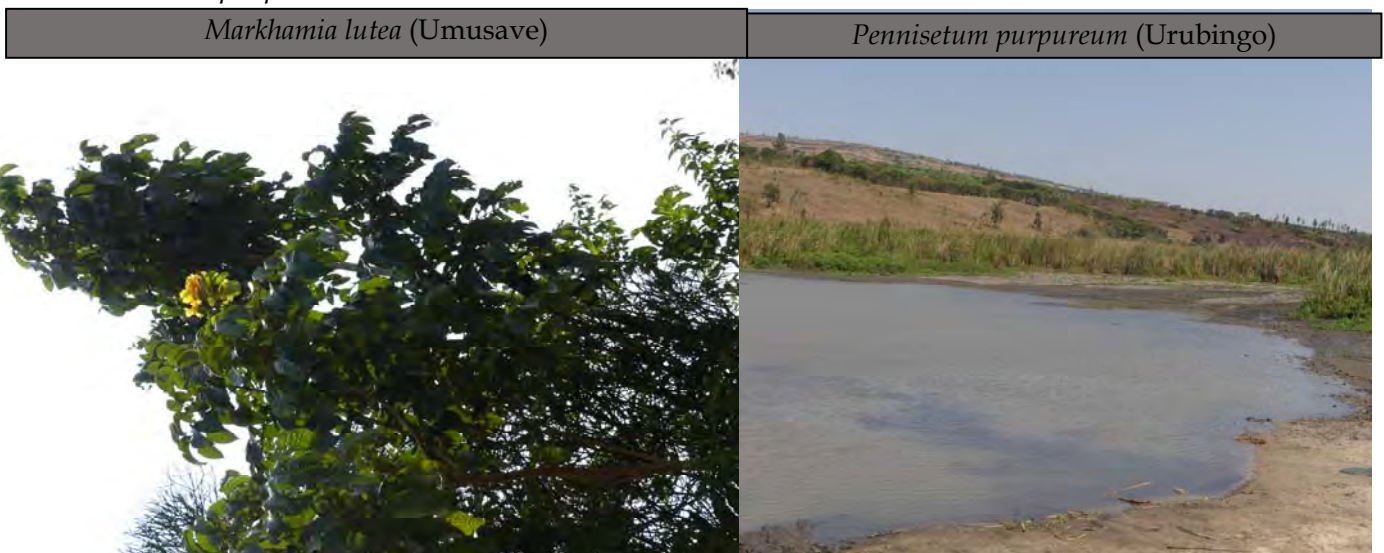


Figure 32: Some flora in Bugugu marshland area

d) Cyimpima Marshlands

Cyimpima is the largest marsh among the 4 sites surveyed. Data were recorded along one reconnaissance trail of 5 km of length. This marsh is characterized by rice plantation and a dam which irrigate the rice fields.

- **Birds:** a total of 16 bird species were recorded and identified. They were categorized into 5 orders and 13 families.

Table 37: Birds species recorded in Cyimpima marsh and their conservation status

Common Name	Vernacular Name	Scientific Name	Order	Family	IUCN Conservation status
Yellow-Billed Duck		<i>Anas undulata</i>	Anseriformes	Anatidae	Least Concern
Pied Crow	Igikona	<i>Corvus albus</i>	Passeriformes	Corvidae	Least Concern
Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Pelecaniformes	Threskiornithidae	Least Concern
Hamerkop	Sarupfuna	<i>Scopus umbretta</i>	Pelecaniformes	Scopidae	Not assessed
African Waddled Lawping	Inkurakura	<i>Venellus senegallus</i>	Charadriiformes	Charadriidae	Not assessed
Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Charadriiformes	Charadriidae	Least Concern
Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Pelecaniformes	Threskiornithidae	Least Concern
Cattle Egret	Inyange	<i>Bubulcus ibis</i>	Pelecaniformes	Ardeidae	Least Concern
Slender-Billed Weaver	Isandi	<i>Ploceus pelzelni</i>	Passeriformes	Ploceidae	Not assessed
African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Passeriformes	Motacillidae	Least Concern
Pied Kingfisher	Murobyi	<i>Ceryle rudis</i>	Coraciiformes	Alcedinidae	Least Concern
Red-Chicked Cordon Bleu		<i>Uraeginthus bengalus</i>	Passeriformes	Estrildidae	Least Concern
Olive-Bellied Sunbird		<i>Cinnyris chloropygia</i>	Passeriformes	Nectariniidae	Least Concern
Grey-Backed Fiscal		<i>Lanius excubitoroides</i>	Passeriformes	Laniidae	Least Concern
Pink-Backed Pelican		<i>Pelecanus rufescens</i>	Pelecaniformes	Pelecanidae	Least Concern
Common Waxbill		<i>Estrilda astrild</i>	Passeriformes	Estrildidae	Least Concern

Source: BESST Ltd, 2016 & IUCN Conservation list



Yellow-Billed



Pink-backed Pelican



Common Waxbill



Red-Chicked Cordon

Figure 33: Photos of birds found in Cyimpima marshland

- **Amphibian:** Cyimpima had all amphibian species found in all sites. 4 species were recorded: *Afrixanus quadrivittatus*, *Amietophrynus kisolensis*, *Ptychadena mascareniensis* and *Ptychadena porosissima*.
- **Insects:** Only 4 insect species were recorded in Cyimpima. These included Dragonfly (2 species), Grasshoppers (1 species) and Lacewing (1 species). These insects were found in and around the dam.
- **Flora:** The Rice is the most dominant plant species found in Cyimpima marshland. However, some plant species are found in areas around the marshland such as: *Pennisetum purpureum*, *Vernonia lasiopus*, *Ephorbia tirucalli*, *Acacia sieberana*, *Musa sp.*, *Grevilea*, *Eucalyptus*, *Lantana camara*, *Ancanthus pubescens*, *Pavetta ternifolia*, *Erythrina abyssinica*, *Colocasia esculenta*

e) Mammal species in all 4 sites

No mammal species both sighting and indirect signs (animal voices, dung, footprint or spoor, hairs, digging and nests) was encountered during the field survey. However, community members that we interviewed mentioned that in the whole area some carnivore species are rarely encountered. There is no indication if their presence is linked to the presence of marshes since they are mostly encountered in areas around the marshes and not within the marshes.

Table 38: Mammal species found in the area

Order	Family	Common Name	Vernacular Name	Scientific Name	IUCN Conservation status
Canivora	Canidae	Side-Striped Jackal	Imbwebwe	Canis adustus	Least Concern
Canivora	Viverridae	Genete	Urutoni	Genetta servalina	Least Concern
Canivora	Herpestidae	Mongoose	Umukara	Galerella sanguinea	Least Concern

Source: BESST Ltd, 2016 & IUCN Conservation list

f) Reptile and fish species found in the area.

Similarly, reptiles were not encountered during the field survey. The information collected was provided by community members around the 4 sites. According to them 4 species are found in the area within the marshes around the marshes. Regarding fishes, they mentioned that in the past, one fish species was found in a few available ponds. This species has disappeared perhaps due to water hyacinth which colonized all ponds in the area. However, the information they provided was not enough and could not allow us to identify the species.

Table 39: Reptile species found in 4 sites

Family	Common Name	Vernacular Name	Scientific Name	IUCN Conservation status
Colubridae	African Green Snake	Incarwatsi	Philothamnus heterolepidotus	Not Evaluated
Viperidae	Puff Adder	Impiri	Bitis arietans	Not Evaluated
Elapidae	Spitting Cobra	Incira	Naja nigricollis	Not Evaluated
Lamprophiidae	Striped Sand Snake	Imbarabara	Psammophis sibilans	Least Concern

Source: BESST Ltd, 2016 & IUCN Conservation list

g) Tree Species to be affected by projects

It was not possible to make a thorough assessment of all trees that are likely to be affected by rehabilitation works. However, in Cyaruhogo dam area the consultant team visited the site where it is expected to construct a new dam and found 5 natural trees species likely to be affected. These are among others: *Erythrina abyssinica*⁶ (Umuko), several trees of Acacia (*Acacia sieberana*) or known as Umunyinya, *Entada abyssinica* (Umusange) and *Pavetta ternifolia* (Umumenamabuye). Other plant species include *eucalyptus trees*, *Euphorbia tirucalli* (Umuyenzi) and *Dracaena afromontana* (Umuhati). If these trees need to be cut, during construction work, they need to be replanted again during site rehabilitation (seeds must be available in RAB (in the former arboretum)). The survey team has identified all trees to be affected and are presented in RAP report appendix. We suggest that the valuation team to make a thorough assessment based on the spatial extent of the area to be affected by dam construction and upgrading.

⁶ Despite this tree being listed in the Ministerial order, this species is not of conservation importance since it is widely distributed in Rwanda especially in the Eastern Province. It gained the status of "protected species" since it has a cultural importance.

CHAPTER FIVE: PUBLIC CONSULTATION AND PARTICIPATION

5.1. Overview

Public consultation and stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an on-going process that involves the following elements; stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism and on-going reporting to affected communities.

5.2. Purpose

- To prepare communities on potential emergency scenarios that could be caused by the project and can affect the community.
- To build a trusting relationship with the affected communities and other interested stakeholders based on a transparent and timely supply of information and open dialogue.
- To ensure effective engagement with local communities and other key stakeholders throughout all phases of the project.
- To actively build and maintain productive working relationships, based on principles of transparency, accountability, accuracy, trust, respect and mutual interests with affected communities and other stakeholders.

5.3. Public consultations and participation

Public participation and community consultation has been taken up as an integral part of social and environmental assessment process of the project. Consultation was used as a tool to inform project affected people, beneficiaries and stakeholders about the proposed activities both before and after the development decisions are made. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process helped in reducing the public resistance to change and enabled the participation of the local people in the decision making process. Initial Public consultation has been carried out in the project areas with the objectives of minimizing probable adverse impacts of the project and to achieve speedy implementation of the project through bringing in awareness among the community on the benefits of the project.

As part of the project consultations, efforts were made to consult with the decision making official at central level as well as a number of local authorities, to determine their thoughts, opinions and feedback on the impact of the project of rehabilitation of irrigation facilities in Rwamagana District. Information and comments collected from the public early in the study process were of use. Local communities especially farmers who are currently using the marshlands were also consulted to give them the opportunity to express their views and concerns. As part of the process, they were also provided with relevant and sufficient information on the project prior to its start - up.

5.3.1. Stakeholders

Discussions with decision making bodies, key stakeholders, sector institutions and specialist experts were made on the very concepts and nature of the proposed project, giving emphasis on levels of public participation, role of key stakeholders and joint contributions of these actors to the success of the project. In addition, the scope of the proposed project and possible means of maximizing local communities' social, economic and environmental benefits from the project implementation were underlined. Key stakeholders and authorities with whom consultations made at the project study areas were:

At national level:

- Ministry of Natural Resources: Director of Environment, water and forest;
- Ministry of Agriculture and animal Resources: irrigation and marshlands development specialist ;
- Rwanda Natural Resources Authority: Director of water resources management
- Rwanda Environment Management Authority (REMA): In charge of pollution control
- Rwanda Development Board RDB: Environmental Review Specialist.
- Rwanda agriculture Boards: different member of irrigation and mechanization department
- MINAGRI/SPIU for marshlands and hillsides irrigation projects(Environment officer, irrigation engineer, social safeguards specialist)

At local level:

- Rwamagana District Authorities and staffs
- Sector agronomist
- Cooperative leaders
- Local mediators known as «Abunzi»

List of consulted people are attached in appendices

5.3.2. Public participation - methods and process

During the Public consultation, the study team applied different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD) and official meetings with stakeholders. Stakeholders consulted were informed on the proposed project and by using the key guiding questionnaires, the study was able to guide discussions and obtain relevant information on the likely impacts of the project activities.

During these consultations stakeholders and the communities were explained about the project, its benefits, social and environmental impacts. The participants were encouraged to (i) be open and make known their concerns and claims. The presentation highlighted the project background, objectives, expected upcoming activities, social economic information, environmental concerns and land acquisition process.

5.4. Consultative meeting held with stakeholders and communities

Different meeting was organized by the study team from the earliest stage of project planning so as to present to all stakeholders the proposed project. In addition to public consultation meeting with project beneficiaries or project affected persons, the study team held technical meeting and one to one meeting with stakeholders as well. Meetings and consultation continued throughout the study period.

5.4.1. Project Introductory meeting of 12th July 2016 At Cyaruhogo Marshlands

This meeting was organizing by JICA study team that is conducting the preparatory survey on the project for rehabilitation of Irrigation facilities in Rwamagana district. The meeting was organized with all stakeholders in order to introduce the project, planned activities and the need of cooperation from the beneficiaries (farmers, cooperatives and Union). The meeting took place on 12th July 2016 at «Cooperative de Riziculteurs de Cyaruhogo (CORICYA) office». The meeting was attended by the executive committee of the four cooperatives and the president of union of cooperatives, JICA consultant team and their subcontractors for geotechnical investigation and topographic survey, and local authorities on district, sector and cell level. The list of all participants and the pictorial view in appendix 2.

After the welcome note provided the district representative, the JST introduced the project and provided details on rehabilitation of Rwamagana scheme project. He explained that the whole project shall consist at rehabilitation of the existing three dams and construct a new one for Cyaruhogo scheme, including main canal lining and establishment of strong cooperative through capacity building as well as Irrigation water users association to ensure the sustainability of rehabilitated irrigation infrastructure.

The Africa drilling & Exploration Company, explained different type of drilling and pit tests soon to be done. He promised that farmer's field which will be affected by the testing activities will be compensated for the damaged crop and his work will provide remunerable job to the community. On the behalf the topographic survey company explained the way the topographic survey will be conducted and it will provide some work to the community. After these presentations, participants were provided with time for question and discussions. The table below gives the main questions/concerns and explanation/answers as well some resolutions:

Table 40: Issues and answers recorded during initial consultation meeting

Speaker	Questions/concerns	Answers/explanations
Present of cooperative Union of Rwamagana scheme	His concern was that there will be a missing rice cropping season during the rehabilitation of irrigation infrastructure and farmers has to be informed in advance to avoid the loss of their crop.	The consultant team told them that after preparation of the entire necessary, farmer will be informed the date of rehabilitation in advance so that the activity will begin with no crop in their field.

President of COCURIC YI	He asked if the sediments available in the reservoir of Cyimpima dam cannot be excavated in order to increase the retention capacity. For the rehabilitation of main canal, he asked too if the paddy field upstream of the dam will be concerned.	He was answered that it is not ease to excavate around 46,000 m ³ of sediments in each affected three existing reservoirs and to find a place to put them. The current proposed solution is to raise the height of the dam. For the upstream dam paddy field are not concerned by this project (out of scope).
President of Zone COCURIG A	Her concerns were about the sedimentation of Gashara Dam reservoir and fields. She asked too if the damaged Gaseke sub-dam, complementary to Bugugu dam to avail sufficient water, will be rehabilitated.	The consultant team answered that the current proposed solution for silted reservoir is to raise the height of dam instead of excavation. Again the sub-dam and field are out of scope of this project and will not be rehabilitated.
president of CORICYA	When the new dam will be constructed, some are have to be submerged by reservoir. How the affected farmers by losing the farm will be compensated?	The explanation of this question was given by District agronomist. All lands in marshland or valley are belonging to the government and farmers use the land through a rental basic. In case there is common development interest, the government requests the farmer to handover the land. In addition, he said that an inventory will be made to identify the current upper surface crops in order to avoid farmers who will plant some valuable crop or install some infrastructure by thinking to be expropriated with money.

Source: BESST Ltd, 2016

After the presentation and discussion, participant to the meeting found the project interesting as it will resolve the insufficient irrigation water problem and hope to increase their rice productivity. Cooperative representatives were requested to convey the message to all cooperatives members and were requested to be supportive in order to conduct this survey successful.

5.4.2. EIA&RAP kick-off meetings

After the recruitment of the subcontractor for EIA and RAP study two kick off meeting were organized at RAB and Rwamagana District offices respectively. The two meetings aimed at introducing the EIA/RAP consultant and sharing available information on the proposed project.

The kick-off meeting at RAB office were attended by Managing director of Bureau for environmental and Social studies/BESST LTD, the Environment and social consultant from JICA study team and, the representative of Irrigation, Land Husbandry and Mechanization Department in Rwanda Agriculture Board (RAB), Ministry of Agriculture, and Animal Resources (MINAGRI).

Among other points discussed in the meeting include the Proposed Entitlement Matrix, Requested Data from RAB and JST, Size of Environmental Buffer Zone, Terms for GIS land use map and Schedule for the further study and meetings. The table below summarize the outcome of the meeting.

Table 41: Outcome of the keck-off meeting at RAB office

Item	Discussion	Conclusion/agreement
Proposed Entitlement Matrix	Key point discussed include: <ul style="list-style-type: none"> - Responsibilities of compensation - Land ownership - Gaps between national and international regulations related to compensation 	<ul style="list-style-type: none"> - Land expropriation and compensation are fully responsibility of the recipient government; - Land in the marshlands is government land and farmers are users; - Land for land compensation will be the first option and then comes cash compensation at replacement cost as much as possible for those who will lose his/her farming lands
		<ul style="list-style-type: none"> - The disturbance allowance is to be 5% of the total compensation cost. In addition, the RAB agreed to prioritize PAPs to be hired as construction labour during the construction period so as their income is to be restored
Requested Data from RAB and JST	The following data were requested from RAB <ul style="list-style-type: none"> - List of farmers who are currently using these marshlands and or Cooperatives - Selected/priority crops in these marshlands; - Any agreement with cooperatives who are using these marshlands(like Water fees); - Previous study conducted for these marshlands to be rehabilitated if An 	<ul style="list-style-type: none"> - RAB provided contact details for Cooperatives leaders who will provides the lists, - Rice is the priority crop selected - No agreement between RAB and cooperative - No study available
	From JST:	JST shared GIS data including (1) shape

	<ul style="list-style-type: none"> - Preliminary studies/design/drawings of planned structure with their sizes/structure (dam and canals, reservoirs); - Materials to be used during constructions; - GPS coordinates and Maps for the location of dam axis and reservoir 	<p>files of marshland, land use, cadastral map, and contour line, (2) Typical cross section of four dams, and (3) JICA's ESCs guidelines (2010 in English version).</p>
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After the kick of meeting at RAB, another meeting was held at Rwamagana district office and the JICA study EIA expert together with BESST team met with district staff including the district agronomist, the district environment Officer, the district statistician and the district coordinator of planning. The meeting aimed at introduction the EIA/RAP consultant and to request the district support for the study. In the meeting, the district staffs were explained the planned studies including the Environmental Impact Assessment, Resettlement Action Plan and baseline data collection. After discussion, district staff expressed their commitment to provide the full support and to avail different documentation. In the meeting with the district agronomist it was decided to have a meeting with farmers who are using the four marshlands.

5.4.3. Consultative meeting of August 23rd, 2016

The meeting was held on Tuesday, August 23rd, 2016, in Cyaruhogo marshland, Rwamagana district. The objective of the consultation meeting was to discuss with stakeholders, project affected persons and local authorities the proposed project of rehabilitation of Cyaruhogo, Cyimpima, Gashara and Bugugu, Environmental and resettlement impacts associated with the projects, preparation of resettlement action plan, project baseline data collection and creation of the Irrigation Water users associations(IWUAs).

The meeting agenda included:

- Presentation of the projects;
- Presentation on the creation of IWUA;
- Discussions on Environmental and Social impacts assessment
- Discussion on compensation and grieves redress mechanism

The public consultation meeting was attended by 60 persons including 47 men and 13 women and was attended by the representatives from local authorities, projects affected persons, and cooperatives that use the marshlands as well as the project proponent and study team. Below are categories of participants:

- Representatives of Projects Affected persons/ Farmers representatives;
- Representatives from Rwamagana Districts(Agronomist, District environment officer and In charge of cooperatives);
- JICA study team;
- EIA& RAP study team;

- Representative of Rwanda Agriculture Boards(RAB);
 - Sector Agronomist;
 - Representatives community judicial court'' Abunzi'';
 - Executives committee of Rice cooperative Union;
 - Executive committee of 4 rice cooperatives(CORICYA, COCURICYI, COCURIGA and COCURIBU); and
 - Representatives of other marshlands users (Association of Water supply in Rwamagana).
- The full list of participants is attached as appendix 1.

The meeting was introduced by district agronomist who made a brief presentation of the proposed projects of rehabilitation Cyimpima, Gashara, Bugugu and Cyaruhogo irrigation infrastructure. He pointed out that the project is being prepared by Japan International Cooperation Agency (JICA) and the Ministry of Agriculture and Animal Resources (MINAGRI) through Rwanda Agriculture Board (RAB). The project will consist on rehabilitation of three existing Dams at Cyimpima, Gashara and Bugugu with associated main irrigation canals. The project also includes the construction of new dam at Cyaruhogo Marshland. He explained that on-going study will include project technical design study, Environmental Impact Assessment, Resettlement Action Plan and baseline data studies conducted by JICA study team and its national sub-contractor BESST Ltd. After the presentation of the project, three more presentations were provided including the creation of Irrigation Water Users Association (IWUA), objective and content of EIA and RAP, compensation and Grievance Redress Mechanism (GRM).

After his intervention, Miss MUKESHIMANA Angélique, in charge of Water Users association in RAB, Eastern zone and was supported by Dr. Shemsu Kemal from JICA study team. The presentation focused on the objective of the creation of IWUA, the composition of different committees of IWUA, process and procedures of electing these committees, differences between organs of Rice cooperative and organs of IWUA. The water users association are set-up to ensure that water are used in accordance with established plan and irrigation infrastructure are protected and maintained by farmers who regularly pay water use fees. Irrigation association will ensure the use of available water in consideration of different users, the group that really need water.

The third presentation focused on environment and social impact assessment and resettlement action plan study including baseline data study. The consultant presented the legal framework of EIA/RAP studies at both national and international level including JICA's New Guidelines for Environmental and Social Considerations. He explained the importance of public consultation in EIA/RAP process whereby Project affected persons and other stakeholders are provided with information on the project and given time to express their views and concern.

Reference made to other similar project, the consultant presented anticipated project impact including adverse impact such as: gradual soil acidification from unregulated fertilizer application, soil and water contamination from oil spillage of construction equipment, Air and noise pollution, Soil erosion and landslides from construction works, Fire outbreaks, Loss of biodiversity at dam reservoir on hillsides and valleys to project activity, Land and crops, mostly to the reservoir, Farmer's income lost by missing cultivation season during construction works, Diseases contracted from interactions during construction, Loss of existing infrastructure (portable water points, power lines), Increase of HIV and other STD.

Among positive impacts the consultant included, Job creation and income generation, Knowledge transfer, increased production from farming all year round, market access for agricultural products, Affordability of medical insurance and education as will have more resources, Flood control, Creation of habitat for fish at the reservoir

The final presentation focused was on compensation and grievance redress mechanism and RAP expert from BESST LTD focused on the process of preparation of Resettlement Action Plan but insisted on compensation of project impacts and how PAPs will be compensated. She highlighted key anticipated impacts including the loss of land, loss of crops and trees as well as the loss of income. She mentioned that although the project funds will be provided by JICA, Compensation fees is the responsibility of the recipient country and national expropriation law as well as JICA guidelines will be complied with. The Government of Rwanda will provide the compensation of affected assets and the replacement cost will be calculated by independent valuar as provided by valuation law.

On the compensation measures, land for land compensation is the first option especially for land based impact and where this is not possible, cash compensation is considered. In addition to the compensation, projects affected persons are given priority in jobs during construction.

In relation to the Grievance redress mechanism she pointed out that GRM committee will be established at site level and other administration conflict resolution mechanism like "abunzi" will be used. She concluded her presentation by urging project affected persons and other stakeholders to provide the required information. She also urged Project affected persons to participate in different RAP committee including GRM and Resettlement Committee. It was agreed that the cut-off date is August 25th, 2016 when baseline data collection starts. After each presentation, participants were provided with opportunity to express their views and concerns.

Table 42: Key questions/concerns and response provided.

Gender	Question	Answer
M	Who are members of executives	The executive committee of WUA is made of eleven member including: <ul style="list-style-type: none"> - Executive committee(5) - Audit committee(3) - Conflict resolution committee(3)
	How the manager of IWUA shall work with the current Manager of Cooperatives.	These are two different institutions and there should be no conflict of responsibilities among them. The manager of cooperatives will collect water fees from cooperative members and deposes them to the IWUA account. The manager of WUAs will manage the use of these fees. In addition he will ensure that all fees are paid and work with other institutions to recover unpaid fees.
	Who are eligible candidates for making IWUAs committees?	Only cooperatives members who do not have leading role in cooperatives are eligible for IWUAs committees. This is to avoid conflict of interests between users and water user's managers.
	Who will elect the executive committee of IWUA? How election will be conducted?	The executive committee of IWUAs is elected by the three members from each farmers group who are eligible and will elect the 11 members of the executive committee.
M	How other waters users will be represented in WUA committees? What about other waters users?	Other users will be represented different committees.
	Should they pay water fees?	Other users who are not in farmers cooperatives will have to pay water fees in accordance with IWUA internal regulations
M	How the project is planning to compensate people who will lose production due to dam rehabilitation/construction since water will be stopped?	Affected people will be provided with employment in dam construction and they will be allowed to cultivate crops which do not need much water.
M	What about water points/springs that will be affected in dam reservoir?	By principle is to replace affected water points and expert from JICA study team will identify potential water sources. Negotiations are on-

		going between RAB and JICA to know who will cover the cost. He informed participant that so far, it's anticipated that Rwamutanazi, Cyaruhogo, Gahonogo spring are likely to be affected
	She asked about the land that will be used as construction camp she wanted to know if owners will be provided with compensation.	All affected person will be compensated whether it's at dam sites, quarries site, construction camps and material deposit sites as long as the owners prove her/his ownership
	Asked participants if there are farmers who have lands at Cyaruhogo dam reservoir.	Though the land at dam reservoir is government lands but farmers are using the land it will be checked if no farmers has land title in the affected area
	He also wanted to know have the information provided in the meeting will be shared.	The information will be shared through Farmers group meeting and village meeting to be organized respectively by group and village leaders who were in the meeting.

5.4.4. One to one consultation

In addition to the public consultation meeting, the consultant team conducted one to one interviews with different official to discuss the projects and collect their views, concern and recommendation. Consultation conducted also allowed the team to collect different data and information related to the projects like existing laws, standards and policies helped. Below are the key stakeholders consulted.

- Ministry of Natural Resources: Director of Environment, water and forest;
- Ministry of Agriculture and animal Resources: irrigation and marshlands development specialist ;
- Rwanda Natural Resources Authority: Director of water resources management, Legal officer, In charge of water Quality,
- Rwanda Environment Management Authority(REMA): In charge of pollution control
- Rwanda Development Board RDB: Environmental Review Specialist.
- Rwanda agriculture Boards: different member of irrigation and mechanization department
- MINAGRI/SPIU for marshlands and hillsides irrigation projects (Environment officer, irrigation engineer, social safeguards specialist).

Key issues identified during one to one consultations include:

- Pollution of water bodies during construction and from non-point sources during project implementation, soil erosion, sedimentation of river due to excavation around the river, Possibility of loss of property , crops and trees, disturbance of water table, loss of biodiversity.

- Likelihood of delays in compensation of PAPs, which could escalate into disputes, Execution period, employment for their citizen, cost and accessibility of potable water waste management and disposal, Source of construction material, health insurance; connectivity to the existing network, cost of land acquisition and eligibility criteria.;
- Possibility of low wages to local workers during construction works;
- Payment of water fees;
- Roles and responsibilities in implementation and monitoring of ESMP/RAP;

The list of stakeholders consulted at central level is presented in appendix 3 while the guiding questions are presented in appendix 4.

5.5. Additional Public consultation at draft stage

At drafting stage further consultation meetings were conducted with PAPs and key stakeholders. These meeting discussed key findings of the Environmental and Social assessment and compensation alternatives.

5.5.1. Consultative meeting with the head of land husbandry and irrigation in RAB

The meeting was held in the office of the Head of Land husbandry Irrigation and Mechanization department, Rwanda Agriculture Board (RAB) on October 17th, 2016. The main purpose of this meeting was to meet head of the LIM, RAB and argue on the progress of the Preparatory Survey on the Project for Rehabilitation of Irrigation Facilities in Rwamagana District and upcoming work on site. There were two agenda for this meeting:

- Hydro-geology and Resistivity survey on site;
- Compensation to farmers who will be affected by this project

On the hydro geophysics, the meeting observed that there is need of some data to be acquired. One participant asked to make list of necessary data and give it to RAB. Then RAB will make request to the concerned Ministries or institutes especially to Rwanda Natural Resource Authority (RNRA).

In relation to farmers that will be affected during construction, the JST team informed the meeting that new JICA guidelines on environmental and social considerations requires project to align with not only the domestic laws and regulations, but international standards like JICA and WB's operational policy, while the previous one just requested to align with the domestic laws and regulations in general. According to this new guidelines, the farmers whose means of livelihoods are to be affected due to lack of irrigation water during the construction are subjected to be compensated regardless of availability of land title. On this issue he recommended to make a list of expected farmers to be affected, what kind of materials are to be compensated and its cost. Above information should be presented on RAP report which will be submitted to RAB. The full minutes are presented in appendix 5.

5.5.2. Meeting with Cooperatives members

Two general meeting were organised with cooperative members one in Gashara on November 10th and another in Cyaruhogo on November 11th, 2016. The two meting discussed the findings of impact assessment, key impacts identified as well as alternative compensation measures. People who attended the meeting were mainly farmers who will lose income during construction due to lack of irrigation water. In total, 156 People attended both meetings and attendance list are attached as appendix 6.

After consultant presentation, PAPs were provided time to ask questions and provide suggestions. The table below summarize key concern/issues raised and answers provided.

Table 43: Questions asked and answers provided during Gashara Meeting

No	Sex	Question/comments	Answer provided by Consultant
1	M	Farmers who are growing other crops in upland near the marshland will be affected? Will they continue to grow their crops during construction	Only crops that require irrigation water will be affected. Farmers will continue to use this land during construction (consultant).
2	F	Shall we use the land in rice scheme for other crops?	Most of farmers who attended the meeting prefer to not use the land for other crops because it may have negative impact on rice (Farmers).
3	M	How many seasons are we going to miss?	The number of season to be missed will be known after final design study and construction schedules. However reference made to other similar number of missed season range between 2 and 4 (consultant).
4	M	He expressed the concern related to cooperatives and union that will not be able to pay their employees during Construction	The issue shall be considered in RAP and loss calculation and means of compensation will be proposed in RAP. (Consultant).
5	F	Is there any compensation for the income loss during construction?	The income losses during construction have been estimated and means of compensation shall be proposed in the RAP including jobs during construction and other possible assistance to be agreed between RAB and farmers (consultant).
6	M	Will it be possible to share the land with People who will lose land in submerged area?	According to RAB and reference made to other similar project, all farmers who will lose land will be compensated whether in cash or land for land (consultant).
7	M	Is there any land redistribution planned after construction?	This will be decided after rehabilitation and this will depend on new irrigation land secured. This has been done for some marshlands developed under RSSP 3
8	M	Are we going to be given Jobs during	Project affected person will be given

	construction?	priority in during recruitment of labour.
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Source: BESST LTD, 2016

Table 44: Question asked and answers provided in Cyaruhogo meeting

No	Sex	Question/comments	Answer provided by consultant or farmers
1	M	The road between Cyimpima and Cyaruho is preventing water to rich plots in Cyaruho marshlands. Is there any plan to widen waterways under the Roads?	There was no plan to rehabilitate this road but the issues will be brought to relevant institution (consultant).
2	M	In Cyaruhogo we are using rain water. Are we going to be affected during construction?	Crops that depend only on rain will not be affected but the water from the stream will be affected during filling of the dam and this should be considered.
3	M	Asked whether works will start at the same time at all marshlands? My recommendation is to start works at the same time and complete it as soon as possible.	This will be decided during final design and during the establishment of construction schedule (consultant).
4	M	He appreciated the initiative of rehabilitation of these infrastructure because there will be able to use all the marshlands and have two full season.	
5	F	She was worried about payment of their employees because they depends on farmers contributions.	The income loss have been calculated for both farmers and Cooperatives and the results will be brought to RAB and shall be discussed together with other compensation for income loss.
6	M	He raised the issue related to floods from Lac Mugesera and water from Cyaruhogo and Cyimpima	The construction of dam at Cyaruhogo and the rehabilitation of Cyimpima dam as well as the rehabilitation of intakes will help to control floods downstream (consultant).
		Is there any plan to rehabilitate dryers?	So far, only dryers that will be used during construction will be rehabilitated.
8	M	He suggested starting construction in dry season after harvesting as a way of reducing income loss.	This will be considered during final design and establishment of project schedule consultant).
9	F	He asked whether they are going to pay rental fees during construction	Usually rental fees is paid when the farmers is using the land. Cooperative leaders shall request the district to suspend these fees during construction.

Source: BESST Ltd, 2016

5.5.3. Consultative meetings with land owners

Special attention was paid to PAPs who will lose their land, trees and crops and the consultant organized specific meetings with project affected people especially those who are likely to lose their trees, crops and land whether temporary or permanently in submerged area, disposal, borrow pit and construction camp sites. These meetings aimed at providing them with information on the size of land to be affected and their compensation rights. It was also the time to confirm the initial identification and make sure that all PAPs are identified.

The consultant explained to the PAPs the proposed activities in line with the rehabilitation of irrigation facilities and impact so far identified. Among the identified impacts, the consultant highlight loss of land whether temporary or permanently, loss of crops and trees as well as loss of income due to loss of water during construction. The consultant explained also the provision of expropriation law, the valuation and compensation process in the country but also provisions of international policies related to involuntary resettlement including JICA guidelines on environmental and social considerations. After the presentation, PAPs were provided with time for questions and comments. Below are photos taken during consultation and summary of questions and answers or comments recorded during consultation meetings.

The following table summarize key questions and response provided in these meetings and the attendance list are presented in appendix 6

Table 45: Questions and answers provided during consultation meeting with PAPs

No	Question/comments	Answers provided by consultant
Consultative meeting in Cyimpima marshland		
1	How are we going to know the value of our properties?	RAB in collaboration with Rwamagana district will hire an independent valuer who will agree with assets owner the compensation value.
2	When the project implementation will start so that we can plan for our agriculture activities?	It is anticipated that construction will start in 2018, but upon the completion of final design studies, farmers will be informed on construction schedule. Just after the year 2017. There is no problem in the whole year 2017. People can cultivate as usual.
3	Will the project gives us the jobs or it will use machines?	Though some activities will require the use of machines, other works will be performed by people and affected people will be given priority.
4	What are the mechanisms that are you putting in place to ensure that local are provided with jobs?	First of all, locals will be provided with information on time but also during the preparation of construction contract RAB

		shall emphasize the use of local resident in construction work where possible.
Gashara consultative meeting		
1	Sometimes the fees paid as compensation is not enough to buy another land. What are you planning to address this issue?	There will be compensation for land owners and Special attention will be taken on these who are going to lose government land. RAB will hire and independent valuer to provide the replacement cost. For the person who disagrees with the value assignment to his/her property appealing measures are provided.
2	When are we going to get results of your data collection?	This exercise is the initial identification of assets and PAPs and results will be included in RAP report which will be made public. However a final asset valuation will be conducted and every PAP will sign on the valuation form after verification of his attest and its value
3	Where beacons have been installed in dam area is the last limit of the land to be acquired?	Beacons were used to establish the full water level and using this line will be used to determine the land to be submerged.
5	Will farmers allowed to continue to use the land located after full water level?	Yes, but a buffer of 20 m will be required for dam protect. Farmers who have land in these meter will receive compensation
6	The road has been placed in the buffer, but even before we had fear that heavy cars could fall in swamp. Is there any plan to relocate the Road?	This will be checked on engineering design document. If found that it is the case, measures will be provided.
7	What about the water point that will be affected? Said: Executive Secretary of Nawe Cell	The design study is conducting field survey to identify potential source of water and affected water point shall be replaced.
9	One PAPs wanted to know the size of his land that will be taken.	All affected land has been measured by GIS expert and though the final design are not yet completed everyone who wants to see his affected land can consult the GIS expert after the meeting. This was done.
Bugugu consultative meeting		
1	Will our land be taken without compensation?	Private land will be compensated and care will be taken to the ones who will lose government land.

2.	What kind of compensation will you give us?	Compensation measures will be provided based on eligibility criteria and the nature of Impact and the compensation may include land for land compensation or monetary compensation. Especially for crops and trees.
3	When shall the construction start?	The final date for construction is not yet fixed but construction works are expected to start in 2018. Farmers will be informed about construction schedule in due time.
4	If one people has two plots in marshland will be counted two times or will be merged.	If the land is for the same use and fall in the same category these areas are to be summed up in order to avoid double counting.
5	We cannot be against public interest but, but what are the support are we going to receive from the government?	Compensation will be provided to the affected people and job opportunities will be provided during construction.
Consultative meeting at Cyaruhogo		
1	We were living for our land. What do you think for us when the project starts?	Owners of private land will be compensated. These who live by government land in affected area will be considered for different supports and follow of their living conditions. Depending on available land, RAB will provide land to those who were using government land.
2.	Will all marshland be prepared?	The project will rehabilitate dams and main canals. Secondary canal and marshland leveling is the responsibility of farmers and Cooperatives.
3.	Existing water point is serving five villages:Nyagatare, Rusenyi, umurehe, Kabuye and Nawe, is it going to be replaced?	Yes, affected water points will be replaced and the identification of potential source is on-going.
4	The Government has given me the land by lease, but I have done some expropriation. Will that land be taken freely? Said"Mutunzi Emile" by phone.	The provision of leasing agreement will be considered and any investment made on the land provided.

5.5.4. Consultation meeting with big land owners at district office

Most of the big land owners did not attended consultative meeting and the consultant discussed with their representatives met on the site but it was deemed necessary to meet the big land owner so as to get their views on proposed project and discuss with them proposed measures.

The meeting was organised by Rwamagana district and held on Tuesday November 29th, 2016 in Rwamagana district office. Fourteen (14) participants were present in the meeting including 12 men and 2 women and only one person from all invited project affected persons didn't attend the meeting due to person reason.

The meeting was supposed to be opened and chaired by the Vice Mayor in charge of economic affairs but PAPs did not attend on the time and he delegated the district agronomist since the Vice-mayor had another meeting. In his opening remarks, he appreciate the participants to attend the meeting and briefly explain the purpose for the meeting including the presentation of the project to the PAPs, presentation of key resettlement impacts, presentation land required by participant, legal provisions and proposed entitlement matrix. After the opening remarks, detailed presentation was provided by EIA and RAP team lead by the study team leader.

In his presentation, consultant provide a brief back ground of the project, EIA and RAP preparation process and progress and highlighted the importance of public consultation in EIA and RAP preparation. Bothe national and international policies related involuntary resettlement were described and key provision highlighted including eligibility criteria, compensation measures, rights and obligations of different stakeholders involved in involuntary resettlement.

Furthermore, the consultant explained the object of the EIA and RAP studies including avoiding adverse impacts of the project; reducing these impacts when avoidance is impossible and providing compensation for affected assets. The consultant pointed out key resettlement impacts identified and their proposed major. Among the identified impacts he mentioned loss of land whether temporary or permanently, loss of trees and crops, loss of income and loss of some infrastructure such water points. After the general presentation, the consultant explained the specific land required from every participant using maps that show the location and size of the land.

After the presentation, participant was provided time for question, clarifications and all of them supported the project but requested the district to provided appropriate compensation for their loses not only for the land and trees but also their investment. The table below summarize the questions/clarifications and answers recorded in the meeting where as the full minutes and attendance list are provided in appendix 7.

Table 46: Question and answers provided in the meeting

No	Question	Answer/Comments provided
1	He began giving thanks to JICA and Rwamagana district for information about the project and he asked if he will get some assistance apart from compensation due to the big investment of sixty millions Rwanda francs (60,000,000Rwf) from the	The representative of Rwamagana district replied that there will be particular discussions between district authority and the PAPs about their affected assets including investment made. He requested to the participants to put together all documentation related to his investment

	bank he put on his project and currently he harvest the production of about ten millions Rwanda francs (10,000,000Rwf) annually.	
	He continued asking district authority to help him to address direct impacts his is having due to some village leaders who are telling people that he has no longer right on his land	The representative of district promised to work with village leaders and local authority to handle this issue.
	He also requested the district to consider 122 farmers that he was using on his land	On these issues the Consultant BESST Ltd explained that those farmers were considered together with other farmers who are losing government land and will be considered.
	He requested to rectify the map showing the land in buffer zone as some part was left out.	This will be rectified (consultant)
2	She had worries about valuation methods to be used during assets valuation of assets if they are only considering land and trees without considering big investment they put on their project.	Team Leader BESST LTD answered her that as provided by both national and international policies, the independent valuer shall use different valuation methods including replacement cost.
	She asked another question concerning buffer zone, if they can use it for their livestock after project implementation.	The allowed activities on buffer zones are the ones that cannot affect the dam and if it's found that their activity is not suitable for dam protection, then they will be compensated.
	She also asked question about the size of buffer zone.	Though the law request 50m for lakes, the proposed buffer zones is 20m from FWL and all activities should be done after this distance.
	She asked another question related to the inconsistency about the land they have and the one appearing on land title and which one will be considered during compensation.	All people with land titles with errors should approach district land bureau and correct them early before assets valuation for the land area that will be considered is the one on land title (land officer).
3	He asked how long the rehabilitation of borrow pit will take and if it will really become like it was before project implementation so that they may use it for	The answer was that if he prefers to get his land after construction he will be provided with compensation for temporary loss up to full rehabilitation of the land (consultant).

	the same activities as before.	
4	He clarified that some lands in the map land should be clearly separated.	This will be rectified.
5	They say that there okay with explanations but requested the contact number for further clarifications if the people they are representing need more clarification.	They got the phone number of district agronomist, district Vice mayor in charge of Economic Affairs and the Consultant.
6	He suggested that all land in buffer zones should be compensated and managed by the district for effective protection.	This recommendation will be included in both EIA and RAP (consultant.

CHAPTER SIX: PROJECT NEED AND ANALYSIS OF ALTERNATIVES

6.1. Project need and justification

The project of rehabilitation of irrigation facilities in Rwamagana will consist at rehabilitation of three existing dams at Cyimpima, Gashara and Bugugu marshlands and construction of a new dam at Cyaruhogo marshlands, rehabilitation of existing main canals, access roads and build farmer's capacity.

The irrigation facilities in these marshlands were developed by Chinese in 1970-1980s and the current situation of these facilities, dams, canals, drainages, and roads are not good. Due to this situation, farmers suffer from the shortage of water almost in every season. Currently, the four marshlands are used by more than thousand farmers grouped in four cooperatives and the available water cannot permit two full seasons and the entire potential irrigation area is not covered.

The need for rehabilitation of irrigation facilities in Rwamagana district is therefore justified by the facts that:

- Agriculture is the main economic activity for the communities in Rwamagana in particular and Rwanda in general;
- Farmers face drainage and irrigation difficulties;
- Water supply in the irrigation scheme is insufficient and too unreliable to allow for two rice growing seasons;

Therefore, the present project intends to change this situation by increasing water storage capacity, improving irrigation system and building farmer's cooperatives capacity in order to transform these marshlands into a secured and highly productive agricultural area. With this rehabilitation, water wastage due to poor irrigation system will be reduced and farmers will have the possibility of using marshlands twice a year.

6.2. Project alternatives

This section discusses and assesses alternatives in terms of activate sites, and technologies and finally a no project option. The project undertook a comparative analysis of various alternatives considered to avoid or minimize the environmental impacts that would be inevitable if best options are adopted.

6.2.1. Site selection

In selecting a feasible site for this project, a criterion of examining biophysical and socioeconomic factors was conducted. The biophysical parameters examined for this site selection include;

- Slope/relief
- Soil type,
- Land use/land cover
- Climate
- Ecological sensitivity,

- Water, and the socioeconomic parameters examined for this site selection include,
- Demographic patterns,
- Human environment (availability of labour, access to extension and research)
- Infrastructure (roads, electricity grids, domestic water supply, markets) among other factors.
- Rate of Return on Investment (RRI)

Some of the major driving force in the selection of the proposed sites relates situation of existing infrastructures in bad conditions and prolonged draught prone to this part of the Country. This situation calls for action, availability of sustainable source of water to guarantee productivity across the entire growing season, and control flooding during the wet season as water will be retained in the dam to be constructed or rehabilitated.

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 the area would be suitable for the type of the intended development has been identified, and therefore no other alternative sites have been considered for the project. Several distinct advantages of the proposed sites include:

- The sites are located ideally in an expanding and emerging peripheral node of developmental/agricultural activity, in a sought after area away from but within proximity of the marshlands and as such is perfectly situated for structured planning and the type of development intended;
- The project is compatible with surrounding activities and the trend of development in the area;
- The terrain and the size of the site, provides the best option for the proposed development;
- The site is well serviced by a traffic artery, murrum road link the project areas to the main roads and makes the sites easily accessible;
- The sites have good surface and ground water potential;
- Nearby communities offer a readily available pool of labour for employment during both the construction and operational phases of the project;
- The site is already zoned for agricultural development activities;
- Project location in the agricultural area of Rwamagana district means the project will have little or no direct impact on natural fauna or flora, human settlements, etc.

Therefore, the decision made of maintaining the existing sites for Cyimpima, Bugugu and Gashara make sense based on an assessment of their potential for water-harvesting and irrigation needs. For Bugugu, it's proposed to shift the dam axis so as to increase the reservoir and also collect enough water. This option was found good for different reason including avoidance of new land acquisition and loss of additional ecosystems. Furthermore, the buffer zones of these marshlands are a little bit protected and this will reduce the cost for dam protection.

For Cyaruhogo, different sites were assessed and parameters considered include the availability of water, sufficient water reservoir and minimum land requirements. Due to the topography of the area, the designing team tried to select the dam axis with reduced length so as to reduce the construction cost but also to minimize the risk of dam failure.

6.2.2. Socio-political Criteria

Socio-political criteria were also used to select suitable project areas and criteria considered included:

- Responsiveness/interest of beneficiaries
- District leadership and ownership
- Level of social impact:
 - o The number of beneficiaries on the site, relative to site size;
 - o Unused surface area is considered
 - o No households to be displaced and land acquisition may occur but small size
 - o Accessibility to markets near Rwamagana city,

6.2.3. Technical and environmental criteria

- Sufficient water harvesting potential
- In a moisture regime where irrigation makes a difference
- Coincidence of excess rainfall and drought (using indicators for drought and rainfall in the socio-economic criteria);
- Ecological functions were also important criteria in selecting the water bodies. This means that water bodies that provided sensitive ecological functions and contained species of rare significance were regarded as critical and if selected the need for stringent mitigation measures would be adopted.

6.3. Dam design alternatives

The JST has assessed different dam design alternatives so as to select the one that has environmental, financial and social viability. The table below presents alternatives assessed.

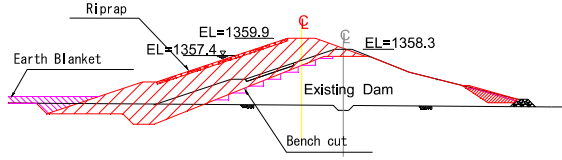
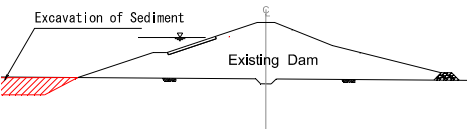
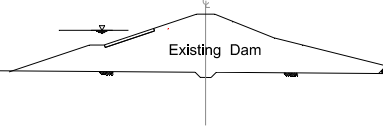
Gashara dam

Item	Plan A Raising existing dam height	Plan B Excavating sediment	Plan C Zero Option
Schematic image			
Outline	To secure necessary storage volume by raising existing dam height.	To secure necessary storage volume by excavating sediment in the reservoir.	No action plan.
Technical point of view	<p>Borrow pit site for enlargement of dam embankment should be secured near the construction site.</p> <p>Reserved water should be drained for construction work.</p> <p>Erosion of spillway, seepage from embankment on downstream, water leakage from intake valve are observed, hence these facilities should be rehabilitated in addition to the enlargement of the dam.</p>	<p>Huge amount of excavated soil (200 thousand m³ approx.) is to be generated in order to secure the necessary storage capacity. However, it seems less feasible to find a site to accommodate such volume of soil near the construction site.</p> <p>Construction becomes hard if the moisture contents of sediment are high.</p> <p>Like Plan A, in addition to the excavation of sediment, rehabilitation of existing irrigation facilities are required.</p>	<p>Keep current condition as it is, hence no special techniques are required.</p> <p>However, risk of dam break is concerned because current spillway does not have adequate outlet capacity against a big flood.</p>
Economic impact	<p>Increasing command area, development of local economy is expected.</p> <p>Work opportunity will be provided to the community during the construction period.</p> <p>However, irrigation water will not be available during the construction period.</p>	Same as Plan A.	Development of local economy will be limited because, some farmers downstream will keep cultivate rice under rain-fed condition due to insufficient storage capacity.
Natural Environment	Generation of turbid water, cutting trees etc due to construction work are expected though temporary, on the other hand, rich ecosystem service will be provided by expansion of irrigatable area in the operation phase.	In addition to the Plan A, based on quality of sediment excavated, some treatment is to be required.	Though none of negative impact is anticipated, rich ecosystem services mentioned in Plan A and B will not be provided because irrigation area is limited.
Social Environment	<p>Resettlement: 0 HHs</p> <p>Land acquisition: Land for construction yards, access roads, borrow pit and disposal site, and area to be submerged are need to be</p>	<p>Resettlement: 0 HHs</p> <p>Land acquisition: Though land submerge will not be occurred because FWL will not be changed, huge area of land should be</p>	<p>Resettlement: 0 HHs</p> <p>Land acquisition: 0ha</p>

	acquired.	acquired for disposing the excavated sediment.	
Construction period	Excavating topsoil, bench cut, enlargement, and rehabilitation of intake facilities are required only in Plan A, but takes more than a half year. However, this period is much shorter than the one required for drain water from reservoir and disposing excavated soil.	Pumping water in depth will takes time. If moisture contents of sediment are high, time to be required for standby, construction, and transport will be more than double of Plan A. Besides, it is challenging to find a huge disposal site near the construction site in Gashara.	No construction work (0 days).
Construction cost	Cheaper than the Plan B.	Construction cost for Plan B is several times of Plan A considering excavation and dispose of 200 thousand m ³ of sediment.	No construction cost is required.
Evaluation	Recommended	Not recommended	Not recommended

Source: JST

Cyimpima Dam

Item	Plan A Raising existing dam height	Plan B Excavating sediment	Plan C Zero Option
Schematic image			
Outline	To secure necessary storage volume by raising existing dam height.	To secure necessary storage volume by excavating sediment in the reservoir.	No action plan.
Technical point of view	Borrow pit site for enlargement of dam embankment (50 thousand m ³ approx.) should be available nearby. Reserved water should be drained for construction work. Due to deterioration of intake, water leakage is observed, and need to be rehabilitated. Spillway should be maintained so as water discharged from the spillway does not flow into the paddy fields directly.	About 2 km distance of construction roads should be constructed for disposing huge amount of excavated sediment (100 thousand m ³ approx). Construction becomes hard if the moisture contents of sediment are high. Due to deterioration of intake, water leakage is observed, and need to be rehabilitated. Spillway should be maintained so as water discharged from the spillway does not flow into the paddy fields directly.	No particular techniques are required.

Economic impact	Increasing command area, development of local economy is expected. Work opportunity will be provided to the community during the construction period. However, irrigation water will not be available during the construction period.	Same as Plan A.	Development of local economy will be limited because, some farmers downstream will keep cultivate rice under rain-fed condition due to insufficient storage capacity.
Natural Environment	Generation of turbid water, cutting trees etc due to construction work are expected though temporary, on the other hand, rich ecosystem service will be provided by expansion of irrigatable area in the operation phase.	In addition to the Plan A, based on quality of sediment excavated, some treatment is to be required.	Though none of negative impact is anticipated, rich ecosystem services mentioned in Plan A and B will not be provided because irrigation area is limited.
Social Environment	Resettlement: 0 HHs Land acquisition: Land for construction yards, access roads, borrow pit and disposal site, area to be submerged are need to be acquired. One spring used by community is likely affected by flooding season, and need construction of alternative facility.	Resettlement: 0 HHs Land acquisition: Though land submerge will not be occurred because FWL will not be changed, huge area of land should be acquired for treating and disposing the excavated sediment.	Resettlement: 0 HHs Land acquisition: 0ha
Construction period	Excavating topsoil, bench cut, enlargement, and rehabilitation of intake facilities are required only in Plan A, but takes more than a half year. However, this period is much shorter than the one required for drain water from reservoir and disposing excavated soil.	Pumping water in depth will takes time. If moisture contents of sediment are high, time to be required for standby, construction, and transport will be more than double of Plan A. Besides, it is challenging to find a huge disposal site near the construction site in Gashara.	No construction work (0 days).
Construction cost	Cost for Plan A will be about a half of Plan B.	Construction cost for Plan B is about double of Plan A considering excavation and dispose of 100 thousand m ³ of sediment.	No construction cost is required.
Evaluation	Recommended	Not recommended	Not recommended

Source: JST 2016

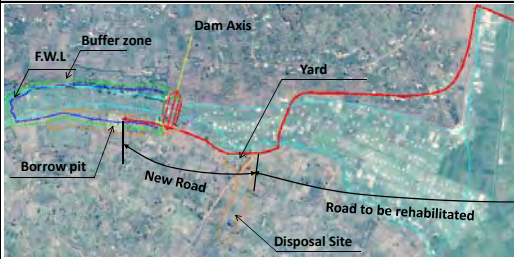
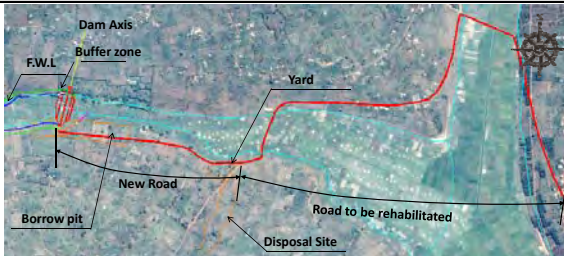
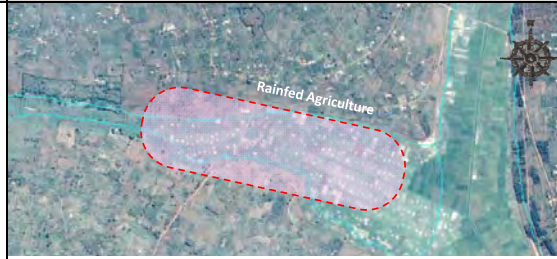
Bugugu Dam

Item	Plan A New dam construction 160 m downstream from the current dam axis	Plan B Enlargement of existing dam on the current dam axis	Plan C Zero Option
Schematic image			
Outline	To secure necessary storage volume stably by shifting dam axis 160m downstream.	To secure necessary storage volume by raising existing dam height.	No action plan.
Technical point of view	<p>By shifting dam axis to downstream, catchment area will be expanded and enable to secure necessary storage volume stably.</p> <p>Existing dam shall be reused as a sediment control dam.</p> <p>Comparing with existing dam axis, length of dam crest will be shortened. Hence, soil volume for embankment is not different from Plan B significantly.</p>	<p>Storage capacity will be improved by enlargement of dam height.</p> <p>However, hydrological analysis unveiled that current catchment area cannot secure necessary storage volume stably. (probability calculation in 5-years return period)</p>	<p>Keep current condition as it is, hence no special techniques are required.</p> <p>However, risk of dam break is concerned because current spillway does not have adequate outlet capacity against a big flood. In fact, currently farmers put sandbags on the dam crest almost every year when a big flood comes.</p>
Economic impact	<p>Increasing command area, development of local economy is expected.</p> <p>Work opportunity will be provided to the community during the construction period.</p> <p>However, irrigation water will not be available during the construction period.</p>	<p>Same as Plan A in general.</p> <p>Area to be submerged is smaller than Plan A because the dam axis will not be moved to the downstream side.</p>	<p>Development of local economy will be limited because, some farmers downstream will keep cultivate rice under rain-fed condition due to insufficient storage capacity.</p>
Natural Environment	<p>Generation of turbid water, cutting trees etc due to construction work are expected though temporary, on the other hand, rich ecosystem service will be provided by expansion of irrigatable area in the operation phase.</p>	<p>In addition to the Plan A, based on quality of sediment excavated, some treatment is to be required.</p>	<p>Though none of negative impact is anticipated, rich ecosystem services mentioned in Plan A and B will not be provided because irrigation area is limited.</p>
Social	Resettlement: 0 HHs	Resettlement: 0 HHs	Resettlement: 0 HHs

Environment	Land acquisition: Land acquisition area will be expanded by shifting of dam axis to downstream. One spring used by community is likely affected by flooding season, and need construction of alternative facility. Relocation of water pipeline constructed by past Japan's grant aid scheme may be required as necessary.	Land acquisition: In addition to the land to be submerged, land for construction yards, and access roads are required.	Land acquisition: 0ha
Construction period	Even if Plan A requires excavation of foundation on proposed dam site, this plan does not require drain work from reservoir. Consequently, construction period of Plan A becomes shorter than Plan B.	Plan B requires drain work, excavation of sediment from reservoir and topsoil, bench cut etc, hence construction period of Plan B becomes longer than Plan A.	No construction work (0 days).
Construction cost	Depending on volume of foundation soil to be excavated, cost becomes slightly higher than the Plan B is expected. However, it will be offset by better workability.	Plan B is slightly economical than Plan A.	No construction cost is required.
Evaluation	Recommended	Not recommended	Not recommended

Source: JST

Cyaruhogo Dam

Item	Plan A New dam construction securing irrigation water for planned command area	Plan B New dam construction minimizing adverse impact to the community	Plan C Zero Option
Schematic image			
Outline	Dam axis is close to the command area.	Original plan to minimize adverse impact to the community (avoid to affect spring water and farm lands).	No action plan.
Technical	Borrow pit and disposal site should be	Same as Plan A. However, distance of	No particular techniques are required.

point of view	secured near the construction site. There is no road to access to the planned dam axis; hence new road should be constructed.	construction roads is longer than Plan A.	
Economic impact	Increasing command area, development of local economy is expected. Work opportunity will be provided to the community during the construction period. However, irrigation water will not be available during the construction period.	Same as Plan A.	Farmers will not be able to shift from rainfed farming to irrigation agriculture so as development of local economy in this Plan will be limited.
Natural Environment	Generation of turbid water, cutting trees etc due to construction work are expected though temporary, on the other hand, rich ecosystem service will be provided by expansion of irrigatable area in the operation phase.	Same as Plan A.	Though none of negative impact is anticipated, rich ecosystem services mentioned in Plan A and B will not be provided because irrigation area is limited.
Social Environment	Resettlement: 0 HHs Land acquisition: Area is bigger than the Plan B because of shifting dam axis to the downstream. On the other hand, Plan A enable to irrigate to planned command area. One spring used by community is likely affected by flooding season, and need construction of alternative facility.	Resettlement: 0 HHs Land acquisition: In addition to the land to be submerged, land for construction yards, construction roads, etc are required.	Resettlement: 0 HHs Land acquisition: 0ha
Construction period	Distance of construction roads become shorter than Plan B, and construction period will be shorter several weeks.	Distance of construction roads become longer than Plan A, and construction period will be longer than Plan A several weeks.	No construction work (0 days).
Construction cost	Distance of construction roads become shorter than Plan B, and construction cost will be lower than Plan B.	Distance of construction roads become longer than Plan A, and construction cost will be higher than Plan A slightly.	No construction cost is required.
Evaluation	Recommended	Not recommended	Not recommended

Source: JST

6.4. No Project Alternative

The no Project alternative option will entail leaving the population in the present situation and this option is not desirable considering the need of the population to sustain their livelihood and increase the production. . If the proposed project is not implemented, it is likely that the majority farmers in Cyimpima, Gashara, Bugugu and Cyaruhogo marshlands who entirely depend on these marshlands will become food insecure given the challenges of persistent draught affecting productivity and at the same time flooding during the wet season.

Besides, there are many significant and specific benefits that would not be accrued if the proposed development is not to be implemented. If the site is not developed would not receive any sound 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 marshland and increased use of sustainable land management practices on associated hillsides / catchment areas to accelerate the pace of agricultural intensification.

Furthermore, 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 infrastructure and dam facilities in Rwamagana 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.

6.5. Project activities development with mitigation measures

The Consultant can conclude that the most preferred alternative would be implementing the Project with mitigation measures in place. A pursuant of this alternative will entail going on with the activities but taking into account the potential impacts on the environment by incorporating mitigation measures. This alternative is more desirable as it will inject a significant amount of money into the economy thereby promoting sustainable development and providing better livelihood to farmers which is one of the government's goals. The potential impacts to the environment and to the community have been assessed, mitigation measures proposed and an Environmental Management Plan has been included in EIA report.

CHAPTER SEVEN: IMPACTS PREDICTION AND MITIGATION MEASURES

7.1. General overview

Generally an environment impact is referring to the changes of existing conditions of any area or environment caused by human activities or any internal or external influence which may be positive or negative. The impacts may also be direct or indirect, long term or short term and may be local or extensive. During the process of identification of impacts of this project on the environment, it was discovered that during the project phases especially during construction and operation, a number of positive impacts on the human environment and some negatives impacts will occur.

During a scoping exercise of this study a number of environmental issues were identified and the purpose of this chapter is to predict and make an assessment of environmental and social impacts that may potentially arise as a result of the implementation of the project whether positive or negative in nature. An impact analysis matrix was developed and used to assess impact and is attached as appendix 12. Furthermore an Environmental Management Plan and Environmental Monitoring Plan that translate mitigation measures into action have been prepared and presented in chapter 8 under table formats so as to translate mitigation measures into actions.

The identified impacts that could potentially occur are grouped and discussed below under the headings of the various environmental components or receptors including socio-economic impacts, biological and ecological impacts and impact on physical environment (land & soil, Water and air).

The detailed assessment of these impacts was made on the basis of information gathered during the scoping process, field visits and discussions with different experts working in irrigation projects, environmental protection, water resources management and project management. The environmental assessment covered the project area which included project site and its surrounding areas, borrow areas, disposal areas and the project catchment.

Potential positive and negative impacts are discussed in different phase of the project from planning to decommissioning and particularly during construction and operation. Mitigation measures were proposed for each adverse impact identified and shall be incorporated into the design and implementation of the project. This will help to minimise, compensate for or avoid the occurrence of these impacts are also discussed in detail.

7.1. Anticipated positive impacts

The implementation of the proposed project of rehabilitation of irrigation facilities in Rwamagana district will bring many positive impacts not only for the user's community but

also for the general environment of targeted marshlands and their catchment. The positive impact ranges from socio-economic benefits to environmental benefits.

7.1.1. Social economic impacts

Socio-economic positive impacts include:

✓ Job creation and income generation

It is no doubt that the implementation of this project will employ (skilled and unskilled) local contractors within and surrounding the area of intervention of the project. This ensures that they will economically benefit from the implementation of the project and as expected, the project will provide up to more than 100 employment opportunities at each site during construction.

Among the jobs that are expected to be created include:

- Technical jobs during design and constructions;
- Casual labour workers(masons and aide-masons) for dam construction/rehabilitation with associated infrastructure; and;
- Creation of jobs in quarries for construction material.

In rural areas manpower cost between 1,500 and 2,000 Rwandan francs/day and this amount can cover the basic need of a farmer. For skilled work like rebar work, concrete work, and form work will be paid higher allowance like 4,000 to 5,000 Rwandan francs/day. RAB and JICA together with the contractor will ensure that local communities are given priority in recruitment. Though these Jobs are temporary they can support farmers who will not be able to irrigate the land during rehabilitation.

✓ Improved local socio-economy

It is expected that all works related to the project will provide a positive increase to the local and national economy since some material will be purchased locally and wages income of workers will be used for house hold development. This will fully contribute to the increase of human socio-economy benefits within and around the project area.

✓ Increase to public revenue / taxes

The implementation of the project will increase revenue and taxes for both the central (Rwanda Revenue Authority) and local authorities. The project will fully participate in increased payments of taxes from retailers and suppliers of the rice produced. Hence the increase production will automatically increase revenues.

✓ Increase in rice production and food security sustainability

It is expected that the implementation of the project will significantly contribute to the increase of rice production particularly in the area of intervention and in the District in general. It is anticipated that after rehabilitation of existing irrigation infrastructure and the construction of new dam at Cyaruhogo will permit farmers to have two seasons on the full potential irrigated area. For instance, last season in Cyimpima farmers used 52.4 ha while the potential irrigated area is 55.1 ha, and it was 38 ha out of 66,2 ha in Gashara and 30.25ha/50.4 ha in . The current production is at 5.5 tonnes/ha in average but where they have enough water the yield can go up

to 7 tonnes/ha. Thus, it's anticipated that after rehabilitation farmers will double their annual production and production per ha will also increase up to 7 tonnes /ha.

✓ **Gender balance enhancement**

It has been observed that men and women are all involved in rice farming almost equally and it is expected the project will benefit both of them. It is also recommended that during the project implementation to offer equal opportunity of employment for both men and women. This will contribute to the government vision of fighting against gender inequality and ensuring that women are given equal opportunity in terms of employment.

✓ **Knowledge transfer**

Technical and planning skills will be gained by the local community members that will be employed by the project and this is likely to contribute to the capacity building within the local community and the ones who have the expertise in the technology to be introduced by the project. Though the project may require external expertise but it's anticipated that more than 80% of workers will be locally hired.

✓ **Market Creation**

The rehabilitation irrigation facilities in Rwamagana marshlands will increase production and hence have an impact on rice production which shall be sold in national and regional markets as a product of Rwanda. So far, farmers are organized in four cooperatives but it is anticipated that after rehabilitation the four cooperatives will form one strong cooperative that can compete on the market.

✓ **Empowerment of farmers**

The project will also have a capacity building component called as "Soft Component" which will enhance the existing cooperative. It is proposed to create Water Users Associations (WUA) for a better management of water resources. The district is also discussing with existing cooperatives on how they can have one strong cooperative to empower farmers and allow them to have a common agreement on the type of crop to plant, collective harvesting and selling, price negotiations on collective produce, sensitized and trained on the efficient use of water as a valuable resource, use of modern irrigation techniques, use of improved seed and fertilizer to improve their produce, maintenance of irrigation infrastructure, thus imparting skills for improved production as well as to access markets, which they will utilize even after the project's exit.

7.1.2. Positive impact on the physical environment

The current situation of marshlands infrastructures does not offer a sustainable environment especially sustainable water resources management. One of the major motives for this project is to balance economic and environmental factors and functions. Key positive environmental impacts including:

✓ **Increased water storage capacity**

Currently the three existing dam, Bugugu, Gashara and Cyimpima has the irrigation storage volume of 730,000 m³ in total while the planned dams will have irrigation Storage volume of 1,753,000 m³ including the new dam to be constructed at Cyaruhogo marshlands. This increased capacity will not only provide enough water for irrigation but also will regulate the water table as water will be stored during heavy rain season and mostly used in dry seasons.

✓ **Flood control**

Another role of dams is flood control. During our field visit farmers report some floods especially at Bugugu dam whereby in the past the water has overflows that dam and affected rice in the marshland. Therefore, the rehabilitation of dams by raising the dam axis, the rehabilitation of spillway, main irrigation canal and intakes will facilitate the flood control. Spillways will help to evacuate excess water especially during heavy rains and irrigation canals will control floods downstream by storing water, channelling it in rice plots and evacuating excess water. Flood control effect of the project will free more land for farming as well as prevent destruction of food crops for those farmers exploiting the irrigated area in the wet season.

✓ **Landscape and aesthetic**

The implementation of the project will not significantly alter the local landscape in the area since the project site has already been altered and the marshlands are largely under rice cultivation. It is expected that, the implementation of this project will be a modernization, upgrading, rehabilitation and quality development of existing irrigation networks. Project will have a significant positive effect on the landscape since the irrigation infrastructures will be built to the highest standards and all stages of construction will be supervised by qualified team. Even most of the borrow pits areas will be rehabilitated and filled with materials excavated in dams sites.

✓ **Rational exploitation of natural resources and local raw materials**

The project is committed to ensuring that local raw materials will be utilized as much as possible for successful completion of the project. It is expected that the demand for the supply and production of local building materials as well as provision of services will contribute to providing a positive boost to various sectors related to the construction industry. The project will contribute to the wise-use of marshland resources, with the overall aim to serve as a model and inspiration for the future attempts to cost-effectively and sustainably transform swamps and marshes for agricultural purposes.

✓ **Sustainable use of water resources**

The rehabilitation of irrigation canals and intakes together with the creation and capacity building of Water Users Association (WUA) will help in water resources management. With performing intakes and canals farmers will be able to use water when is needed and implement water distribution calendar depending on their needs.

✓ **Habitat for fish and birds nesting**

Though the project components does not include fishing but the developing a water reservoir would present an opportunity of introducing fish farming in the area and this enhance household diet hence contributing to a balanced diet. Also with introduction of the reservoir, its proposed buffer green belt will be habitat for different bird species nesting in these grasses and trees thereby improving the ecosystem in the area.

7.1.3. Positive impact on biological environment (fauna and flora)

The positive impact on flora and fauna include:

- Increased available habitat for some birds species which like to swim in water such as Pink-Backed Pelican and Yellow-Billed Duck
- Increased available habitat for amphibians due to increase in number and size of the dams,
- Increased number of aquatic insects such as Dragonfly and Lacewing
- The water catchment protection activities will improve the vegetation in the surroundings of those irrigation infrastructures and other erosion susceptible areas.

7.2. Predicted adverse impacts

Impacts were identified using regulations, guidelines(national and international) including standards and norms related to usage of pesticides and fertilizers, swamp, marshlands development and exploitation, waste disposal, effluents, site location operational practices. Negative impacts were assessed by considering different planned activities and were presented in three main project phase: Design & planning phase, Construction phase and operation phase. For each negative impact identified a mitigation measure was proposed.

7.2.1. Adverse impacts during the design and planning phase

The design phase of this project involved identification of a suitable site for the infrastructure and undertaking preliminary design studies there are no adverse impacts expected during this stage, however, best practices were incorporated at this stage to ensure that the design takes into account the environmental issues to consider.

7.2.2. Impact during construction phase

The construction phase involves several activities including; site clearing for the dam area, site installation, trench excavations, earth stripping, road network clearing and levelling, construction of a dam, reservoir, excavation of main canals and construction of intakes. Anticipated adverse impacts associated with these works are discussed hereafter.

7.2.2.1. Socio-economic impacts

- ✓ **Loss of Land and crops**

The construction of new dam at Cyaruhogo and rehabilitation of existing dams at Cyimpima, Bugugu and Gashara marshlands will require additional land in submerged area. Land is also required for material deposit, construction camps, borrow pit areas and new access roads. Few rice paddies will also be affected especially at Bugugu dam where the dam axis will be shifted few meters downstream. The lands to be submerged are mainly owned by Government but are being used by local people for subsistence agriculture. The field survey and design studies provided an indication of land and crops that are likely to be affected. So far the land expected to be affected permanently is in total 72.00 ha including 40.87 ha owned by private people and 31.13 ha owned by government private people. In addition to that, 3.25 ha will be affected temporary at camp sites and access roads. The size of land to be affected is as follows:

- Submerged area: 34.05 ha
- Disposal area: 5.46 ha
- Borrow pits: 12.65 ha
- Buffer zone: 19.85 ha
- Camp sites: 2.09 ha
- Access Roads : 1.16 ha

The land in submerged and access roads will be permanently lost while other land can be used after construction. However, the land in disposal and borrow pits area can also be used after rehabilitation though the rehabilitation maybe costly. It is recommended to compensate it as permanent loss and the district can use the land for other purposed like environmental protection. Due to scarcity of land in the area, farmers can also continue to use the land in buffer zone in environmental friendly way like the establishment of radical terraces used in project like LWH and RSSP.



Figure 34: Radical terraces used in the protection of watersheds

Impact significance

This impact can be of severe magnitude to the PAPs if not handled with appropriate measures and if PAPs are not provided with fair compensation.

Mitigation Measure(s)

The project was designed to minimize the resettlement impacts and a Resettlement Action Plan (RAP) has been developed together with this EIA and provides more details on land requirement and compensation measures.

Among the proposed mitigation measures include:

- Land for land compensation for project affected persons who will lose private land;
 - New farming land for farmers who will lose the Government land. This can be done on new land secured due to the irrigation areas or through land redistribution. This has been done successfully in some marshlands developed by MINAGRI under the Third Rural Sector Support Project (RSSP).
 - For temporary loss of land PAPs shall receive the compensation equal to the benefit they would have gained in they have used their land.
- ✓ **Loss of trees and crops**

It is expected that farmers will be informed on the construction period and encouraged to harvest their crops before construction work. However, some perennial crops and trees will be affected and the initial inventory identified 2,199 trees that are likely to be affected. Detailed list of PAPs, their assets and estimated value are presented in the RAP.

Significance of impact

This impact is of low significance because the area is already used and only few assets including trees will be affected.

Proposed Mitigation measures

- Farmers will be informed on construction schedules so as to allow them plan accordingly. This will minimize the quantity of crops to be lost at working areas but also crops that may be affected by loss of water;
 - The construction should be started after rice harvesting season and in this case no rice that will be affected;
 - Cash compensation for crops and trees at replacement cost;
- ✓ **Loss of social infrastructure**

During construction some social infrastructure like water point, spring and water supply infrastructure will be affected especially in submerged area. Two spring water, one in Cyaruhogo and another one in Bugugu will be submerged while the water pipe is buried in the ground very close to the proposed borrow pit.

Proposed mitigation measures

- Identification of new water source and construct alternative water supplying facilities
 - Relocation of water supply pipeline at Bugugu borrow pit.
- ✓ **Income losses from missed farming season during construction period.**

Worries from farmers and sector agronomists during field visits were observed, of missing seasons of cultivation during construction. For an estimated period of 12 months is required for rehabilitation works in addition to the water filling period into the reservoirs. This implies that the farmer will lose the produce that they could have obtained in missed seasons hence a loss in

home income and in most cases domestic food. It will also affect targets of crop production set by local government officials in their performance contracts. The most affected people are the one who are growing rice because rice cannot survive without water. The table below present in summary of income loss in the marshlands by season

Table 47: Income loss in four marshlands in one season

Name of the Marshland	Number of HHs	Area in Ha	Total production in kg/season	Total income in Frw/season	⁷ Total investment in Frw/season	Net income loss in Frw/season
CYIMPIMA	256	52.47	293,804	69,043,940	46,641,385	22,402,555
BUGUGU	127	30.25	160,325	37,676,375	26,892,250	10,784,125
CYARUHOGO	739	106.56	575,397	135,218,295	94,727,395	40,490,900
GASHARA	223	38.65	224,170	52,679,950	34,359,850	18,320,100
Total	1,345	227.93	1,253,696	294,618,560	202,620,880	91,997,680

Source: Calculation based on available data in four cooperatives

The table above shows that in one season farmers will lose 91,997,680 Rwandan francs that is 113,000 USD. If we consider the worst scenario where farmers miss four seasons, then the income loss will be 452,000 USD.

Impact significance

This impact can be of high significance to the affected farmers since it affects farmer’s apparent livelihoods. However, it is not an impact of regular occurrence and a number of measures should be applied by the project developer as well as contractors.

Mitigation Measure(s)

- A clear implementation program indicating areas to be affected and dates of completion of each activity will be established and communicate to farmers. Contractors will then implement the established plan and will be requested to speed up construction works. A monitoring exercise involving project staff, sector agronomists and established cooperative committees should establish. It should also be shared with the local farmers as an awareness campaign.
- Farmers who have been affected should be given an affirmative priority in employing them as casual labour required at that time. This will be an alternative income source to sustain their domestic requirements.
- RAB, Rwamagana district, cooperatives and farmers will discuss and agree on alternative crop which does not require much water and farmers will be allowed to grow these crops during construction phase. However in consultation meeting agrees to hold their plots in fallow because other crops may affect rice production after construction.

⁷ Details of investment cost are provided in appendix 3 and includes labour, fertiliser, cooperative charges, land rental fees and seedlings

- Where possible works that require the evacuation of water in dam reservoir will be conducted in dry season and after farmers have harvested the rice. Dams will be closed again in rainy season so as to shorten the dam filling period.
- Compensation for income loss: So far RAB has never compensated people for income loss but requested the consultant to calculate the income loss and based on this RAB will discuss with its partners on compensation measures.

✓ **Income loss for cooperatives and cooperative union**

During public consultation, leaders of Cooperatives and cooperative expressed their concerns related to the income loss during construction that may affect their capacity of paying their employees. Cooperatives cover the operational cost by charges paid by cooperative members where by 9 Rwanda francs are charge to one kg sold by farmers. In Total, Cooperative and Cooperative union are expected to lose total income loss estimated at 11,282,049 Rwandan Francs per season. Without this money they will not be able to keep hire their employees and cover administrative cost. RAB will have to assist cooperatives so that they can pay employees and sustain their administrative cost

Impact significance

This impact is also of medium significance in terms of magnitude, since cooperatives relies only to this income to cover their operation cost.

• **Mitigation Measure(s)**

- RAB should assist cooperative to cover the payment of cooperative employees during construction if cooperative fee (9 Frw/person/kg) is not included in the compensation amount to the PAPs.

✓ **Injuries of workers from construction works**

During construction, workers will be subjected to situations that could be detrimental to their health and safety. A few examples include: Injuries caused by handling of construction equipment, spills and leakage of oils, injuries from stepping on or using sharp objects and fires.

Impact significance

This impact is also of medium significance in terms of magnitude, since it directly affects the humans and is of common occurrence. Injuries are common in construction but can be reduced to an extent with safety precautions taken.

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:

- Workers on the site should be provided with appropriate protective gears such as; wellington boots, helmets, nose masks, eye goggles and overalls. Wearing of safety gear should be enforced on site by introduction of a safety compliance department.
- The contractor shall be required to have an insurance policy taking care of any injuries or deaths that might occur on site.

✓ **Diseases from construction activity**

During construction, communicable disease hazards due to interactions among the workers or with service providers such as food vendors, dust from clearing and excavation works and fumes from vehicles and other machinery that might cause respiratory dysfunctions, Noise and vibrations from construction equipment causing temporary or permanent deafness. Not forgetting transmission of HIV from workers that have migrated to this region in such of work plus locals willing to spend more due to increased income from construction wages.

This impact is also of medium significance in terms of magnitude, since it directly affects the humans. Contraction of diseases are common in construction but can be reduced to an extent with safety precautions taken.

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:

- Sprinkling water every day in dry season to suppress excessive dust during construction, use of gas masks and goggles for dusty sections is strongly recommended;
- 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.

✓ Occupational health and safety impacts

Construction of the project will involve many activities and procedures with significant risks levels to the occupational health and safety of workers and personnel. The contractor will be required to prepare an OHS plan and identify procedures with potentially high risk levels including:

- Entering and working in confined spaces (e.g. tanks, deep excavations);
- Work in hazardous environment (e.g. dusty environment);
- Work at height;
- Operation and handling of heavy equipment and machinery
- Use of explosives (blasting to break rock, if at all required, is expected to be limited as discussed)

Significance of impacts

This impact is also of medium significance in terms of magnitude, since it directly affects the humans and is of common occurrence.

Mitigation measures

- Strict adherence to safety measures and procedures will minimise (or eliminate) risks of accidents or hazardous developments occurring and ensure healthy and safe conditions for all persons working on the site;

- Provision of life insurance and make sure that all workers have health insurance “mituelle de sante”;
- Training of all workers on OHS measures

7.2.2.2. Negative Impact on biological environment

✓ Predicted project impact on fauna include:

- Disturbance to birds given the high number of workers who will be present at the site;
- Destruction of the habitat of amphibians due to digging work especially in Cyaruhogo where a dam will be created newly;
- In sites where the dam will be enlarged/upgraded, amphibian's eggs will be destroyed; especially those located at the close to the shore of the dam;
- Destruction of snake's burrow during the digging works;
- Loss some natural tree species which will be cut down;

Proposed mitigation measures

- Whenever trees have to be cut down for dam construction or upgrading, precautions need to be taken in order to avoid destroying bird nests. One staff need to be trained and made responsible for handling and relocating nests to trees which will not be affected. RDB has experts in the conservation and tourism department who can train such person. They are also other institution such as Kitabi College of tourism and conservation of Rwanda association for the conservation of nature that can provide these that training.
- Avoid any killing of animal during the construction work. Before construction works start, workers need to be sensitized and briefed to avoid any killing of animal.
- Avoid cutting trees which are beyond the area designated for dam construction or expansion.

✓ Loss of aquatic flora and fauna

It is expected that during the construction of irrigation canals, there will be some disturbance or loss of some aquatic species and /or their habitat. However considering the fact that there were no identified protected/endangered species, there will be no loss of such flora.

This impact is of medium significance in terms of magnitude since it is an area that has been under agriculture and no forests will be affected by the project.

Mitigation Measure(s)

Lost local species (such as *Ipomoea involucrata* and *Acanthus pubescens*) can be offset by applying them on water catchment protection and in protection of the stream and irrigation canals.

✓ Destruction of marshland biodiversity

Some part of the marshlands is colonized by wetlands vegetation and the transformation of these lands into rice plot will cause the destruction of this biodiversity. It is worth to note that

there is no plant or animal species of special conservation purpose surveyed that will be affected by construction works.

Mitigation Measure(s)

This impact is unavoidable and will be mitigated through compensation measures which will include tree planting in water catchment and along canals for protection. Protection of the water catchment area should include different layers especially in the marshland buffer zone including grass layer, shrubs layer and tree layer

7.2.2.3. Negative Impact on Physical environment

✓ Soil erosion

Construction activities are of particular concern. Soil erosion is an important problem both at its source and downstream of the development site. Lost soil will be deposited somewhere, and the location of the deposition could alter downstream hydrology and increase flooding. It may also pose a water quality issue directly as a result of siltation and indirectly from contaminants carried with or attached to soil particles.

Mitigation Measure(s)

Though the proposed sites do not have high slop that can cause severe soil erosion, some mitigation measures are needed so as to minimise soil erosion risk and keep uniform quality of soil for construction material. This impact can be avoided or minimized through:

- Planting vegetation on the cleared sites immediately after construction;
- Only clear areas earmarked for construction;
- Use stockpile method to keep soils.

✓ Contamination of water bodies

During the construction of irrigation infrastructure no heavy machinery is required but the track that will be providing construction material may require re-fuelling, maintenance works, repair works, which in effect result in oil spillage. At point sources, contamination of soils and run-off ending in the receiving bodies could cause water quality degradation, if no mitigation measures are implemented. This impact can be considered of low magnitude, duration and spatial extent since it shall only be experienced during the early construction phases and few tracks will be used.

Mitigation Measure(s)

- 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. E.g. site position for the guard's house construction.
- The area allocated for fuels shall need to have a cemented floor and a sand stock for use in the absorption of spilled oil.

- Water quality will be regularly monitored so as to compare the baseline and monitoring results. If during monitoring process water is contaminated, then additional measures will be taken.

✓ **Air and noise pollution**

During construction, there will be movement of construction equipment at the project site. Dust and exhaust fumes that may cause air pollution as well as noise, is expected from graders, trucks other machinery such as concrete mixers, dumpers, etc.

This impact can be considered of low magnitude, short term duration and localized. It occurs only during the construction phase. Also, the project area is not heavily populated and only workers will be affected.

Mitigation Measure(s)

Contractor will spray water regularly when clearing land to reduce the dust;
Generators for use at the site shall have silencers to reduce on the noise emitted;
Furthermore, workers will be provided with personal protective equipment's.

7.2.3. Negative Impact during Operation Phase

7.2.3.1. Socio-economic Impacts

✓ **Health hazards from poor pesticide and fertilizer application**

Use of fertilizer is crucial in improving soil fertility while pesticides will kill likely pests that might destroy crops. However, if applied by farmers out of ignorance, it might result in health hazards such as; respiratory tract diseases, skin irritation, eventual cancers, soil infertility, pest resistance and water quality contamination. Furthermore, might affect soil composition and texture eventually drastically affecting its functionality to produce crop.

The impact could be of high significance in terms of magnitude and considering the quantities of chemicals applied. The effect on human health from exposure to continuous exposure to pesticides or fertilizers either directly or by food chain effect could be long term and irreversible if it turns out cancerous.

Mitigation Measure(s)

- Farmers and extension staff shall be trained over season long period on weekly basis on the pests and diseases identification, damage problems, yield loss caused, control methods and safe pesticide use.
- Combined efforts of project agronomist and those of the sector should be able to offer technical assistance to the farmers once the project has taken off. Their responsibility is determining which type of fertilizer and pesticides are required, amounts required for application, recommend the areas of application and will be charged with the responsibility of training and following up on how farmers adopt to these techniques hence reducing on the misuse of these products.

✓ **Water conflicts arising from the creation of irrigation scheme**

The development of irrigation schemes go with some conflict with other water users who need water for other uses like feeding cattle, water supply and hillsides irrigation. This can escalate in conflicts. In addition to that we have observed some cattle taking water from existing dam and this may cause conflicts between farmers and cattle keepers but also water pollution.

Impact Significance

The impact could be of medium significance in terms of magnitude and duration. It will be of short term effect or even avoided since there is an existing water users association and the project is planning to have a water users association and encourages organizing farmers into groups and cooperatives through which such issues can be resolved.

Mitigation Measure(s)

- To create and operationalize Water Users Association that includes all users in the marshlands (Rice farmers, cattle keepers etc...);
- To provide at least two water point per site for cattle keepers.

✓ **Vandalism of Irrigation infrastructure**

With the coming of the project, a number of infrastructures will be made from metal, steel, concrete, sluice gates, valves. 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 organized in such as to have community policing to guard the infrastructure, they will be vandalized and sold elsewhere.

The impact could be of low significance in terms of magnitude. With community policing encouraged in Rwanda and organized cooperatives operating in the project area, such an impact might be of short term scattered periods of vandalism.

Mitigation Measure(s)

- Early establishment of farm organization (i.e. into groups and 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.
- Application of penalties to perpetrators convicted of vandalism is necessary and punitive actions towards perpetrators by the authorities will facilitate compliance by the locals thereby avoiding vandalism.

✓ **Increased spread of waterborne diseases**

In reference to social data from field public consultation, there were no resilient diseases observed by the locals. e.g. malaria, dysentery or diarrhoea. However, water borne diseases such as; dysentery, diarrhoea, stomach-related disorders specifically infestation by worms, all resulting from using the canal water for domestic purposes (drinking and cooking).

Impact Significance is low because residential houses are far from the marshland and households will be provided with spring water where the existing ones are to be affected.

Mitigation Measure(s)

Though the risk is low some mitigation measures should be taken including:

- Planting of *Phytolaca decocandra* which will destroy the Bilharzia snails that serve as hosts of *shistosomiasis* along the shores of the lakes and river.
- In addition to this, the project may work along with MINISANTE in issuing mosquito nets for those who don't have, to reduce on the spread of malaria. This shall go along with sensitization of sleeping under a mosquito net and its importance to the locals.
- The formed cooperatives shall need to work with local authorities in restricting locals from using water from the drains/canals for domestic consumption.

✓ **Destruction of irrigation canals**

It has been observed some farmers encroaches irrigation canals to increase their plot which destroy these infrastructures. Furthermore cattle keepers who are searching for water may also destroy canals and other infrastructure.

Impact Significance

The impact will be short term considering locals are aware of the environmental law restricting a buffer zone of 10 m from water sources and the zero grazing policy is being successfully implemented.

Mitigation Measure(s)

- There should be provision of water points for cattle;
- A buffer zone should be established along the main canals and streams and farmers should be sensitized about the protection of infrastructures.

✓ **Wastage of water**

Ignorance and insufficient skills of farmers on the irrigation could result in poor management of water distribution to plantations. In-experienced people managing the water realised from the central drain into the secondary canals, excessive amounts of water released into the plantations, water leakages in the open channels, could all result in wastage of water meant for efficient irrigation during dry seasons.

Impact significance

The impact is of low significance especially since the proposed project intends to strengthen existing cooperative so as to enable them to manage issues arising at the catchment areas and also the irrigation facilities. This impact shall occur all through the operation phase but can be easily resolved technically through this organized farmers' structure.

Mitigation measure(s)

- Establishment of Water Users Association (WUAs) to manage quantities of apportioned for each plantation hence reducing on likely water misuse. WUAs are required to have trained technicians in water management, infrastructure control and repair. These will be of technical assistance to WUAs in managing water losses.

- Frequent inspection and repairs of leaking infrastructure is necessary to reduce on losses of water through leakages.
- Water allocation infrastructure such as intake structures of metal flood gates, wooden beams should only be managed by trained technicians. This will avoid excessive distribution of water thereby preventing wastage of water from the central drain.

7.2.3.2. Impact on Physical Environment

✓ **Water pollution from fertilizers and pesticides**

So far no water pollution from the use of fertilizers and pesticides observed in the project area however, farmers need continuous training and awareness on adequate use of fertilizers and pesticides to avoid any pollution.

The impact could be of low significance because farmers are already familiar with rice farming and in pest management practices.

Mitigation measure(s)

To avoid this impact, the farmers should

- Continue to adopt the Pest Management Plan (PMP) practices for the proposed crops (rice);
- Farmers should be trained on the right application of fertilizer and safe use of pesticides.
- A baseline test of the water quality, preferably every two years, 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.

✓ **Sedimentation of irrigation canals and dams reservoir**

The erosion from marshlands hillsides and farming practices whereby some farmers encroach river banks and canals will contribute to the sedimentation of canals. During site visit it was observed that dams have a lot of sediment due to poor protection of hillside. Sedimentation of dams reduce the storage capacity while the sedimentation of canals reduces their carriage capacity and hence low flows insufficient to meet the crop water requirement for the plantations in the irrigated area.

Mitigation Measure(s)

It is proposed that in addition to the catchment protection additional measures should be considered and includes:

- Farmers should proceed with regular removal of silt and sediments in canals;
- RAB should work with Rwamagana district and Cooperatives and sensitise people on the protection marshlands and dam hillsides.
- A buffer zone known as silt trap zone should be established around the four dams. This may have between 20 and 50 m per as recommended by environmental law. Three layers are proposed as follows:
 - o First layer of 5m width comprising *Typha domingensis* or simply natural vegetation;
 - o Middle row of 9 m comprising; *Calliandra calothyrsus* and

- Third row of *Pennisetum purpurdeum*.

A typical buffer zone cross section is presented in appendix 12

Beyond 20 m other erosion control such as ditches and radical terraces are recommended and depending on the available funds, the project can adopt the comprehensive watershed protection using RSSP model.

Though the project design has not included a component for watershed management, RAB or Rwamagana district can look funds from other partners to implement this component. RAB can consider submitting project to FONERWA, National Fund for Environment and Climate Change. In this case the fund can fund only the component on watershed and buffer zone protection while JICA can cover the cost of irrigation facilities. This was done in Rusuli marshlands implemented by Welt Hunger/former Agro-Action Allemande (Germany cooperation). The project can be submitted by RAB or Rwamagana district since both institutions are eligible for the funds.

✓ **Water losses from evaporation and leakages**

main advantage of the storage dam is that it allows to kick start the irrigation season (especially for rice) hence the duration of cultivation may be year round (12 months) while the evaporation from the storage dam is likely superior as compared with the non-flooded traditional crop production situation. Year round 4 mm/day evapotranspiration amounts to 14 600 m³/ha/year. Considering an inundated dam area of about 5% of the irrigated area, and additional 2 mm/day for evaporation and seepage losses from the dam, further water demand is about 3 650 m³/ha/year. A very approximate estimation for overall irrigation water demand is about 18 000 m³/ha/year of which about 3 000 to 7 000 m³/ha/year is supplemental to the natural hydrological condition in the marshland, or on average 5 000 m³/ha/year (National Water Resources Master Plan, MINIRENA 2014).

Mitigation Measures

- Regular canal inspections to detect possible leakages early enough so as to reduce on avoidable water losses.
- Irrigation canals need to be lined in areas with pervious soils to prevent ground seepage of water into the soil.
- The proposed canal are in concrete lining and therefore will improve the current situation by: Therefore, this should be one of the positive impact improving current situation
 - Minimal losses through seepage, percolation and evaporation.
 - Irrigation efficiency will increase;
 - Prevents weed growth thereby resulting in saving of expenditure incurred on weed removal in the case of earthen canal;
 - Low maintenance cost;
 - Reduces cross sectional dimensions of canal;

- Improvement in command;
- Minimizes the possibility of breaching of canals;

✓ **Floods from reservoir over flow or dam collapse**

Circumstances when the reservoir overflows or when the dam collapses and bursts should be envisioned. Though the planned dam are small but store a huge amount of water that could flood the immediate area downstream of the dam and the command area below may occur; causing soil erosion, crop destruction, destruction of property and in very severe cases killing people in the marshland and livestock at the hillsides closest to the marshland.

Impact Significance

The impact could be very severe and highly significant if it was to occur and may cause destruction of crops and loss of lives.

Mitigation Measure(s)

The designing team has already championed precaution measures at the stage of project design of the dam and as provided by guidelines on small dam safety the design should consider:

- A Spillway has been designed will act as a flood control structure. This means that should the water level exceed dam height above ground, water will be evacuated via the spillway thereby avoiding the dam from being damaged or destroyed by water flowing on, over or against it.
- A Cut-off trench shall be included in the design of the dam to reduce seepage and improve stability of the dam, preventing it from tipping to allow water from the reservoir to flood downstream.
- The design of the dam shall include a rock toe which will help relieve seepage problems in the downstream area of the dam on impervious foundation hence preventing it from collapsing as a result of seepage.
- Regular inspection of likely areas of weakness along the dam (such as; cracks, fissures) by qualified and experienced expert personnel is crucial to avoiding such calamities. In case of fissures, it can be cleaned off and concreted. For larger indentations or cracks, slush grouting should be used, which is a thick slurry mix of cement and water poured and bloomed into the larger cracks and fissures before any concrete is laid to fill the remaining indentations.
- Regular monitoring is essential to detect seepage and prevent failure. Downstream from the dam, seepage may be measured by increased flow from ground water springs in existence prior to the reservoir as might be caused by the pool of water behind the dyke.
- Also regular reservoir water level measures might indicate seepage. Continuous and sudden drop in the normal reservoir level could be sign that there is actual seepage that requires treatment to avoid collapse of the dam.
- Furthermore certain observations from routine inspections of the downstream face of the dam or contact of the embankments with the spillway or dam could indicate seepage. E.g. Growth of emergent plants in lush and dark green around the downstream face of the dam, slides in the embankment of the spillway or dam are possible signs of saturation of water in

soils due to seepage, eroded soils in the shape of cone around the outlet of the downstream face of the dam, all these are signs of the possibility of seepage.

- **Installation of monitoring instrument:** The objective of the instrumentation monitoring is to determine that the behaviour of the dam is in accordance with predictions or, if this is not the case, to assess the likely cause and impact of any untoward occurrence. As part of normal operating procedures the instruments will be monitored regularly to observe changes that occur and to confirm that movements, foundation pressures and seepage values are within acceptable limits.

7.2.3.3. Adverse impact on biological environment during operation phase

✓ **Loss of biodiversity**

Damming of rivers tends to affect biodiversity through reduced water quality and quantity especially in downstream areas. For instance, the physico-chemical parameters of the water, including turbidity and pH, could be affected by the reduced or regulated water flow regimes affecting macro-invertebrates and flora that thrive under particular water flow regimes. This may affect the marshland fringes natural vegetation and probably local community crops and agro-biodiversity in the immediate areas surrounding the marshlands that may be directly impacted by the damming and creation of the reservoir.

Mitigation measures

- Release of environmental flow may reduce this impact
- ✓ **Increased conflict with rice farmers** and bird's species which feed on rice and Ibises for stepping on rice at vegetative and reproductive stage.

Mitigation measures:

- Use traditional means of birds protection

✓ **Eutrophication of dams by water hyacinth**

Eutrophication is the deterioration of an aquatic ecosystem by the proliferation of certain plants, especially planktonic algae (known as plankton bloom. During our site visit we have observed the presence of Water hyacinth in existing dams and main irrigation canal. The presence of water hyacinth may lead to dam reservoir eutrophication and loss of aquatic biodiversity.

Mitigation measures

- Regular remove of water hyacinth. Cooperatives should organize regular community work to remove water hyacinth.

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The Environmental Management and Monitoring Plan (EMMP) are broadly divided into two parts one is the **Environmental Management Plan (EMP)** and an **Environmental Monitoring Plan**.

The Environmental Management Plan translates proposed mitigation and management measures into actions to be undertaken during the construction and operational phases of the project. It indicates the expected impact, action to mitigate it, time frame, and responsible institution and provide the estimated cost. The Environmental Monitoring Plan details monitoring activities and measures to be undertaken during construction and operation phases. It provide key parameters to be monitored, indicators and means of verification, frequency and timeframe, responsible institution and the estimated cost

Rwanda Agriculture Board in collaboration with Rwamagana district, Cooperatives and WUA shall be responsible for overall implementation of the EMP. However the contractor will be the key actor during construction phase as it is the one to implement mitigation measures related to rehabilitation works. RAB shall designate a staff to make day to day follow up (e.g. supervision and liaising with stakeholders). The estimated costs for implementation of the mitigation measures are just indicative. Appropriate bills of quantities should clearly give actual figures. In any case the consultant used informed judgment to come up with these figures.

8.1. Environmental Management Plan

8.1.1. Environmental Management Plan for Construction Phase

TABLE 48: Environmental Management Plan

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
PLANNING AND CONSTRUCTION PHASES						
Site clearance and excavation	Loss of Land	Land for land compensation for government land through land redistribution	After rehabilitation	RAB	Once	
		Land for land compensation or compensation of land in cash	Prior to construction	RAB	Once	
	Loss of crops and trees	Monitory compensation on market value and disturbance allowances	Prior to construction	RAB	Once	
Dam construction and rehabilitation	Income loss due to missed season	Employment opportunity	During construction	RAB	On-going	
		Financial compensation based on number of season missed and expected production	During construction	RAB	On-going	
		Proper planning and information on construction schedules.	Before construction	RAB-Rwamagana District	As Required	
	Income loss for Cooperatives and union	Financial assistance in payment of employee	During construction	RAB	Monthly	
	Water conflicts arising from the creation of irrigation scheme	– Creation and operationalize water Users association and include other users in the association;	Operation	– RAB	Once	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
		- Construction at least two water points par site outside the dam for cattle keepers	Before the end of construction	- RAB	Once	
		- To enforce zero-grazing policy	Through the project life	- Community policing	As required	
	Workers safety including Injuries	Preparation and implementation of Contractor Occupational Health and Safety plan	Before and during construction	Contractor	Once	
		Provision of Personnel Protective Equipment (PPEs) to workers (wellington boots, helmets, nose masks, eye goggles...)	During construction	Contractor	As required	
		Life insurance for workers	During construction	Contractor	Once	
		Provision of First Aid kit, one per site and provide training its use	During construction	Contractor	once	
	Communicable diseases	Health insurance known as «Mutuelle de Santé»	During construction	Workers and Contractors	Once	
		Spraying water regularly to suppress excessive dust during construction	During construction	Contractor	As required	
		Sensitisation of workers and communities on communicable diseases and HIV	During construction	Contractor	Twice	
	Occupational risks	Training of workers on occupational and health measures and adherence to them	During construction	Contractor	As required	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
Site clearance	Migration of Birds due to works presence and destruction their Nests	Clear only the areas required for construction and relocating nests to trees which will not be affected.	Before excavation and clearance	Contractor	As required	
		Sensitisation of workers on fauna protection	Before excavation and clearance	Contractor	As required	
	Destruction of amphibian eggs and destruction of snake's burrow	Avoid any killing of animal during the construction work. Before construction works start, workers need to be sensitized and briefed to avoid any killing of animal.	Before excavation and clearance	Contractor	As required	
	Loss some natural tree species	Avoid cutting trees which are beyond the area designated for dam construction or expansion.	During clearance and excavation	Contractor	As required	
		Maintain ecological flow in reservoir and canals	During construction	Contractor / Cooperatives	Always	
Excavation and Construction	Soil erosion	<ul style="list-style-type: none"> - Planting vegetation on the cleared sites immediately after construction; - Light compaction will be necessary to stabilise the soil. . 	During site closure	Contractor	Once	
		Only clear areas earmarked for construction.	During construction	Contractor	As required	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
		<ul style="list-style-type: none"> - Stockpiling, backfilling and resurfacing after excavation to avoid facilitation of erosion agents. - Light compaction will be necessary to stabilise the soil 	During excavation and site clearance	Contractor	As required	
	Contamination of water bodies	<ul style="list-style-type: none"> - Restrict re-fuelling, oil change, maintenance works, repair works will need to allocated a restricted area, far from the water bodies; - Stock for fuels shall need to have a cemented floor and a sand stock for use in the absorption of spilled oil. 	During construction	Contractor	As required	
	Modification of flows for downstream flow and loss of fauna and flora	<ul style="list-style-type: none"> - Design of diversion structures should incorporate release on environmental flow from the central drain at all times to maintain a specific water level downstream and maintain the existing ecosystem. - Design should ensure a proper drainage network allowing for return flow from the plantation plots into the stream during the dry season. 	Design Phase	Study team	As Required	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
Welding, electrical installations, refuelling of equipment, smoking on site.	Fire outbreaks	Specific area restricted to only authorized personnel and with fire extinguishers, should be allocated for fuel storage. Fire management drills for the workers should regularly be done.	Throughout construction	Contractor	Any time during construction	
OPERATIONAL PHASE						
Regulation of water flow from dam through the sluice gates	Modification of flows for downstream usage	Maintain 10% of flow as environmental flow for the survival of the existing ecosystem before it is considered degraded (Montana, 1997).	At the time of releasing water for irrigation	- Water User's Association (WUA)	All through operation	
		Clean irrigation canal and to allow for adequate water supply downstream.	At the time of releasing water for irrigation	- Cooperatives	All through operation	
Application of excess fertilizers and pesticides	Water pollution from non-point sources	<ul style="list-style-type: none"> - Pest Management Plan (PMP) as guidance for pest management. - Training of local farmers on the safe and appropriate amounts of application of pesticides and fertilizers. 	Training before every season of planting.	<ul style="list-style-type: none"> - RAB - Cooperatives 	Training twice a year.	
		<ul style="list-style-type: none"> - Water quality tests to understand the impact of the project on the quality of water bodies and curb any likely impacts there may be before water quality deteriorates. 	Water quality tests at the end of every 2 years of cultivation	<ul style="list-style-type: none"> - RAB - Rwanda Natural Resources Authority 	Tests once every 2 years	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
Irrigation of field	Water logging	<ul style="list-style-type: none"> Regulated water quantity released from reservoir for irrigation based on crop water requirement could minimise occurrence of water logging. 	Through the irrigation	<ul style="list-style-type: none"> RAB Cooperatives Formed WUA. 	As long as irrigation scheme exists	
		<ul style="list-style-type: none"> 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. 	At the beginning of each season	<ul style="list-style-type: none"> RAB 	Once year	
	Vandalism of Irrigation infrastructure	<ul style="list-style-type: none"> Sensitization of farmers to ensure project ownership and effecting community policing as a means of ascertaining security, will collectively avoid vandalism. Punitive actions towards perpetrators by the authorities will facilitate compliance by the locals thereby avoiding vandalism 	Throughout the project implementation	<ul style="list-style-type: none"> Cooperatives Cooperative Union Rwamagana District 	As required	
	Wastage of water during irrigation	<ul style="list-style-type: none"> Train members and technician of Water Users Association (WUAs) to manage quantities of apportioned for each paddy field hence reducing on likely water misuse. 	During operational phase	<ul style="list-style-type: none"> RAB 	As required	
		<ul style="list-style-type: none"> Frequent inspection and repairs of leaking infrastructure is necessary to reduce on losses of water through leakages. 	Throughout operational phase	<ul style="list-style-type: none"> WUAs technician 	On-going	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
	Increased spread of Waterborne related diseases	- Planting of <i>Phytolaca decocandra</i> which will destroy the Bilharzia snails that serve as hosts of <i>shistosomiasis</i> along the shores of the lakes and river.	Before water harvesting	- Cooperatives - Rwamagana District	As required	
		- Sensitization of farmers on the use of mosquito nets for those who don't have as a way of to reduce on the spread of malaria.	Before water harvesting	- Ministry of Health - Rwamagana District	As required	
Growing rice	Destruction of central drain boundaries and main canals	- A buffer zone should be established along the main canals and farmers should be sensitised to protect canals	During canal construction	- Cooperatives - Farmers	As required	
		- Regular maintenance of irrigation canals to ensure a proper drainage network allowing for return flow from the plantation plots into the stream	Throughout the operational Phase	- Farmers - Cooperatives	As required	
	Water pollution from fertilizers and pesticides	- Farmers training on Integrated Pest Management practice for the proposed the crops (rice).	Throughout the operational Phase	- Farmers - Cooperatives	As required	
	Loss of birds due to conflict with rice farmers and bird's species.	- There is an existing conflict where by big birds feed on rice and in some cases they destroy a considerable amount of rice. Traditional means of scaring birds Known as «Baringa» instead of	During the maturity of Rice	- Farmers	As required	
	Eutrophication of dams by water hyacinth	Regular remove of water hyacinth.	During the operation phase	Farmers WUAs	As required	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
Cultivation on the hillside catchment area of the reservoir	High sedimentation levels in the Reservoir	- Bench Terraces on the catchment area of the reservoir.	When demarcations of reservoir have been established.	- Rwamagana districts -	Once	
Application of fertilizers on plantations of the upstream catchment.	Reduction of aquatic life due to reservoir eutrophication	- Periodic manual removal of weeds from the reservoir.	Weed removal every 3 months.	- Cooperative. - RAB.	As required.	
		- Introduction of fish species that feed on invasive aquatic weeds and mosquito larvae.	Fish introduction once reservoir is filled.	- Cooperatives - RAB	On-going	
Water harvesting in reservoir	Floods from reservoir over flow or dam collapse	Dam design includes. - A well designed and maintained Spillway and regular inspection of likely areas of weakness along the dam (such as; cracks, fissures) and repair is crucial to avoid such calamities.	- Design phase	- Study team	Through the life cycle of the dam	
		Installation of dam monitoring instrument	- Design phase	- Study team	once	
		Regular monitoring	- Operation phase	- WUA - Rwamagana District	As required	

Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US\$)
Using water for non-irrigation activities	Drowning of children and livestock	- Sensitization of locals on the dangers of swimming and fetching water in the reservoir.	During operational Phase	- RAB - Rwamagana District	As required	
		- Establishing of panels of restricted activity in the reservoir and make public awareness	Before the completion of construction	- Contractor	Once	
EXPECTED IMPACTS DURING DECOMMISSIONING						
Demolishing of the irrigation infrastructure	Land depreciation from abandoned Infrastructures	- Plan for a better income generating project for the area before this irrigation project is replaced.	- At the pre-feasibility stage of a replacing project	- MINAGRI	Once	
Decommissioning of the Dam	Dust and noise pollution from demolition activities	- Protective gear, such as; eye goggles, ear phones and nose masks. - Spray of water to reduce dust. - Compaction of soils in areas where demolition is complete.	- During demolition	- Contractor.	All through the demolition period	
Collapse of the dam during demolition	Possibility of downstream flooding	Controlled draining of the reservoir is crucial to avoid recipients downstream or even the plots in the command area from flooding plus avoiding the river embankments from eroding.	- During demolition	- Contractor	Once when the dam is destroyed	
Disposal of debris during demolition	Contamination and impaired environment	Monitoring of the waste disposal in authorized dumping areas to avoid contamination of receiving waters or causing human health hazards.	- During demolition	- RAB	Once during debris disposal	
Total Budget						

8.2. Environmental Monitoring Plan

This section describes the monitoring plan and proposed key indicators to be monitored. It also indicates measurements of parameters, responsibility and cost estimates of outcomes of the proposed mitigation measures.

8.2.1. Environmental Monitoring Plan for Construction and operational phase

Table 49: Environmental Monitoring Plan

Adverse Impacts	Proposed Mitigation/Enhancement measures	Monitoring indicator	Means of verification	Responsible institution	Timeframe/Frequency	Estimated costs (US\$)
PLANNING AND CONSTRUCTION PHASES						
Loss of Land	Land for land compensation for government land through land redistribution	Number of PAPs	Compensation report	RAB	Once	
	Land for land compensation or compensation of land in cash	Number of PAPs	Compensation report	RAB	Once	
Loss of crops and trees	Monitory compensation on market value and disturbance allowances	Number of PAPs	Compensation report	RAB	Once	
Income loss due to missed season	Employment opportunity	Number of PAPs	Compensation report	RAB	On-going	
	Financial compensation based on number of season missed and expected production	Number of PAPs	Compensation report	RAB	On-going	
Income loss for Cooperatives and union	Financial assistance in payment of employee	Amount paid	Payment receipt	RAB	Monthly	
Water conflicts arising from the creation of irrigation scheme	– Creation and operationalize water Users association and include other users in the association;	Registration certificate of WUA	Certificate	RAB	Once	

Adverse Impacts	Proposed Mitigation/Enhancement measures	Monitoring indicator	Means of verification	Responsible institution	Timeframe/Frequency	Estimated costs (US\$)
	- Construction at least two water points par site outside the dam for cattle keepers	Number of structure constructed	Field report	- RAB	Once	
Workers safety including Injuries	Preparation and implementation of Contractor Occupational Health and Safety plan	OSH report	Field report	Contractor	Once	
	Provision of Personnel Protective Equipment (PPEs) to workers (wellington boots, helmets, nose masks, eye goggles...)	Number of PPE	Field report	Contractor	As required	
	Life insurance for workers	Number of workers insured	Field report	Contractor	Once	
	Provision of First Aid Kit, one per site and provide training its use	Number of First Aid Kit	Field report	Contractor	once	
Communicable diseases	Health insurance known as «Mutuelle de Santé»	Number of workers with health insurance	Field report	Contractor	Once	
	Spraying water regularly to suppress excessive dust during construction	Water spraying report	Field report	Contractor	On daily	
	Sensitisation of workers and communities on communicable diseases and HIV	Number of sensitization meeting	Minutes and attendance list	Contractor	Twice	
Occupational risks	Training of workers on occupational and health measures and adherence to them	Number of trained people	Training report	Contractor	As required	
Migration of Birds due to works presence and destruction their Nests	Sensitisation of workers on fauna protection	Number of trained people	Training report	Contractor	Once	

Adverse Impacts	Proposed Mitigation/Enhancement measures	Monitoring indicator	Means of verification	Responsible institution	Timeframe/Frequency	Estimated costs (US\$)
Destruction of amphibian eggs and destruction of snake's burrow	Before construction works start, workers need to be sensitized and briefed to avoid any killing of animal.	Number of sensitized people	Sensitization report	Contractor	Once	
Loss some natural tree species	Maintain ecological flow in reservoir and canals	Ecological situation report	Field verification	Contractor	As required	
Soil erosion	- Planting vegetation on the cleared sites immediately after construction;	Ha protected	Field verification	Contractor	Once	
	- Stockpiling, backfilling and resurfacing after excavation to avoid facilitation of erosion agents.	Soil erosion control report	Field verification	Contractor	As required	
Contamination of water bodies	- Restrict re-fuelling, oil change, maintenance works, repair works will need to allocated a restricted area, far from the water bodies; - Stock for fuels shall need to have a cemented floor and a sand stock for use in the absorption of spilled oil.	Status of contamination	Field verification report	Contractor	As required	
Fire outbreaks	- Fire management drills for the workers should regularly be done.	Number of brief meeting	Briefing report	Contractor	twice	
	- Provision of extinguisher at site	Number of extinguisher	Field verification	Contractor	As required	
OPERATIONAL PHASE						

Adverse Impacts	Proposed Mitigation/Enhancement measures	Monitoring indicator	Means of verification	Responsible institution	Timeframe/Frequency	Estimated costs (US\$)
Modification of flows for downstream usage	Maintain 10% of flow as environmental flow for the survival of the existing ecosystem before it is considered degraded (Montana, 1997).	Quantity of released water	Flow measurement	- Water User's Association (WUA)	Quarterly	
	Clean irrigation canal and to allow for adequate water supply downstream.	Status of canals	Field visit report	- Water User's Association (WUA)	All through operation	
Water pollution from non-point sources	- Training of local farmers on the safe and appropriate amounts of application of pesticides and fertilizers.	Number of farmers trained	Training report	- RAB - Cooperatives	Every season	
	- Irrigation Water quality tests to understand the impact of the project on the quality of water.	Level of biochemical parameters	Laboratory results	- RAB	Tests once every 2 years	
	- Drinking water test for new constructed spring water	Level of biochemical parameters	Laboratory test	- RAB	Before handover	
Water logging	- Training of farmers and WUA technician to regulate quantities of water	Number of trained people	Training report	- Formed WUA.	At the beginning of each season	

Adverse Impacts	Proposed Mitigation/Enhancement measures	Monitoring indicator	Means of verification	Responsible institution	Timeframe/Frequency	Estimated costs (US\$)
Vandalism of Irrigation infrastructure	- Sensitization of farmers to ensure project ownership and effecting community policing as a means of ascertaining security, will collectively avoid vandalism.	Number of sensitization meeting	Sensitization report	- Cooperatives - Rwamagana District	As required	
	- Punitive actions towards perpetrators by the authorities will facilitate compliance by the locals thereby avoiding vandalism	Number of case recorded	Field report	- WUA	Monthly	
Wastage of water during irrigation	- Frequent inspection and repairs of leaking infrastructure is necessary to reduce on losses of water through leakages.	Inspection report	Field verification	- WUAs technician	On-going	
Increased spread of Waterborne related diseases	- Planting of <i>Phytolaca decocandra</i> which will destroy the Bilharzia snails that serve as hosts of <i>shistosomiasis</i> along the shores of the lakes and river.	Number of trees planted	Field verification	- Cooperatives - Rwamagana District	On-going	
	- Sensitization of farmers on the use of mosquito nets for those who don't have as a way of to reduce on the spread of malaria.	Number of meeting	Meeting report	- Ministry of Health - Rwamagana District	As required	
	-	Cases of waterborne diseases	Survey report	- Ministry of Health Rwamagana District	Annually	

Adverse Impacts	Proposed Mitigation/Enhancement measures	Monitoring indicator	Means of verification	Responsible institution	Timeframe/Frequency	Estimated costs (US\$)
Loss of birds due to conflict with rice farmers and bird's species.	- There is an existing conflict where by big birds feed on rice and in some cases they destroy a considerable amount of rice. Traditional means of scaring birds Known as «Baringa» instead of	Existing birds protection structure	Field verification report	- Cooperatives	As required	
Eutrophication of dams invasive species	Regular remove of water hyacinth.	Level of water hyacinth in dams	Field verification report	WUAs	Monthly	
	- Periodic manual removal of weeds from the reservoir.	Level of cleanness of dams	Field verification report	- Cooperative. - RAB.	As required.	
	- Introduction of fish species that feed on invasive aquatic weeds and mosquito larvae.	Quantity of fishes introduced	Field verification report	- Cooperatives - RAB	On-going	
High sedimentation levels in the Reservoir	- Bench Terraces on the catchment area of the reservoir.	Ha of protected area	Field measurement	- Rwamagan a districts	On-going	
Floods from reservoir over flow or dam collapse	- Regular inspection of likely areas of weakness along the dam (such as; cracks, fissures) and repair is crucial to avoid such calamities.	- Monitoring report	- Field verification	- WUA	Through the life cycle of the dam	

Adverse Impacts	Proposed Mitigation/Enhancement measures	Monitoring indicator	Means of verification	Responsible institution	Timeframe/Frequency	Estimated costs (US\$)
Drowning of children and livestock	- Sensitization of locals on the dangers of swimming and fetching water in the reservoir.	Number of people who attended meeting	Report Sensitization meeting	- RAB - Rwamagana district	Once year	
	- Establishing of panels of restricted activity in the reservoir and make public awareness	Presence of panels	Field verification	- RAB - Rwamagana district	Once	
Total budget				-		

8.2.2. Environmental monitoring for specific parameters.

In addition to the monitoring of EMP implementation other parameters need to be monitored by the project to check the impact of project on the environment but also to the live hoods of marshland users. Monitoring is proposed for water quality especially to determine the level and concentration of pesticides and fertilizer content in the project area. We proposes the identification of three different points in order to monitor the quality of water, one point at the upstream end of the marshland, the point in the middle of the marshland and the third point at the end of the marshland downstream. Periodic taking of water samples should be undertaken twice a year during the cultivation season to determine water quality. These samples should be taken by the Project Environmental officer, or a private subcontracted company in water quality monitoring specialist 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.

Furthermore, Monitoring social economic parameters should be measured including living condition of farmers, improvement of yield, diseases spread should be done to monitor the possible impacts of the marshland development to users. The table below shows the key parameters to monitor to assess the project impact on environment and farmers.

Table 50: Environmental monitoring plan for specific parameters

Impact	Parameter	Monitoring Indicator	Method	Frequency of Measurement	Responsibility	Costs Estimate s (USD)
Physical Environment						
Water Pollution	Water quality	Nutrient Load (Nitrates, phosphates, potassium, sodium, etc.), pesticide residue, COD & BOD, Turbidity	Samples should be taken from the point where sampling were taken during baseline data collection watershed	Seasonally	Rwamagana district/ farmers cooperatives	
Potential reduction in Water flow downstream	Water flow	Flow rates per second	Stream gauging	Seasonally	Rwamagana district/ farmers cooperatives	
Soil erosion	Soil cover loss	Water turbidity	Observation and water test	Continuous	Rwamagana District/ farmers cooperatives	

Impact	Parameter	Monitoring Indicator	Method	Frequency of Measurement	Responsibility	Costs Estimate s (USD)
Flooding	Flooded area	Floods downstream of project area or in the middle of the marshland	Observation and reported cases of flooding	Continuous	Cooperatives managing the rice scheme,	
Socio-economic Environment issues to monitor						
Water-borne Diseases	Disease prevalence Microbes contained in water	Increased cases of waterborne diseases Types of microbes contained in water	Consultation of health records at near health centre in the project area Twice a year during wet and dry season (samples should be taken from the point where sampling were taken during baseline data collection watershed	Quarterly Three Seasonally	Rwamagna District RAB and Ministry of Health	
Total Budget for monitoring						

8.3. Implementation arrangement for EMP

The chapter three has provided the institutional arrangement in relation with environmental management and the environmental management and monitoring plans have indicated the responsible institution that will implement each mitigation measures. Although the implementation arrangement is not yet established, this section provides key actors that will lead the implementation of the project and environmental management and monitoring plan.

8.3.1. MINAGRI and RAB

The overall responsibility of implementation of this EMP is under Ministry of Agriculture and Animal Resources, Rwanda Agriculture Board, Rwamagana District and the Construction Contractor. RAB should designate one of its officers to act as Environmental Officer (EO), to formally address environmental and social issues on a routine basis, who will have an oversight of environmental aspects of the construction contracts, including the enforcement of all monitoring provisions, the locations of construction and labour camps, etc. Before the commencement of construction, the designated EO will receive training in the environmental and social issues associated with irrigation facilities.

8.3.2. Rwanda Environment Management Authority/ REMA

REMA was established in 2004 to act as the implementation organ of environment-related policy and laws in Rwanda. REMA is also tasked:

- to coordinate different environmental protection activities undertaken by environmental promotion agencies;
- to promote the integration of environmental issues in development policies, projects, plans and programmes;
- to coordinate implementation of Government policies and decisions taken by the Board of Directors and ensure the integration of environmental issues in national plan among concerned departments and institutions within the Government;
- to advise the Government with regard to the legislation and other measures relating to environmental management or implementation of conventions, treaties and international agreements relevant to the field of environment as and when necessary;
- To make proposals to the Government in the field of environmental policies and strategies; etc.

In relation to Regards to the implementation of this EMP, REMA will ensure that all policies and regulations related to environmental protection are observed and advise on the better way to implement EIA. REMA is also entrusted with monitoring and inspection of constructions activity to check whether they are compliant with laws. REMA will also ensure that conditions of approval provided by RDB are implemented.

8.3.3. Rwamagana District, sectors and cells

Generally, decentralized entities are responsible for the implementation of laws, policies, strategies, objectives and programmes relating to protection, conservation and promotion of the environment in Rwanda. Article 61: In the framework of conservation and protection of the environment, decentralized entities are particularly responsible for:

- ensuring activities related to better management of land, especially controlling soil erosion and tap rain water;
- afforestation, protection and proper management of forests;
- efficient management of rivers, lakes, sources of water and underground water; 4° efficient management and effective use of swamps;
- protection and proper management of reserved areas, historical sites, endangered animal and plant species

Article 62: Decentralized entities shall have the responsibility of designing plans of collecting and treatment of domestic waste. Decentralized entities are also responsible for collecting and piling domestic waste. This is carried out in collaboration with institutions Districts, Sector and Cells of or associations and authorized competent individuals.

Decentralized entities shall also put much emphasis on the removal of any other waste in any possible way depending on its nature and quantity, supervision and its treatment. Through district environmental officer, Rwamagana District will carry out regular monitoring and inspection work to ensure that the project is implemented in compliance with this environmental management and monitoring plan.

8.3.4. Environmental and social safeguards training

The training program will cover measurement techniques in the field, tools for the prediction of pollutants, conservation of water bodies including marsh lands, etc. Rwanda Environmental Management Authority, Rwanda Bureau of Standards and Rwanda Development Board may be consulted for such training. The need for additional and specialised training will be examined and appropriate training will be undertaken as required. Training of personnel to be deployed on the proposed project during construction and operation, with regard to environmental requirements should be the integral part of the planning. In addition all employees will be trained on safety, methods of disaster prevention, action required in case of emergency, fire protection, environmental risk analysis etc.

Capacity to quantitatively monitor water sediments or turbidity (by suitable portable test equipment) and noise is always advantageous, but monitoring will primarily involve ensuring that actions taken are in accordance with contract and specification clauses, and specified mitigation measures. Some awareness training will be provided to the contractor personnel to ensure that this occurs effectively.

8.3.5. Monitoring and reporting procedures

The project designated EO will visually assess contractor's practices and, if high pollutant levels are suspected instruct the contractor to make corrections. Photographic records will be established to provide useful environmental monitoring tools. A full record will be kept as part of normal contract monitoring. All applicable regulations need to be enforced by the Project manager and designated EO. Under the Environment Organic law (2005) water quality discharge standards, air pollution emission standards and noise standards have been established. It is a legal obligation of

the Contractor that any discharges from the work sites meet these standards. Steps will be taken by the Project manager and designated EO to ensure that regular monitoring of water quality parameters such as pH, suspended solids, turbidity, magnesium, oil and grease be carried out as provided in the contract. Regular monitoring of noise and dust will also be carried out as provided in the environmental monitoring program.

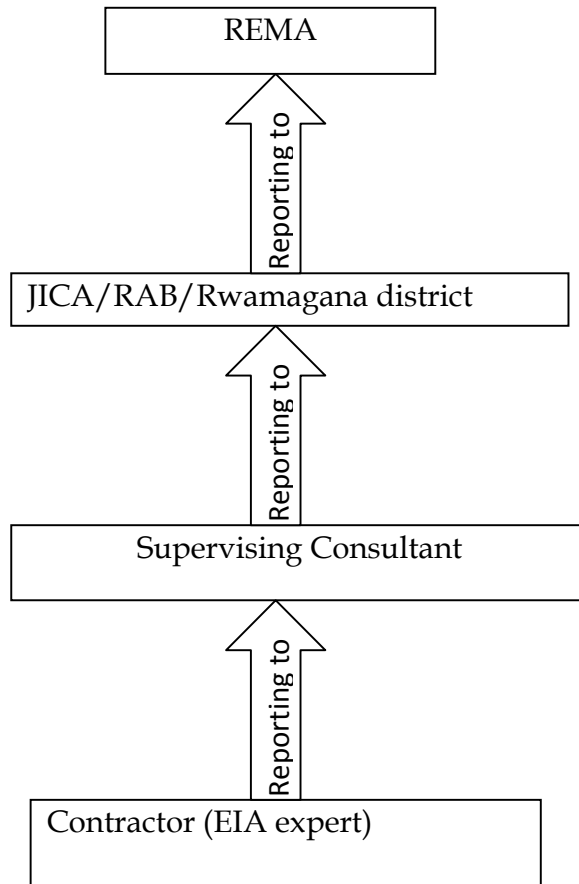


Figure 35: EMP reporting structure

8.3.6. Record Keeping

Monitoring form should be devised for documentation, analysis and record of parameter. The form should focus attention on environmental issues and provide feedback for the future stages of the work. Mitigation and enhancement measures adopted in final design will be explicitly under the bill of quantities (BOQ) so that performance and completion is readily documented. Daily project diaries would record environmental problems (spills, dust, noise, etc.) as well as safety incidents and will be retained as part of accepted modern contract management and summarized in Quarterly Environmental Reports.

8.3.7. Implementation schedule

The most important aspects of the implementation are the appointment of the Environmental Officer to oversee the implementation of the environmental mitigation measures incorporated in the design and contract specifications. Development and delivery of an environmental training program for selected staff and Project coordinators responsible for overseeing the construction

contracts can commence immediately thereafter. This will be an on-going process since contracts will be awarded over a period of time stretching over many months. Most of the planned mitigation measure will be implemented along with project activities and is provided in Environmental Management Plan and environmental monitoring Plan.

8.3.8. Summary of estimated EIA implementation budget

No	Item	Estimated Budget(USD)	
		Government	Contractor
1	Implementation of Environmental management plan		
2	Environmental Monitoring Plan		
3	Trainings and staffing		
	Sub Total		
	Grand Total		

CHAPTER NINE: CONCLUSION AND RECOMMENDATIONS

9.1. CONCLUSIONS

The environmental and social assessment has identified a number of impacts pertaining to the proposed Project. Impacts have been assessed and described in some detail to gain an adequate understanding of possible environmental effects of the proposed project – from design to operational phases, in order to formulate mitigation measures in response to negative aspects which have emerged. The Environmental Management Plan (EMP) provides a way forward for implementation of the identified mitigation measures. The EMP should be implemented as a prerequisite for a positive Record of Decision (RoD) by the appropriate authorities.

The estimated costs of implementing the mitigation measures are just indicative. Appropriate bills of quantities should clearly give the actual figures. In any case the consultant has used informed judgement to come up with these figures with reference to other similar projects.

The Environmental Monitoring Plan provides parameters to be monitored and responsibility. The study is recommending that the project developer (RAB) to assign the environmental and social safeguard officer or a watershed officer to undertake the monitoring of the mitigation measures for the project through its existence. This way the proponent will achieve sustainable project implementation at reduced cost for undertaking the monitoring. The figures given are considered to be absolute maximum such monitoring could cost. However, regular internal monitoring shall be carried out by the project proponent. The external Monitoring should be carried out by Rwanda Environment Management Authority. Furthermore, the contractor to be hired should be provided with resource to implement and monitor the EMP on daily basis.

Given the nature and location of the proposed project, the EIA team is the view that the potential impacts associated with the proposed development are of a nature and extent that can be reduced, limited and eliminated by the application of appropriate mitigation measures. The EIA team concludes that, the project is feasible and there are no major negative environmental impacts that could result from the implementation of this project that cannot be mitigated.

9.2. RECOMMENDATIONS

For the sustainability of this project the mitigation measures will have to be implemented along with the specific recommendations as detailed below:

1. Before construction, the contractor should be requested to prepare and implement an Occupational Health and Safety Plan (OHS);
2. Dam to be rehabilitated and the one to be construction should be designed and operationalize in compliance with «**Small Dams Safety Guidelines**» developed by Ministry of Agriculture and Animal Resources for small dams owners.
3. The preservation of buffer zone along dams and rivers is required by the Ministerial Order N°007/16.01 of 15/07/2010 determining the length of land on shores of lakes and rivers

transferred to the public property. Therefore, the project design should consider at least 20 m buffer zone to reduce sedimentation of reservoirs

4. Members of the existing Cooperatives and Water Users Association should be trained and empowered. To avoid conflict over water use, the formation of water users association should consider other users.
5. Training of the local beneficiaries in the modern rice cultivation methods, access to markets and to the inputs especially fertilizers are among the key issues raised by farmers that should seriously be addressed by the project and this is key for the successful implementation of this project.
6. Though the project design does not include the protection of water catchment, Rwamagana district, RAB and farmers should enhance soil erosion infrastructure in the entire water catchment. This can be done on an individual basis but also in community work «Umuganda» ;
7. Periodical maintenance of irrigation facilities by RAB and/or community”.

REFERENCES

1. CHANNING, A. & HOWELL, K. M. (2006): Amphibians of East Africa. - Ithaca, London ;
2. East African Community, 2004. East African protocol on environment and natural resources management.
3. EDPRS 2008-2012, Economic Development and Poverty Reduction Strategy.
4. EIA Guidelines, REMA 2007
5. EICV3 Rwamagana district profile ,2012
6. Government of Rwanda, 2008. Ministerial order No. 003/2008. Relating to the requirements and procedure for Environmental Impact Assessment, 2008.
7. Government of Rwanda, 2008. Ministerial order No. 004/2008. Establishing the list of works, activities and projects that have to undertake Environmental Impact Assessment, 2008.
8. Government of Rwanda, 2008. Ministerial order No. 007/2008. Establishing the list of Animal and plant species, 2008.
9. Government of Rwanda, 2004. National Land policy.
10. Government of Rwanda, 2004. Sector policy on water and sanitation.
11. Government of Rwanda, 2008. Organic law 04/2005 of 08/04/2005. Organic law determining the modalities of protection, conservation and promotion of the environment in Rwanda.
12. Government of Rwanda, 2005. Organic law N° 08/2005 of 14/07/2005. Determining the use and management of Land in Rwanda.
13. JICA new guidelines for environmental and social considerations, https://www.jica.go.jp/english/our_work/social_environmental/guideline/
14. MINITERE (2003), the Rwandan Environmental Policy.
15. Ministry Of Natural Resources, Rwanda Natural Resources Authority, Water Resources Information Bulletin No 08 for February 2013
16. www.worldbank.org, world bank policies and procedures, safeguards policies
17. SPAWLS, S., HOWELL, K., DREWES, R., ASHE, J., DUFF-MC KAY, A. & HINKEL, H. (2002):
18. STEVENSON, T. & FANSHAW, J. (2002): Field Guide to the Birds of East Africa Kenya, Tanzania, Uganda, Rwanda, Burundi. 1-602. T. & A.D. Poyser, London.
19. World Bank Group, Kigali Bulk Water Supply, Project, Technical Feasibility Report ,July 2011
20. TROUPIN, G. (1988): Flore du Rwanda. Spermatophytes. Vol. 4. Ann. Musée Tervuren. no. **16**: 1 - 651.

APPENDICES

Appendix 1: Bird species recorded and their location

No.	Transect	Site Name	X	Y	Order	Family	Common Name	Vernacular Name	Scientific Name	IUCN Conservation status
1	2	Gashara	212244	9777640	Accipitriiformes	Accipitridae	African Harrier Hawk	Ikizu	<i>Polyboroides typus</i>	Least Concern
2	3	Bugugu	213508	9780947	Accipitriiformes	Accipitridae	Black kite	Sakabaka	<i>Milvus migrans</i>	Least Concern
3	4	Cyimpima	215111	9778421	Anseriformes	Anatidae	Yellow-Billed Duck		<i>Anas undulata</i>	Least Concern
4	1	Cyaruhogo	213360	9775032	Charadriiformes	Charadriidae	African Wattled Lawping	Inkurakura	<i>Venellus senegallus</i>	Not assessed
5	1	Cyaruhogo	213365	9775035	Charadriiformes	Charadriidae	Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Least Concern
6	1	Cyaruhogo	211630	9776051	Charadriiformes	Scolopacidae	Green Sandpiper		<i>Tringa ochropus</i>	Least Concern
7	2	Gashara	212761	9777150	Charadriiformes	Charadriidae	African Wattled Lawping	Inkurakura	<i>Venellus senegallus</i>	Not assessed
8	2	Gashara	212675	9777217	Charadriiformes	Charadriidae	Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Least Concern
9	2	Gashara	211958	9778052	Charadriiformes	Charadriidae	Long-Toed Lapwing	Inkurakura	<i>Vanellus crassirostris</i>	Least Concern
10	3	Bugugu	213391	9779430	Charadriiformes	Charadriidae	African Wattled Lawping	Inkurakura	<i>Venellus senegallus</i>	Not assessed
11	3	Bugugu	213391	9779765	Charadriiformes	Charadriidae	Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Least Concern
12	4	Cyimpima	214354	9776202	Charadriiformes	Charadriidae	African Wattled Lawping	Inkurakura	<i>Venellus senegallus</i>	Not assessed
13	4	Cyimpima	214406	9776555	Charadriiformes	Charadriidae	Black-Headed Heron	Uruyongoyongo	<i>Ardea melanocephala</i>	Least Concern
14	2	Gashara	211843	97782018	Ciconiiformes	Ciconiidae	Yellow-Billed Stork		<i>Mycteria ibis</i>	Least Concern
15	3	Bugugu	213273	9781969	Ciconiiformes	Ciconiidae	African Open-Billed Stork		<i>Anastomus lamelligeru</i>	Least Concern
16	1	Cyaruhogo	213154	9774902	Coliiformes	Coliidae	Spickled Mousebird	Umusure	<i>Colius striatus</i>	Least Concern
17	2	Gashara	211643	9778383	Columbiformes	Columbidae	Speckled Pigeon	Inuma	<i>Columba guinea</i>	Least Concern
18	1	Cyaruhogo	213322	9775002	Coraciiformes	Alcedinidae	Pied Kingfisher	Murobyi	<i>Ceryle rudis</i>	Least Concern
19	1	Cyaruhogo	211901	9775961	Coraciiformes	Alcedinidae	Malachite Kingfisher	Murobyi	<i>Corythornis cristatus</i>	Least Concern
20	2	Gashara	212497	9777373	Coraciiformes	Alcedinidae	Malachite Kingfisher	Murobyi	<i>Corythornis cristatus</i>	Least Concern

21	3	Bugugu	213592	9780503	Coraciiformes	Alcedinidae	Pied Kingfisher	Murobyi	<i>Ceryle rudis</i>	Least Concern
22	4	Cyimpima	215059	9778183	Coraciiformes	Alcedinidae	Pied Kingfisher	Murobyi	<i>Ceryle rudis</i>	Least Concern
23	1	Cyaruhogo	213427	9775070	Passeriformes	Corvidae	Pied Crow	Igikona	<i>Corvus albus</i>	Least Concern
24	1	Cyaruhogo	213117	9774951	Passeriformes	Ploceidae	Slender-Billed weaver	Isandi	<i>Ploceus pelzelni</i>	Not assessed
25	1	Cyaruhogo	212052	9775862	Passeriformes	Motacillidae	African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Least Concern
26	1	Cyaruhogo	211225	9776109	Passeriformes	Pycnonotidae	Common Bulbul		<i>Pycnonotus barbatus</i>	Least Concern
27	2	Gashara	212634	9777258	Passeriformes	Motacillidae	African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Least Concern
28	2	Gashara	212077	9777882	Passeriformes	Passeridae	Common Grey-Headed Sparrow	Igishwi	<i>Passer griseus</i>	Least Concern
29	2	Gashara	212051	9777922	Passeriformes	Leiothrichidae	Arrow-Marked Babbler	Ikijwangajwanga	<i>Turdoides jardineii</i>	Least Concern
30	3	Bugugu	213374	9779062	Passeriformes	Corvidae	Pied Crow	Igikona	<i>Corvus albus</i>	Least Concern
31	3	Bugugu	213475	9780276	Passeriformes	Motacillidae	African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Least Concern
32	4	Cyimpima	214022	9775342	Passeriformes	Corvidae	Pied Crow	Igikona	<i>Corvus albus</i>	Least Concern
33	4	Cyimpima	214841	9777654	Passeriformes	Ploceidae	Slender-Billed Weaver	Isandi	<i>Ploceus pelzelni</i>	Not assessed
34	4	Cyimpima	214955	9777830	Passeriformes	Motacillidae	African-Pied Wagtail	Inyamanza	<i>Motacilla aguimp</i>	Least Concern
35	4	Cyimpima	215132	9778515	Passeriformes	Estrildidae	Red-Chicked Cordon Bleu		<i>Uraeginthus bengalus</i>	Least Concern
36	4	Cyimpima	215163	9778618	Passeriformes	Nectariniidae	Olive-Bellied Sunbird		<i>Cinnyris chloropygia</i>	Least Concern
37	4	Cyimpima	215266	9778950	Passeriformes	Laniidae	Grey-Backed Fiscal		<i>Lanius excubitoroides</i>	Least Concern
38	4	Cyimpima	215464	9779386	Passeriformes	Estrildidae	Common Waxbill		<i>Estrilda astrild</i>	Least Concern
39	1	Cyaruhogo	213415	9775061	Pelecaniformes	Threskiornithidae	Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Least Concern
40	1	Cyaruhogo	213389	9775041	Pelecaniformes	Scopidae	Hamerkop	Sarupfuna	<i>Scopus umbretta</i>	Not assessed
41	1	Cyaruhogo	213415	9775061	Pelecaniformes	Threskiornithidae	Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Least Concern
42	1	Cyaruhogo	213411	9775053	Pelecaniformes	Ardeidae	Cattle Egret	Inyange	<i>Bubulcus ibis</i>	Least Concern
43	2	Gashara	212801	9777105	Pelecaniformes	Threskiornithidae	Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Least Concern
44	2	Gashara	212642	9777247	Pelecaniformes	Threskiornithidae	Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Least Concern

45	3	Bugugu	213382	9779179	Pelecaniformes	Threskiornithi dae	Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Least Concern
46	3	Bugugu	213382	9779238	Pelecaniformes	Scopidae	Hammerkop	Sarupfuna	<i>Scopus umbretta</i>	Not assessed
47	3	Bugugu	213366	9779925	Pelecaniformes	Threskiornithi dae	Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Least Concern
48	3	Bugugu	213374	9780042	Pelecaniformes	Ardeidae	Cattle Egret	Inyange	<i>Bubulcus ibis</i>	Least Concern
49	4	Cyimpima	215142	9778525	Pelecaniformes	Pelecanidae	Pink-Backed Pelican		<i>Pelecanus rufescens</i>	Least Concern
50	4	Cyimpima	214084	9775445	Pelecaniformes	Threskiornithi dae	Sacred Ibis	Nyirabarazana y'indagi	<i>Threskiornis aethiopicus</i>	Least Concern
51	4	Cyimpima	214302	9775870	Pelecaniformes	Scopidae	Hamerkop	Sarupfuna	<i>Scopus umbretta</i>	Not assessed
52	4	Cyimpima	214447	9777032	Pelecaniformes	Threskiornithi dae	Hadada Ibis	Nyirabarazana y'inkara	<i>Bostrychia Hagedash</i>	Least Concern
53	4	Cyimpima	214603	9777250	Pelecaniformes	Ardeidae	Cattle Egret	Inyange	<i>Bubulcus ibis</i>	Least Concern

Appendix 2: Amphibian species recorded and their location

Transect No.	Site Name	X	Y	Order	Family	Common Name	Scientific Name	IUCN Conservation status
1	Cyaruwego	212860	9775143	Anura	Ranidae	Northern Leopard Frog	<i>Ptychadena mascareniensis</i>	Least Concerned
1	Cyaruwego	212743	9775283	Anura	Hyperoliidae	-	<i>Afrixanus quadrivittatus</i>	Least Concerned
2	Gashara	212299	9777619	Anura	Ranidae	Northern Leopard Frog	<i>Ptychadena mascareniensis</i>	Least Concerned
3	Bugugu	213397	9779657	Anura	Ranidae	Northern Leopard Frog	<i>Ptychadena mascareniensis</i>	Least Concerned
3	Bugugu	213444	9781059	Anura	Bufonidae	-	<i>Amietophrynus kisoensis</i>	Least Concerned
4	Cyimpima	214051	9775474	Anura	Hyperoliidae	-	<i>Afrixanus quadrivittatus</i>	Least Concerned
4	Cyimpima	214378	9776619	Anura	Bufonidae	-	<i>Amietophrynus kisoensis</i>	Least Concerned
4	Cyimpima	214986	9777998	Anura	Ranidae	Northern Leopard Frog	<i>Ptychadena mascareniensis</i>	Least Concerned
4	Cyimpima	215243	9778909	Anura	Ptychadenidae	-	<i>Ptychadena porosissima</i>	Least Concerned

Appendix 3: Insect species recorded and their location

No	Transect No.	Site Name	X	Y	Common name	Order	No. of species
1	1	Cyaruhogo	212906	9775147	Dragonfly	Odonata	3
2	1	Cyaruhogo	212906	9775147	Cicada	Homoptera	2
3	1	Cyaruhogo	212673	9775334	Butterfly	Lepidoptera	2
4	1	Cyaruhogo	212182	9775708	Grasshoppers	Orthoptera	2
5	1	Cyaruhogo	212182	9775708	Praying Mantis	Dictyoptera	1
6	1	Cyaruhogo	212182	9775708	Lacewing	Neuroptera	2
7	2	Gashara	212726	9777164	Locusts	Orthoptera	1
8	2	Gashara	212726	9777164	Bees	Hymenoptera	1
9	2	Gashara	212726	9777164	Grasshoppers	Orthoptera	2
10	2	Gashara	212304	9777553	Butterfly	Lepidoptera	2
11	2	Gashara	212304	9777553	Beetle	Coleoptera	2
12	2	Gashara	211829	9778220	Dragonfly	Odonata	2
13	2	Gashara	211829	9778220	Lacewing	Neuroptera	1
14	3	Bugugu	213384	9779162	Dragonfly	Odonata	2
15	3	Bugugu	213440	9780137	Butterfly	Lepidoptera	2
16	3	Bugugu	213355	9781515	Grasshoppers	Orthoptera	2
17	3	Bugugu	213355	9781515	Lacewing	Neuroptera	2
18	4	Cyimpima	214161	9775506	Mosquitoes	Diptera	1
19	4	Cyimpima	214366	9776170	Dragonfly	Odonata	2
20	4	Cyimpima	214909	9777745	Lacewing	Neuroptera	1
21	4	Cyimpima	215114	9778332	Grasshoppers	Orthoptera	1

Appendix 4: List of flora species recorded and their conservation status

No.	Order	Family	Scientific Name	Vernacular Name	IUCN Conservation status
1	Commelinales	Pontederiaceae	<i>Eichornia crassipes</i>	Amarebe	Not assessed
2	Poales	Xyridaceae	<i>Xyris Valida</i>	-	Not assessed
3	Lamiales	Bignoniaceae	<i>Markhamia lutea</i>	Umusave	Not assessed
4	Proteales	Proteaceae	<i>Grevillea robusta</i>	Gereveriya	Not assessed
5	Laurales	Lauraceae	<i>Persea gratissima</i>	Avoca	Not assessed
6	Fabales	Fabaceae	<i>Erythrina abyssinica</i>	Umuko	Not assessed
7	Lamiales	Verbenaceae	<i>Lantana camara</i>	Umuhengeri	Not assessed
8	Poales	Poaceae	<i>Arundinaria alpine</i>	Umugano	Not assessed
9	Fabales	Fabaceae	<i>Acacia sieberana</i>	Umunyinya	Not assessed
10	Malpighiales	Euphorbiaceae	<i>Euphorbia tirucalli</i>	Umuyenzi	Least Concern
11	Asparagales	Asparagaceae	<i>Dracaena afromontana</i>	Umuhati	Least Concern
12	Asterales	Asteraceae	<i>Tithonia diversifolia</i>	-	Not assessed

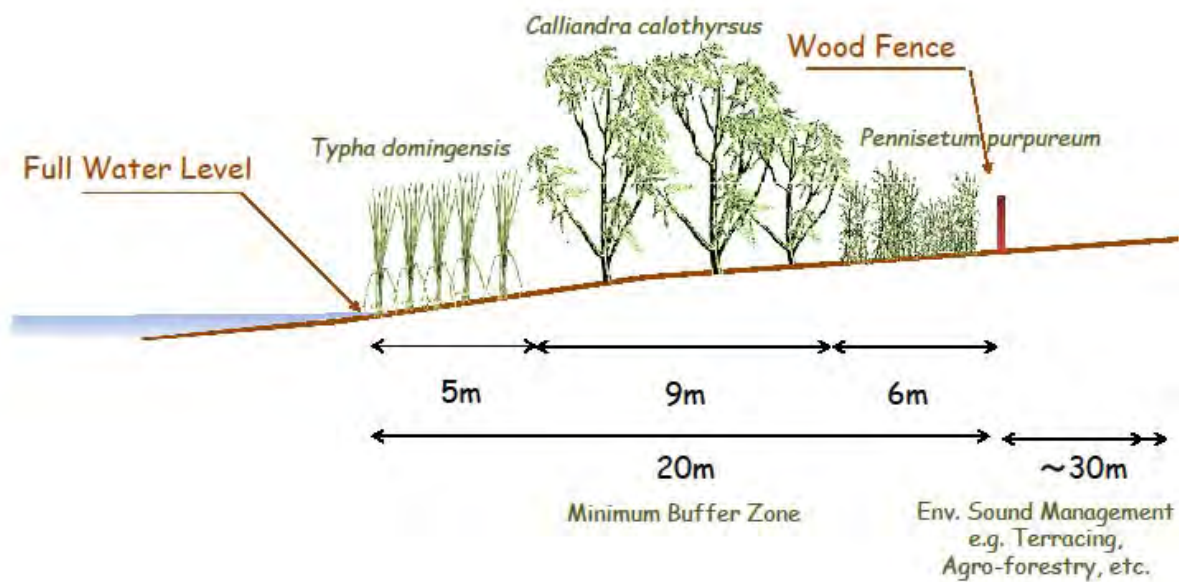
13	Asterales	Asteraceae	<i>Vernonia lasiopus</i>	Ihiheriheri	Not assessed
14	Poales	Poaceae	<i>Pennisetum purpureum</i>	Urubingo	Not assessed
15	Asterales	Asteraceae	<i>Coryza sumatrensis</i>	Bambuwa	Not assessed
16	Gentianales	Rubiaceae	<i>Pavetta ternifolia</i>	Umumenamabuye	Not assessed
17	Alismatales	Araceae	<i>Colocasia esculenta</i>	Amateke	Least Concern
18	Zingiberales	Musaceae	<i>Musa spp.</i>	Insina	Not assessed
19	Myrtales	Myritaceae	<i>Eucalyptus sp.</i>	Inturusu	Not assessed
20	Gentianales	Rubiaceae	<i>Chassalia subochreatea</i>	-	Not assessed
21	Brassicales	Caricaceae	<i>Carica papaya</i>	Ipapayi	Not assessed
22	Sapindales	Anacardiacea	<i>Mangifera indica</i>	Umwembe	Not assessed

Appendix 5: Impact analysis matrix

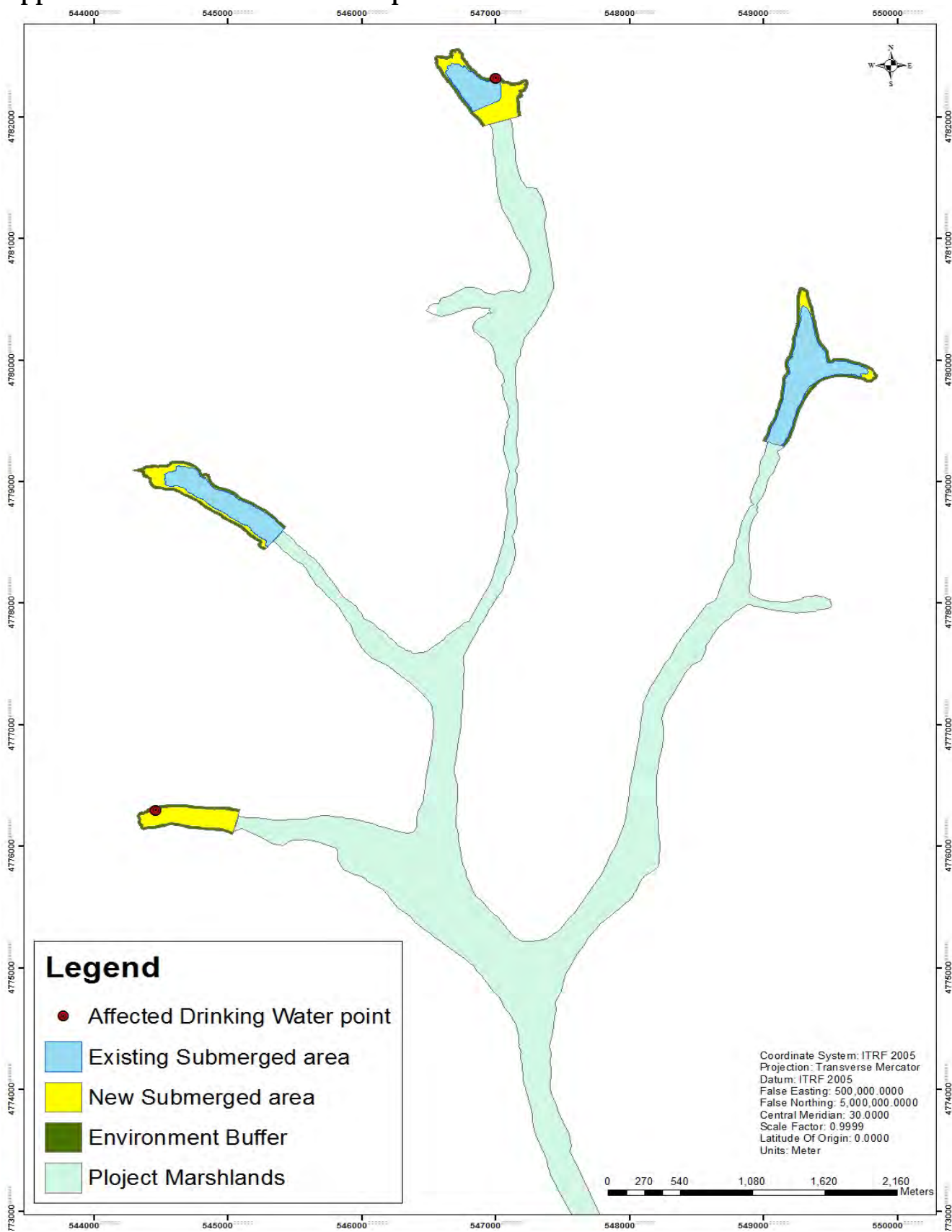
Environmental and Social Impacts	Impact type								Mitigation	
	Positive		Negative		Short term	Long term	Irreversible	Cumulative	Required	Not required
	Significant	Not Significant	Significant	Not Significant						
Rehabilitation of irrigation facilities in Rwamagana District										
Increase of production from farming all year	X									X
Market access for agricultural products	X									X
Collective harvest for large quantities and market continuity	X									X
Increased crop yield	X									X
Affordability of education	X									X
Affordability of medical insurance	X									X
Employment creation	X									X
Transfer of skills during the construction phase	X									X
Improved soil fertility	X									X
Agricultural Intensification	X									X
Increased Livestock fodder and dairy production	X									X
Land Appreciation	X									X
Empowerment of farmers	X									X
Gradual soil acidification										
Oil spillage resulting in soil and water contamination			X		X	X		X	X	
Air and Noise pollution			X		X				X	
Soil Erosion and land slides			X			X	X	X	X	
Fire Outbreak			X		X		X		X	
Loss of biodiversity in valley			X			X		X	X	
Loss of land, houses and crops			X			X		X	X	
Income loss from missed season cultivation			X			X		X	X	
Injuries from construction works and borrow pits			X			X		X	X	
Diseases from interactions of construction activity			X			X		X	X	
Loss of public infrastructure; power lines, portable			X			X		X	X	

water points										
Modification of flows for downstream usage			X			X	X	X	X	
Water pollution by fertilizer and pesticide application			X			X	X		X	
Water logging and salinization			X			X		X	X	
High sedimentation levels			X			X		X	X	
Clogging and damage of irrigation infrastructure due to water nature and quality			X			X		X	X	
Water loss from evaporation and leakage			X			X		X	X	
Reduction of aquatic life due to reservoir eutrophication			X			X		X	X	
Loss of existing river biodiversity due to changes in water temperature.			X			X		X	X	
Loss of income source of people dependent on brick making in the command area			X			X		X	X	
Health hazards from poor pesticide and fertilizer application.			X			X		X	X	
Water conflicts from the creation of irrigation scheme			X			X		X	X	
Vandalism of irrigation infrastructure			X			X		X	X	
Floods from reservoir over flow			X						X	
Increased spread of Water related diseases			X			X		X	X	
Encroachment of the reservoir and primary emissary			X			X		X	X	
Abandoned Infrastructure			X			X	X		X	
Dust and noise pollution from demolition activities			X		X				X	
Contamination and impaired environment			X			X		X	X	
Loss of livelihood			X						X	

Appendix 6: Typical buffer zone cross section

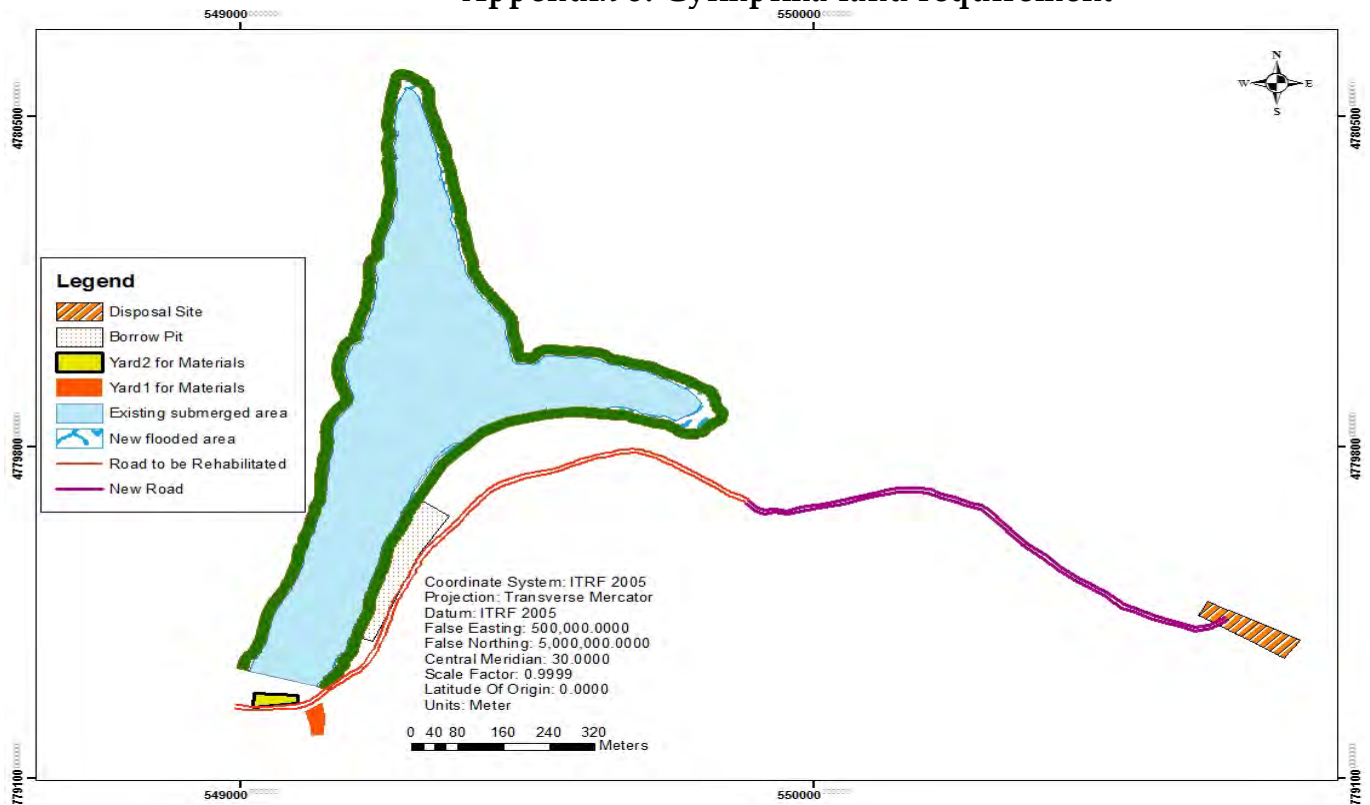


Appendix 7: General overview map of the four marshlands



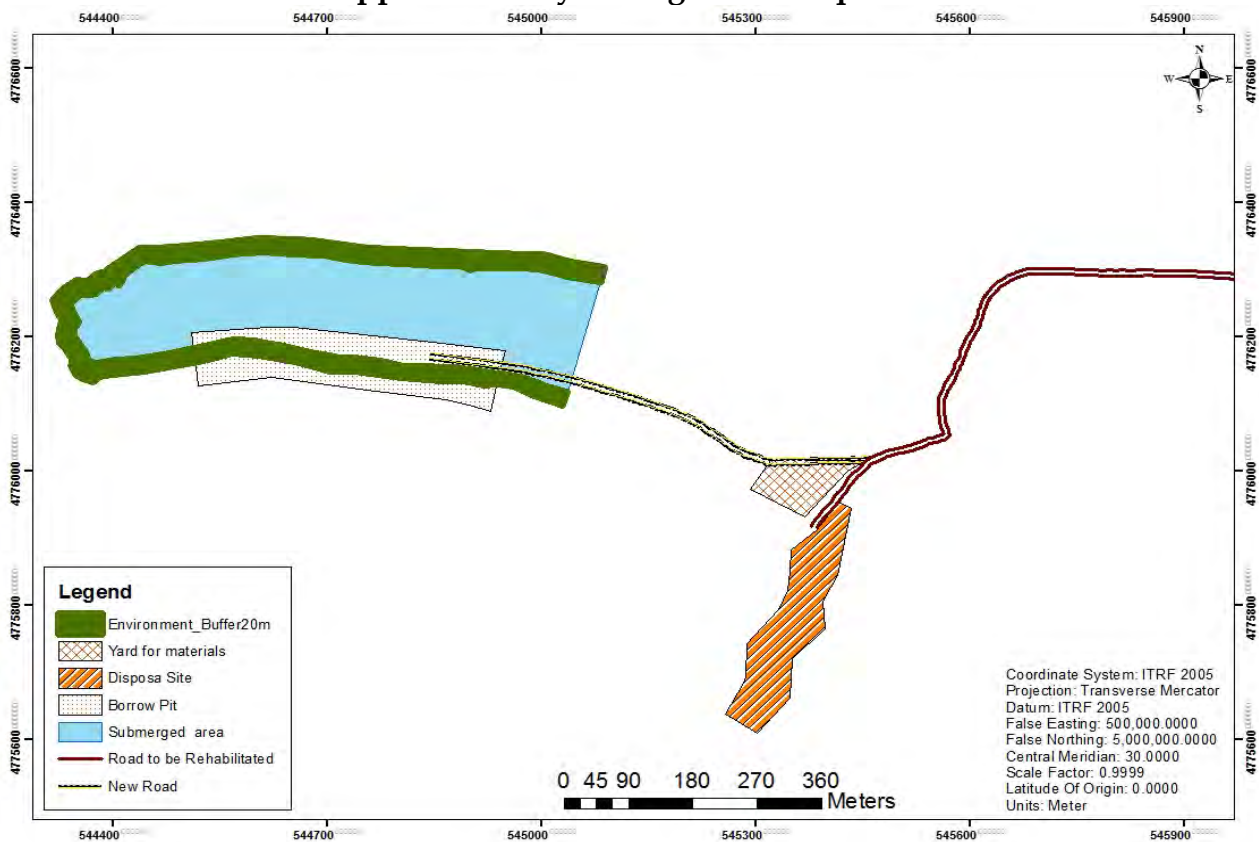
Source: BESST Ltd 2016

Appendix 8: Cyimpima land requirement



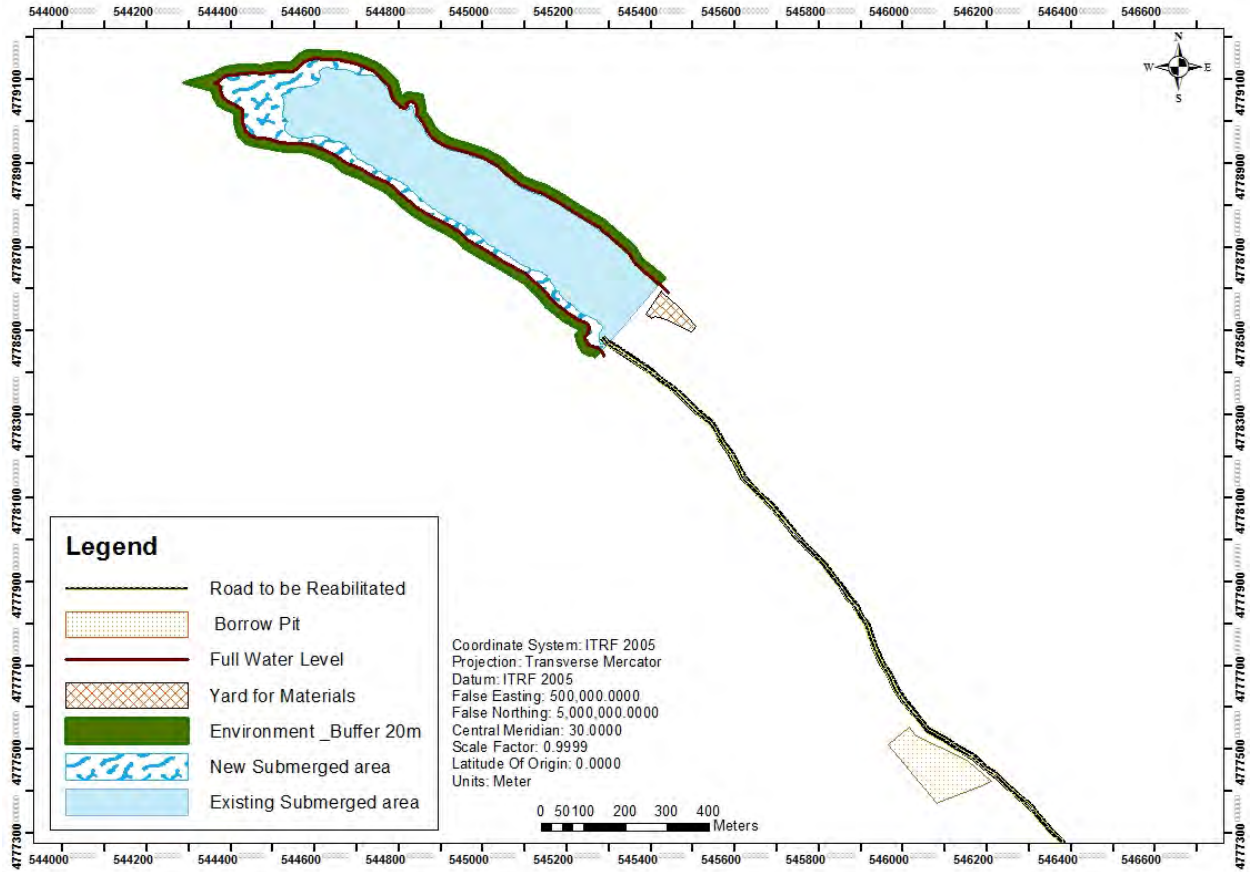
Source: BESST Ltd, 2016

Appendix 9: Cyaruhogo land requirement



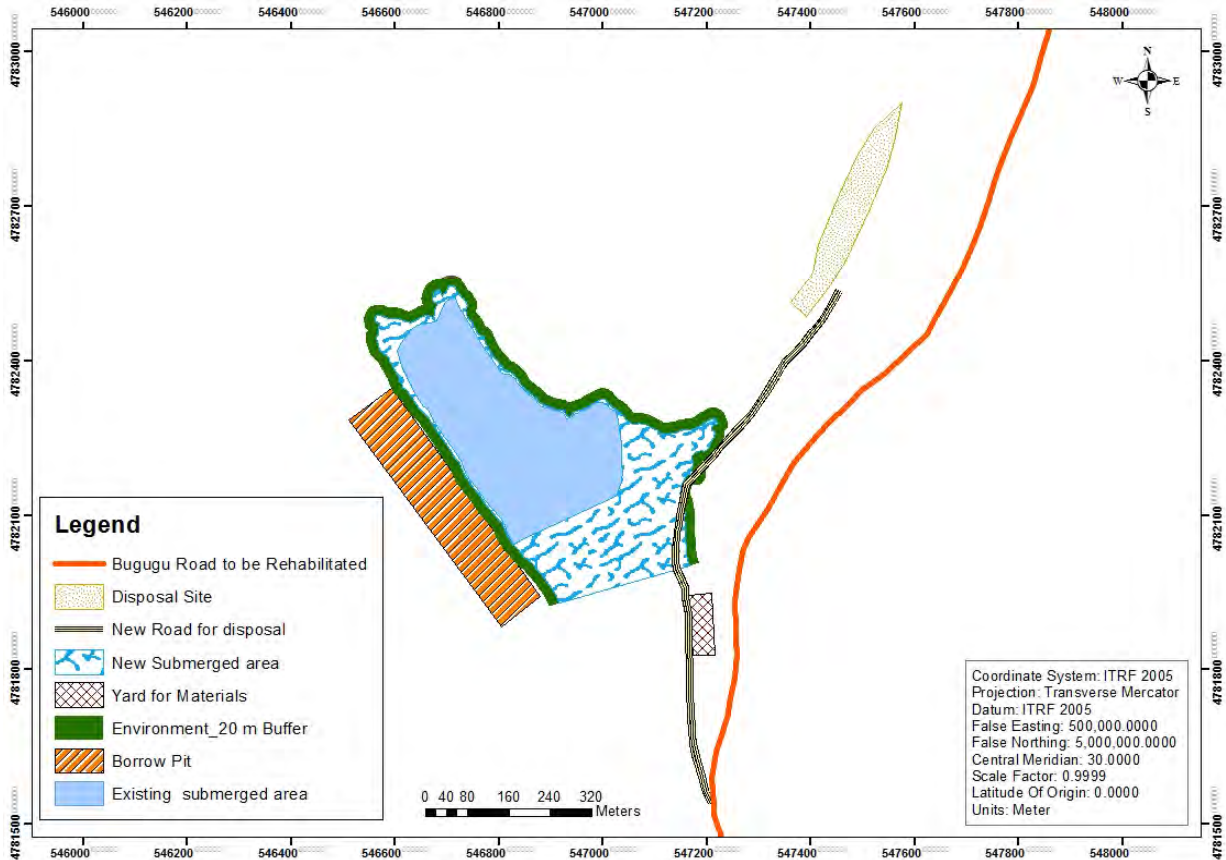
Source: BESST Ltd, 2016

Appendix 10: Gashara land requirement



BESST Ltd, 2016

Appendix 11: Bugugu land requirement



Source: BESST Ltd, 2016

Appendix 12: Approval letter for terms of reference



Kigali 31/08/2016

Ref: RDB/EC/533-2468-08-2016/08/16

Rwanda Agricultural Board (RAB)

Tel: 4675

Dear Sir/Madam,

RE: Terms of Reference for Environmental Impact Assessment Study

Reference is made to your letter submitting to Rwanda Development Board (RDB) the project brief related to Rehabilitation of irrigation facilities in Rwamagana District in the Republic of Rwanda in the plot N° located in Sovu Cell, Kigabiro Sector, Rwamagana District, East Province ;

We would like to inform you that after the screening of your project brief, the visit conducted in the project site and consultation of laws and regulations, it was found that your project is subject to an EIA study to the level specified in the Terms of Reference. Therefore, please find attached Terms of Reference which will guide your EIA Expert in the preparation of the Environmental Impact Report (EIR).

RDB will issue the EIA Certificate after the review and the approval of EIR.

Sincerely,

Francis GATARE
Chief Executive Officer



A handwritten signature in blue ink, appearing to read 'Francis Gatare'.

CC:

- Governor/Mayor of East Province
- Director General of REMA
- Mayor of Rwamagana District

ANNEX 6 住民移転計画書



Republic of Rwanda
Ministry of Agriculture and Animal Resources
Rwanda Agriculture Board (RAB)



Japan International Cooperation Agency

FINAL REPORT
RESETTLEMENT ACTION PLAN (RAP) FOR THE PROPOSED PROJECT OF
REHABILITATION OF IRRIGATION FACILITIES IN RWAMAGANA DISTRICT, REPUBLIC
OF RWANDA



Prepared by:
BUREAU FOR ENVIRONMENTAL AND SOCIAL STUDIES/ BESST Ltd

January, 2017
Ver.20170125

DISCLOSURE OF CONSULTANT

Name of the Project: RESETTLEMENT ACTION PLAN (RAP) FOR THE PROPOSED PROJECT OF REHABILITATION OF IRRIGATION FACILITIES IN RWAMAGANA DISTRICT, REPUBLIC OF RWANDA	
Nature of assignment	Preparing RAP Report
Name of approved EIA expert	Bureau for Environmental and Social Studies/BESST Ltd

I hereby undertake that all the points raised in the ToRs requirements provided by the client and approved by Rwanda Development Board (RDB) are complied with. I also undertake that the facts given in this RAP report are factually correct to the best of our knowledge.

Managing Director
Bureau for Environmental and Social Studies

EXECUTIVE SUMMARY

The Government of Rwanda (GoR) is pursuing a comprehensive poverty reduction program, which includes implementation of various sustainable agriculture projects. Agriculture sector in Rwanda, counts for about 34% of the country's GDP (World Bank: 2013) and about 80% of the national population are engaged in the sector. However, the small-scale farming is majority and most of them are under rain-fed which production is very much affected by weather. Therefore, irrigation development which is less susceptible to the climate condition is desired for improvement of farmers' stable income.

On the basis of above background, the GoR requested the support from the Government of Japan (GoJ) for the rehabilitation of irrigation facilities including Cyaruhogo, Cyimpima, and Bugugu and Gashara marshlands in Rwamagana district, hereafter referred as Project. Preliminary surveys and design studies has started and the proposed Project will invest in expanding the irrigation area through upgrading existing dams, construction of new dam at Cyaruhogo marshlands and rehabilitation of existing irrigation main canals.

The construction of new dam at Cyaruhogo and rehabilitation existing dams at Cyimpima, Gashara and Bugugu as well as the rehabilitation of irrigation system will required additional in submerged area, disposal, borrow pits, access roads and construction camp sites. The acquisition of additional lands is expected to lead to physical displacement of people and loss of access to the land that provides for economic resources. This therefore principally triggers the JICA guidelines for environmental and social considerations, World Bank OP 4.12 on involuntary resettlement, and national laws on expropriation and land ownership.

The land likely be affected by the Project is mainly owned by government and private individuals and is being used for various land uses including rice farming, livestock grazing and subsistence agriculture. The required land include the land to be affected permanently (submerged, access roads, disposal and borrow areas) and the land affected temporary (construction camps site). The proposed environmental management plan prepared along with this RAP has recommended the establishment of a 20 m buffer zone for dam protection and this will lead to the land use change and hence land acquisition. Furthermore, it is anticipated that during construction, will not have water to irrigate their rice and they will lose expected income.

Therefore, in accordance with JICA guidelines on environmental and social considerations, national regulations on expropriation and compensation and the World Bank OP 4.12, a Resettlement Action Plan (RAP) must be developed and implemented by project developer so as to address adequately project impacts related to land acquisition. The RAP should be prepared in compliance with all the necessary requirements outlined in JICA guidelines on environmental and social considerations and national expropriation law but also in compliance with international policies including WB OP 4.12.

The objective of RAP is to ensure immediate compensation or other supports to Project Affected Persons (PAPs) for their affected properties at the project sites prior construction. The main elements of the RAP are: public consultation, documentation and inventory of assets and, disclosure of entitlement, assessment of alternatives compensation and resettlement measures, establishment of Grievance Redress Mechanism (GRM), implementation, monitoring and reporting arrangement.

The present report principally describes the proposed Project components/activities and associated resettlement impacts. The report also provides the socio-economic baseline data, identified PAPs and inventory of properties/assets highlights to be affected, biography of the PAPs and the magnitude of the properties to be lost. The RAP also provides the legal and regulatory framework for assets valuation, eligibility, and compensation.

The persons to be compensated were meaningfully consulted and participated in planning and implementing the compensation process. Before and during the preparation of this RAP, consultative meetings were held on site to inform the PAPs that their properties or their income might at some point be destroyed or cleared to make way for the rehabilitation of irrigation facilities. In the meetings, PAPs got to know how the compensations will be done, their rights and their major role in the Project activities. Other meetings and interview were also conducted with implementing and regulatory institutions as well as different expert working in similar projects.

The identification of PAPs and provisional inventory of assets likely to be affected indicate that the proposed Project will affect in total 1,699 households in four marshlands and the estimated cost for RAP implementation and monitoring is 553,780,627 Frw (679,485 USD)¹. However, upon the completion of final design studies, the inventory done during the RAP preparation shall be updated and valued by independent valuar and then RAB will provide compensation for land, crops, trees and income loss prior construction. The entitlement matrix has been developed and the first option for land compensation should be land for land compensation and then compensation in cash. Moreover, technical training such as livestock and agriculture and employment opportunities will be provided to the affected persons to ensure that PAPs livelihood is restored or improved.

RAB together with Rwamagana district will be responsible for implementation, monitoring and reporting the implementation of the RAP. Any aggrieved party may ask for justification of the decisions from the resettlement and compensation committee to be established, but should the answer still be unsatisfactory, they may appeal to the local authorities starting with the cell, sector and district authorities. If the grievances are not resolved in this way, the complainant should bring his case to local mediators known as «Abunzi» or court of law depending on the nature of complaint. RAB and Rwamagana district will ensure that all PAPs appreciate the complaints procedure and will make sure each party involved fulfils its duties.

¹ BNR exchange rate in October =1 USD=815 frw

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ACRONYMS

BESST	: Bureau for Environmental and Social Studies
DDP	: District Development Plan
DLB	: District Land Bureau
EIA	: Environmental Impact Assessment
EICV	: Enquête Intégrale sur les conditions de vie
ESMF	: Environmental and Social Management Framework
FRW	: Franc Rwandais/Rwandan Franc
GDP	: Gross Domestic Product
GIS	: Geographic Information System
GoJ	: Government of Japan
GoR	: Government of Rwanda
HH	: Household
JICA	: Japan International Cooperation Agency
M&E	: Monitoring and Evaluation
MINAGRI	: Ministry of Agriculture and Animal Resources
MINIRENA	: Ministry of Natural Resources
NGO	: Non-Governmental Organization
OP	: Operation Policy
PAPs	: Project Affected Parties/People
RPF	: Resettlement Policy Framework
RAB	: Rwanda Agriculture Board
RAP	: Resettlement Action Plan
RDB	: Rwanda Development Board
REMA	: Rwanda Environment Management Authority
RNRA	: Rwanda Natural Resources Authority
RPF	: Resettlement Policy Framework
RSSP	: Rural Sector Support Project
SPIU	: Single Project Implementation Unit
ToRs	: Terms of Reference
UPI	: Unique Personnel Identification
USD	: United States Dollars
WB	: World Bank

DEFINITIONS

Agricultural labourer: means a person primarily resident in the affected area who does not hold any land in the affected area but who earns his livelihood principally by manual labour on agricultural land therein immediately before such declaration and who has been deprived of his livelihood;

Agricultural land includes lands being used for the purpose of:

- a) Agriculture or horticulture;
- b) Dairy farming, poultry farming, fishing, breeding of livestock or nursery growing medicinal herbs;
- c) Raising of crops, grass or garden produce; and land used by an agriculturist for the grazing of cattle, but does not include land used for cutting of wood only.

Census is a data collection technique of completing enumeration of all Project Affected Households and their assets through household questionnaire.

Compensation: means payment in cash or in kind to replace losses of land, housing, income, and other assets caused by a project.

Cut-off date: This refers to the date prior to which the project affected family was in possession of the immovable or movable property within the affected zone.

Entitlement: is defined as the right of project affected persons (PAPs) to receive various types of compensation, relocation assistance, and support for income restoration in accordance with the policy provisions.

Entitlement Matrix is a table to define different nature of PAPs losses and compensation packages and other relocation assistance.

House hold includes a. person, his' or her spouse, minor sons, unmarried daughters, minor brothers, unmarried sisters, father, mother and other relatives residing with him or her and dependent on him or her for their livelihood; and includes "nuclear family" consisting of a person, his or her spouse and minor children.

Non-agricultural employer means a person who is not an agricultural labourer but is primarily residing in the affected area who does not hold any land under the affected area but who earns his livelihood principally by manual labour or as a rural artisan immediately before such declaration and who has been deprived of earning his livelihood principally by manual labour or as such artisan in the affected area;

Non-titleholder: Affected persons/families with no legal title to the land, structures and other assets adversely affected by the project. Non-titleholders include encroachers, squatters, etc.

Project Affected Persons (PAPs): indicates any person being as it may an individual, a household, a firm or a private or public who, on account of the execution of the project, or any of its components or sub-projects or parts thereof would have their rights, title or interest in any house, land or any other asset acquired or possessed, in full or in part; or business, occupation, work, place of residence or habitat adversely affected; or standard of living adversely affected.

Rehabilitation (Income restoration/Livelihood restoration): means the process to restore income earning capacity, production levels and living standards in a longer term.

Replacement cost/value: Replacement cost is the cost of purchasing comparable assets elsewhere by the affected person in lieu of the acquired land, buildings, structures, and other immovable assets, etc.

Socio-economic survey: is carried out in order to prepare profile of PAPs and to prepare for Resettlement Action Plan. The survey result is used (i) to assess incomes, identify productive activities, and plan for income restoration, (ii) to develop relocation options where applicable, and (iii) to develop social preparation phase for vulnerable groups.

Titleholder: A PAP who has legal title to land, structures and other assets in the affected zone and the land has a unique personnel Identification;

Loss of income: In this RAP, loss of income is defined as the future benefit that was going to be gained if the project was not implemented.

Measurement unit and rates used

- 1 ha= 100 are
- 1 Are=100 sqm
- 1 USD=813 Frw(BNR exchange rate on December 15th , 2016)

CHAPTER ONE: INTRODUCTION

1.1. Project background

The Government of Rwanda (GoR) is pursuing a comprehensive Poverty Reduction Program, which includes implementation of various sustainable agriculture projects. Agriculture sector in Rwanda accounts for about 34% of the country's GDP (World Bank: 2013) and about 80% of the national population engages in the sector. However, the small-scale farming is majority and most of them are under rain-fed which production is very much affected by weather. Therefore, irrigation development which is less susceptible to the climate condition is desired for improvement of farmers' stable income.

To boost the agriculture sector, the GoR has set a goal in the third Strategic Plan for Agriculture Transformation (SPAT3) of increasing of irrigation area to 100 thousand ha by 2018. To contribute this strategy, projects such as RSSP for marshland and LWH for hillside have been implemented with support of the World Bank and other donors. With the support of its development partners, the Government wants also to rehabilitate existing irrigation areas developed from 1970s to 80s so as to increase water storage capacity and minimize wastage of water resources.

On the basis of above background, the GoR requested support from the Government of Japan (GoJ) for the rehabilitation of irrigation facilities including Cyaruhogo, Cyimpima, and Bugugu and Gashara marshlands in Rwamagana. Preliminary surveys and design studies has studied and the proposed Project will invest in expanding the irrigation area through upgrading existing dams, construction of new dam at Cyaruhogo marshland and rehabilitation of existing irrigation canal.

The construction of new dam and rehabilitation of existing dams as well as the rehabilitation of irrigation system will required additional in submerged area, disposal, borrow pits, access roads and construction camp sites. The acquisition of additional lands is expected to lead to physical displacement of people and loss of access to the land that provides for economic resources. This therefore principally triggers the JICA guidelines for environmental and social considerations, World Bank OP4.12 on involuntary resettlement, and national laws on expropriation and land ownership.

Due to the expected resettlement impacts and in compliance with JICA guidelines for environmental and social considerations, national regulations on expropriation and compensation and the World Bank OP 4.12 on involuntary Resettlement, it was deemed necessary to prepare and implement a Resettlement Action Plan (RAP) for the proposed project. This is to ensure immediate compensation of Project Affected Persons (PAPs) for their affected properties at the project sites prior construction.

1.2. Scope of the RAP

The aim of the RAP report is to develop an action plan that ensures that the PAPs livelihoods and standards of living are improved or at least restored, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is

higher. The scope of work undertaken during the RAP preparation included public consultation, PAPs identification, and assets inventory, establishment of legal and regulatory framework for assets valuation and compensation, monitoring and grievance redress mechanism. The provisional assets inventory and estimated cost was included in the RAP but shall be updated upon the completion of final design studies and compensation made prior construction.

1.3. Methodology

The preparation of this RAP results of the combination of desk study, field surveys and census as well as public consultation with PAPs and stakeholders. The desk study involved review of previous study documents and analysis of the proposed project maps; and field surveys to establish the location of the proposed dam, irrigation canals and related infrastructure. The field survey consisted on conducting household census of identified PAPs; conducting baseline socio-economic survey on the project area as well as census and measurement of lands and crops which are likely to be affected. Discussions with PAPs and key stakeholders including district administration was also another tools used along the preparation of this RAP.

1.3.1. Literature review

Review on the existing baseline information and literature material will be undertaken to gain a further and deeper understanding of the project. Among the documents reviewed included the Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) for the third Rural Sector Support Project (RSSP), RAPs of similar projects such as Ngoma 22 and Rwamagana 34. The consultant also reviewed policies related to involuntary resettlement such as JICA guidelines for environmental and social considerations, World Bank OP 4.12 on involuntary resettlement and national regulations on expropriation, valuation and land acquisition. The 4th National Census, the third and fourth integrated survey on living conditions (EICV3& EICV4) was also used to assess social economic conditions of projects area.

1.3.2. Field work

The consultant deployed surveyors /enumerator's team lead by a GIS expert and used a detailed questionnaire to collect socio-economic baseline data. Furthermore, the GIS expert and his team used a designed form to record all properties including land, crops and trees in submerged, borrow pits, disposal, access roads and camps site areas. The identification of all projects affected person was also done through field survey by GIS expert and surveyors. The provisional assets valuation was made based on similar project and prevailing market price in the area but it shall be updated upon the completion of final design studies and payment should be made prior rehabilitation works.

1.3.3. Public consultation

In compliance with national regulations and international standards, stakeholder engagement was the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement involved, in varying degrees, the following elements: stakeholder analysis and

planning, disclosure and dissemination of information, consultation with stakeholders and participation, grievance mechanism, and on-going reporting to beneficiaries or PAPs.

From the scoping exercise, stakeholders were identified in two categories. First category made of implementing and regulatory agencies including government institutions, local administration and key experts in the area of irrigation and involuntary resettlement. Second category is made by potential project beneficiaries and/or project affected persons. During the Public consultation, the RAP expert applied different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD) and official meetings with stakeholders. Stakeholders were informed on the proposed project and anticipated resettlement implications, existing legal framework and provisions in relation to involuntary resettlement. Though the consultant guided discussions, most of the time was given to participants to provide views, and comments and ask questions. For each meeting, key issues discussed were recorded and included in the RAP report together participants lists.

1.3.4. Social impact assessment

The proposed Project has positive social and economic benefit to the user's communities and individuals but it may also have negative impacts including loss of land, crops, trees and means of livelihood. Therefore, the consultant assessed both social benefits and negative effects of the proposed project on local population and users. The social impact assessment considered permanent changes in land use and loss of property and other assets caused by occupation of land for the irrigation structure, temporary changes in land uses caused by short term occupation of land for construction, and changes in accessibility to existing land uses resulting from the temporary or permanent presence of the Project.

Expected resettlement impacts include loss of trees, crops, land, Loss of access to social and economic infrastructure such as water points/springs as well as income loss. For each impact identified, the consultant has proposed mitigation and compensation measures. The consultant has also provided an entitlement matrix and estimated costs associated with mitigation measures including provisional compensation cost.

1.3.5. Assets valuation methodology

As provided by the valuation law, the company certified valuer used the methodology whereby the proposed price for the real property is close or equal to replacement value. The valuer compared prices by referring to the prices recently assigned to a real property that is similar or comparable to the real property subject to valuation. Income loss were estimated based on investment cost, average production on one hectare, unit cost per 1kg for the last season times number of missed season. It is worth to note that the valuation done is just provisional and will be updated upon the completion of final design studies.

1.3.6. Content of the RAP report

The RAP report is structured into different chapters as follow:

- Executive summary;
- Chapter one: Introduction and methodology

- Chapter two: Project description and location
- Chapter three: Legal and regulatory frame work;
- Chapter four: Socio-economic survey;
- Chapter five: Impact assessment and compensation measures;
- Chapter six: Public consultation;
- Chapter seven: RAP implementation and monitoring;
- Chapter eight: RAP budget ;
- Chapter nine: RAP disclosure;
- Appendices

CHAPTER TWO: PROJECT DESCRIPTION AND LOCATION

2.1. Project area

2.1.1. Location

The Project of Rehabilitation of Irrigation Facilities in Rwamgana district covers four marshlands located between four sectors namely Kigabiro, Mwalire, Munyaga and Rubona. Figure 1 and figure 2 provide the project location administratively.

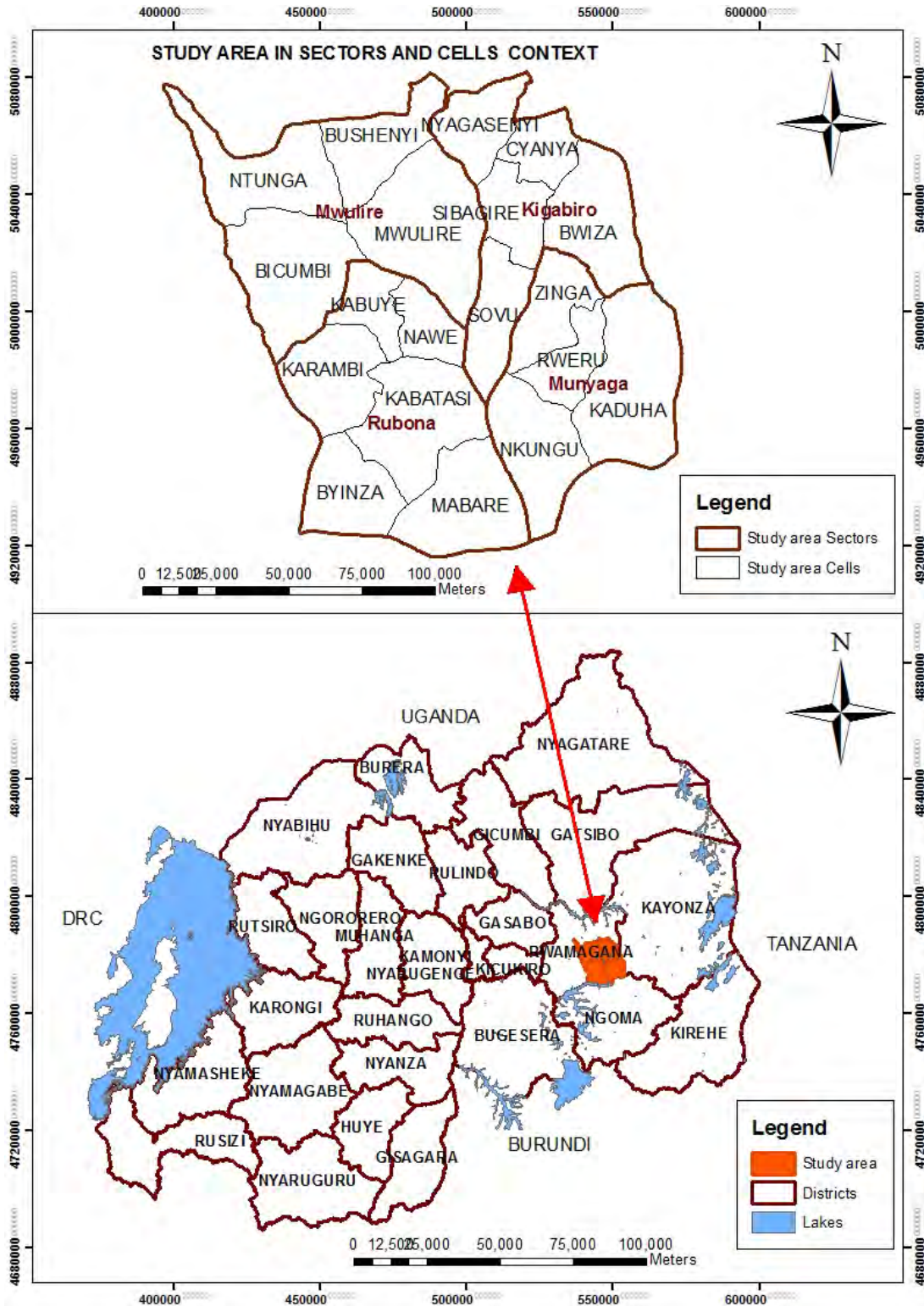


Figure 1: Administrative location of project area

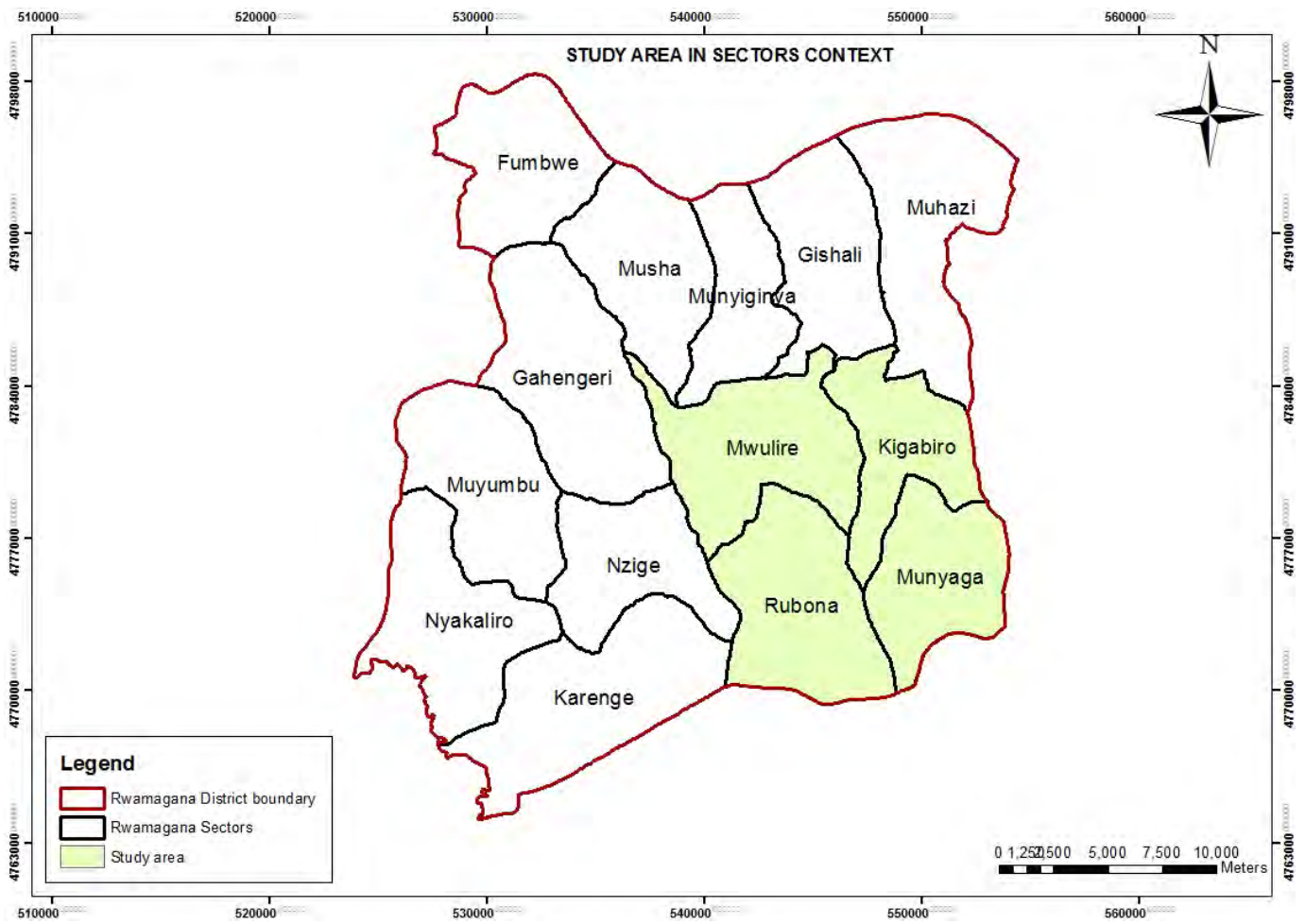


Figure 2: Project area in local context

2.2. Description of the project

The aim of describing the project in the resettlement action is to highlight project component that will lead to land acquisition but also to provide the project location so as to understand the land ownership in the area.

2.2.1. Brief description and components of the project

Brief description and component of the project are shown in the following table. However, it is notable that these contents shall be revised after site visiting and discussion among stakeholders.

Table 1: Key project information

Major Project Component	<p>3 existing irrigation sites: rehabilitation/improvement of dam, main irrigation canals, and related facilities, access roads, etc.</p> <p>1 new site: new development site is next to the aforementioned existing sites and similar irrigation facilities shall be installed newly. NB: Total distance of the irrigation canal expected is about 26.2km</p>
Targeted Sites:	Rwamagana district, Eastern Province, Republic of Rwanda
Responsible organization:	Ministry of Agriculture and Animal Resources (MINAGRI)
Implementation organization	Rwanda Agriculture Board (RAB)
Donor Agency:	Japan International Cooperation Agency (JICA)
Direct Beneficiary:	Farmers in irrigation area (1,345 HHs)

Indirect Beneficiary:	Consumers/buyers of the agricultural products
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Source: JST 2016

2.2.2. Project key activities

The project will consist at rehabilitation of three existing dams at Cyimpima, Gashara and Bugugu marshlands and construction of a new dam at Cyaruhogo marshlands. The project is also planning to rehabilitate the existing main canals, intakes and water intake controlling houses, and access roads. The table below presents key futures of the planned rehabilitation works.

Table 2: Key futures of the planned rehabilitation works

Conditions	Item	Unit	Cyimpima	Gashara	Bugugu	Cyaruhogo
Existing conditions	Catchment area	Km ²	15.3	26.5	11.0(existing) 13.9(new)	7.7
	Dam capacity when constructed	m ³	540,000	380,000	35,000	No dam
	Current dam capacity	m ³	500,000	200,000	30,000	None
	Irrigated area	Ha	55.1	66.2	16.0	6.6
Rehabilitation plan	Proposed works		Rehabilitation of dam (Raise of dam height)			Construction of a new dam
			Rehabilitation of spillway and intake facilities			New construction of spillway and intake facilities
			Lining the main canal			

Source: JST 2016

Table 3: Planned dam specifications

Dams	Catchment area (km ²)	Irrigation Storage volume (m ³)	Sedimentation volume (m ³)	Total storage volume (m ³)	Full water level (m)	Water depth at FWL (m)
Cyimpima	15.3	553,000	83,000	636,000	1,357.4	6.9
Cyaruhogo	7.7	271,000	76,000	347,000	1,353.7	8.2
Gashara	26.5	478,000	159,000	637,000	1,361.6	8.6
Bugugu	13.9	451,000	125,000	576,000	1,383.5	8.0

Source: JST 2016

2.2.3. Design of main canals

In addition to dam rehabilitation, the project will also rehabilitate existing main canals within the existing alignment. Main canal length for rehabilitation (lining) is shown in table below.

Table 4: Main canal length for rehabilitation

Dam	Rehabilitation length (km)
Cyimpima	8.6
Cyaruhogo	2.5
Gashara	6.5
Bugugu	8.6
Total	26.2

Source: JST 2016

Canal type

At present, the concrete flume is deemed as a canal type for rehabilitation and the rectangle shape was selected for the following reasons.

- Construction speed should be fast, construction cost economical and constructed canal durable.
- Considering the existing earthen main canal of large cross sections in many cases, the canal type should be self-supported wall one.
- And in other case, the main canal is to be constructed by excavating soft weak soils. In the case, the canal type should be self-supported wall one too.

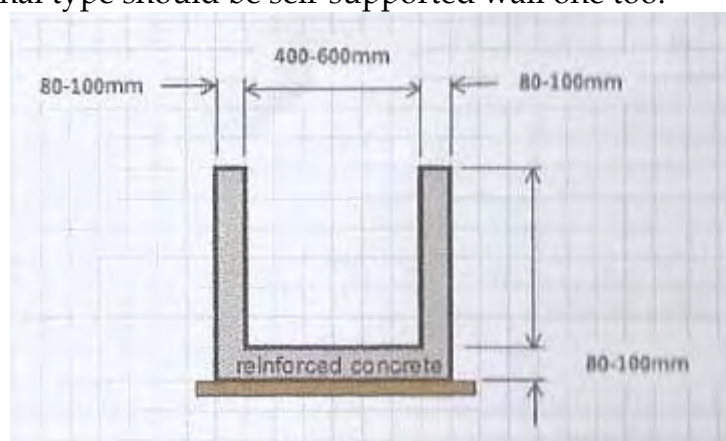


Figure 3: Design and size of main canal

Maintenance Road

Maintenance road will be constructed along the rehabilitated canal. Its width will be 2.0m. However, if the existing road is running along the rehabilitated canal, this maintenance road will not be planned.

Cover

Concrete covers will be placed on the rehabilitated canal for canal crossings. Its interval will be 100 m interval principle. Therefore, bridges will not be planned in principle.

Turnouts

At present, farmers or group representative (Bugugu only) operate water intake from the main canal by opening pipe or canal bank. On the other hand, the main canal will be lined after the project. Therefore, turnouts should be constructed considering:

- From the viewpoints of water management, secondary canal system is effective.
- However, practical activity regarding the construction of secondary canal in the future is the major factor which determines the turnout system under the project.

2.2.4. Project land requirement

The project will mainly consist at rehabilitation of existing infrastructure, dams, intakes and main canals and this reduce the size of land required by the project. However, some projects component will require additional land and hence lead to land acquisition whether permanent temporary. Structures that would lead to land acquisition include the construction of new dam

at Cyaruhogo, upgrade of existing dams at Cyimpima, Gashara and Bugugu, access roads, Borrow pits, deposit sites and camp sites.

The table below summarize project features that may have resettlement and land acquisition implications.

Table 5: Land requirement for different project features

Marshlands	Affected area	Nos of HHs		Land size (m2)	
		Private land	Government land	Private land	Government land
Cyimpima	a.Submerge	---	14	---	42,110
	b.Borrow pit	---	1	---	14,648
	c.Disposal	---	17	---	10,636
	d.Buffer	18	16	72,720	22,038
	Sub total I	18	48	72,720	89,432
	Sub total II*	56			
Bugugu	a.Submerge	4	19	36,389	35,900
	b.Borrow pit	3	---	48,898	---
	c.Disposal	4	---	22,860	---
	d.Buffer	3	2	23,074	9,852
	Sub total I	14	21	131,221	45,752
	Sub total II*	29			
Cyaruhogo	a.Submerge	8	113	52,029	74,524
	b.Borrow pit	8	---	30,329	---
	c.Disposal	17	---	21,123	---
	d.Buffer	11	1	17,440	5,628
	Sub total I	44	114	120,921	80,152
	Sub total II*	152			
Gashara	a.Submerge	12	35	12,616	86,929
	b.Borrow pit	4	---	32,628	---
	c.Disposal	---	---	---	---
	d.Buffer	14	6	38,642	9,064
	Sub total I	30	41	83,886	95,993
	Sub total II*	58			
Sub total I		106	224	408,748	311,329
Grand Total*		295		720,077	

Note: * Figures indicate actual number of PAHs because several farmers own/use both private and government lands which are to be affected by the Project.

Marshlands	Affected area	Nos of HHs		Land size (m2)	
		Private land	Government land	Private land	Government land
Cyimpima	e. Camp sites	---	2	---	3,492
	f. Roads	5	---	4,901	---
Bugugu	e. Camp sites	1	---	5,216	---
	f. Roads	2	---	2,295	---
Cyaruhogo	e. Camp sites	1	---	7,561	---
	f. Roads	8	---	4,432	---
Gashara	e. Camp sites	---	2	---	4,690
	f. Roads	---	---	---	---
Sub Total I		17	4	24,405	8,182
Sub Total II*		20		32,587	

Note: * One farmer has a land in both candidate camp site and road. Hence, total number of PAHs becomes twenty.

Source : JICA Sturdy team

The following figures show additional lands that will be flooded by rehabilitation of exiting dam and construction of new dam at Cyaruhogo.

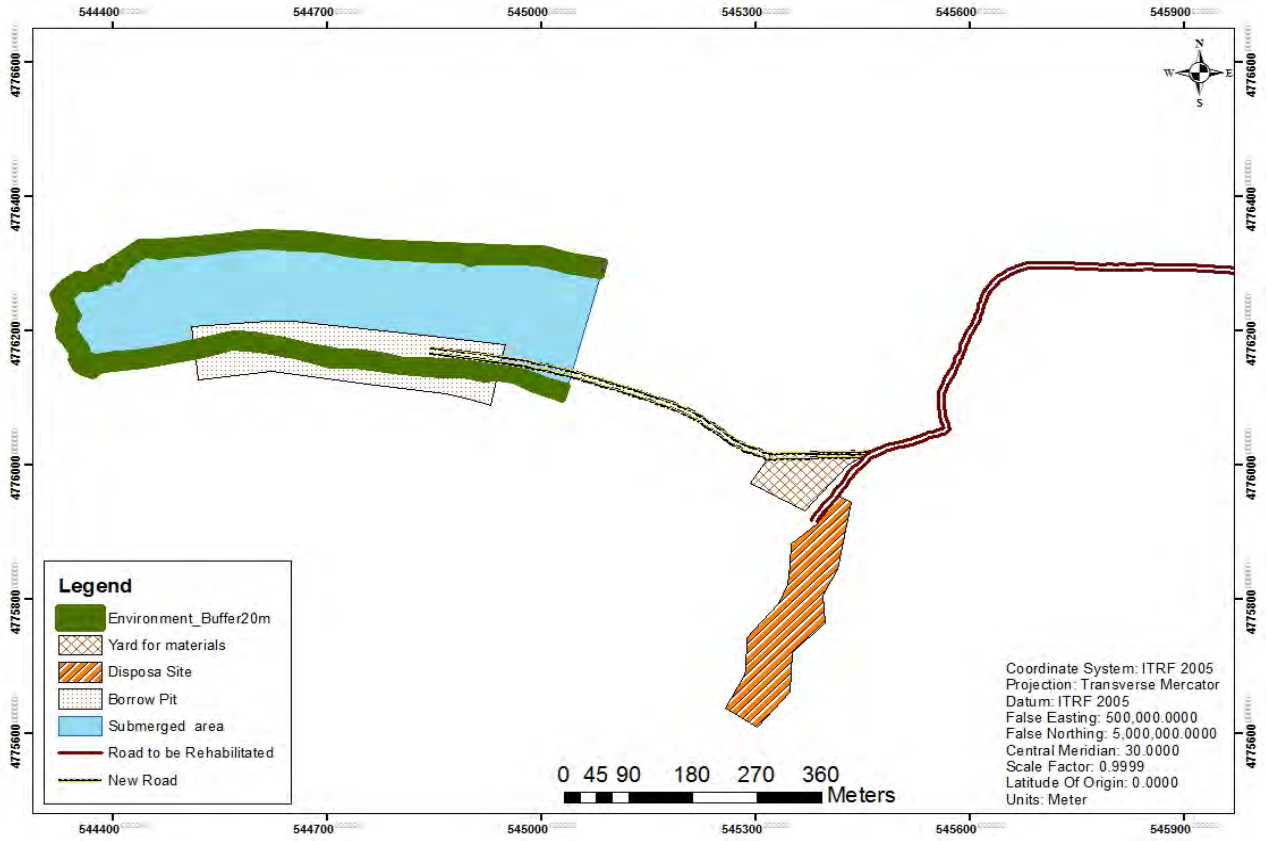


Figure 4: Land requirement in Cyaruhogo site

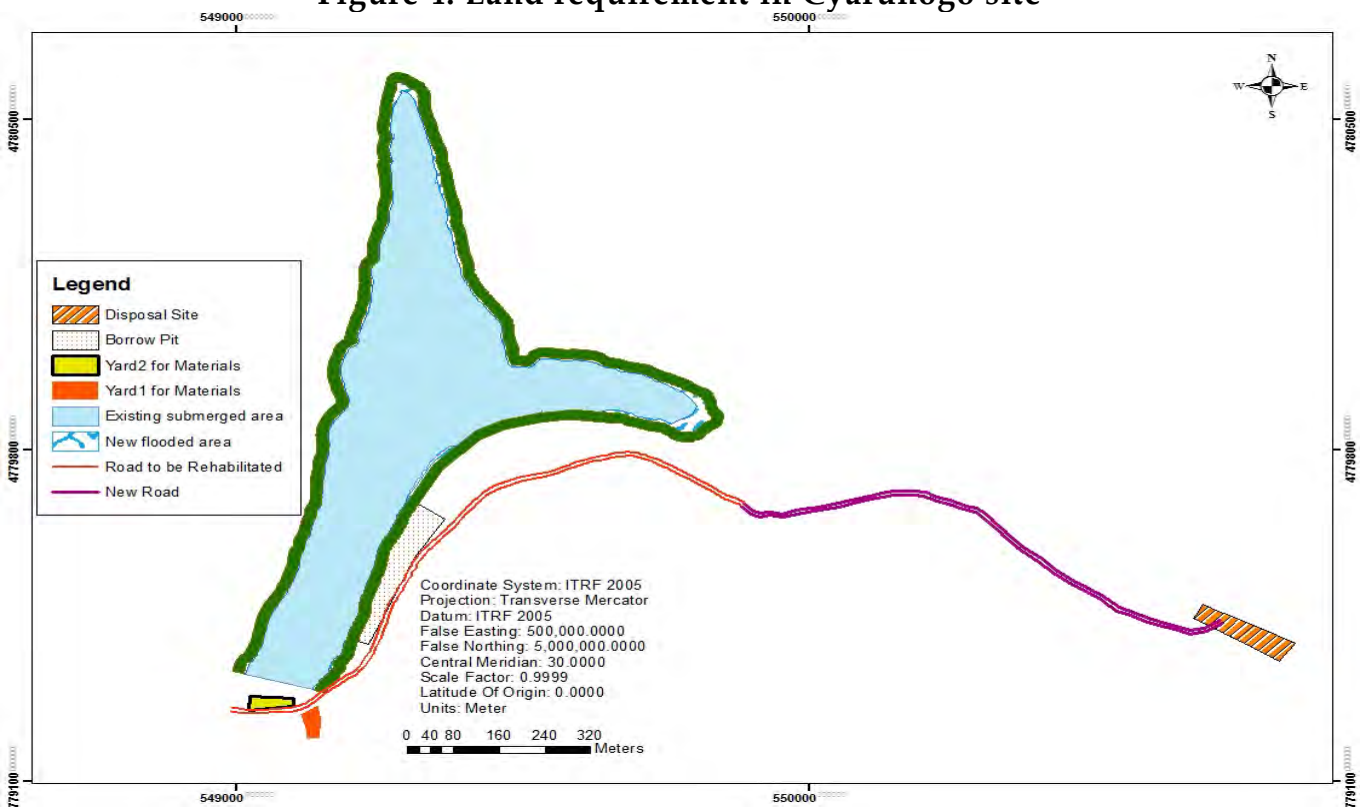


Figure 5: Land requirement in Cyimpima site

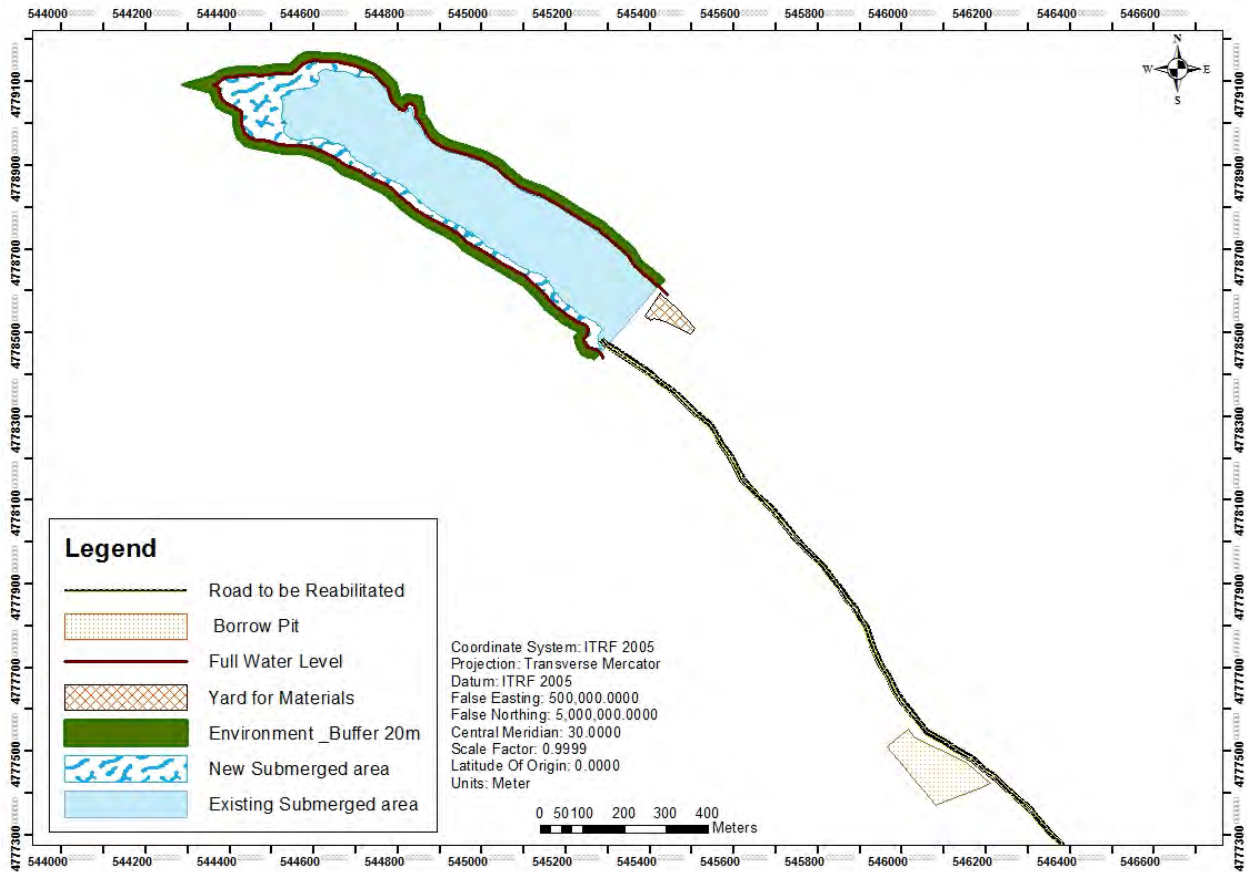


Figure 6: Land requirement in Gashara site

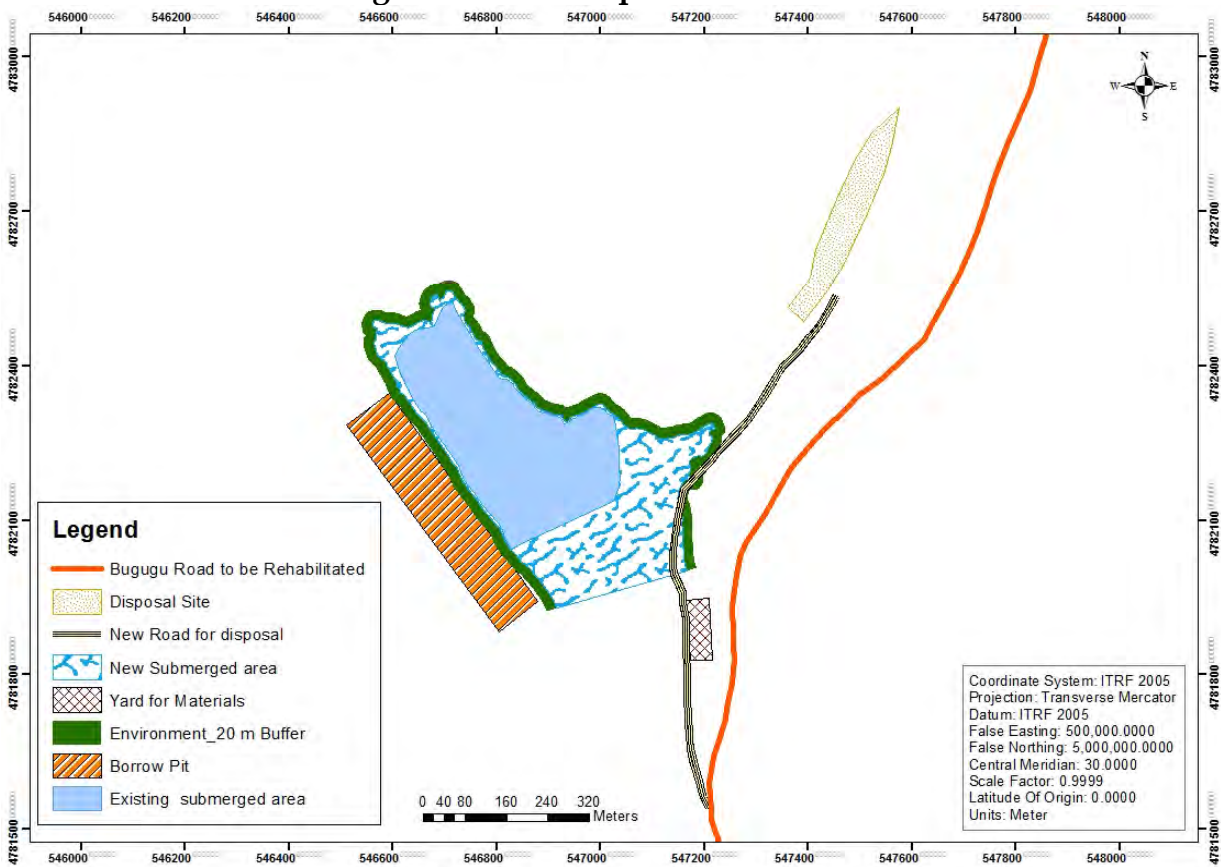


Figure 7: Land requirement in Bugugu site

CHAPTER THREE: LEGAL AND INSTITUTIONAL FRAMEWORK

3.1. Introduction

This chapter describes relevant policies, strategies, legal instruments, institutional arrangement and framework applicable the preparation and implementation of rehabilitation of irrigation facilities project in Rwamagana district. The legal and institutional framework evaluated the available laws, regulations, policies and institutions that guide the land acquisition and compensation, crop and assets compensation including mechanisms for conflict resolution and appeals. These legal frameworks provide applicable legal and administrative procedures including remedies available to displaced persons in the judicial process and the normal time frame for such procedures and available alternative dispute resolution mechanisms that may be relevant to the project.

Both national and international regulations related to land ownership; land acquisition and involuntary resettlement were reviewed and gap analysis made.

3.2. National regulations

This part describes national institutional, legal and policy framework for resettlement requirements in Rwanda, applicable to the project as well as the international provisions that bear relevance to the implementation of this project.

3.2.1. Land tenure system and provisions in Rwanda

The organic land law no 08/2005 of 14/7/2005 amended in 2013 categorizes land via two criteria: (1) land use and (2) land ownership. Land use (article 9) is split into two categories: urban lands and rural lands. Urban lands are defined as lands confined within the legal boundaries of towns and municipalities as well as lands in suburbs and collective settlements of towns and municipalities. Any other land is rural land.

Land ownership is divided into the following categories: individual owned lands and State lands (whether urban or rural). Article 11 provides that individual land is comprised of land acquired through custom, written law, acquisition from competent authorities, purchase, gift, exchange and sharing. State lands are further categorized into two sub-categories: public domains and private State owned lands (articles 12 and 13). State land for public domain comprises land reserved for public use, for use by organs of state services or for environmental protection. Private state owned land consists of all other state owned land not considered to be part of public domain.

- Land tenure legal provisions in Rwanda

The Organic Land Law also provides two types of formal land tenure: full ownership/ freehold and long term leasehold. So far, all land in the country has been registered and land titles issued to citizens. According to article 10 of new land law of June 2013, private individual land shall comprise land acquired through custom or written law. That land has been granted definitely by competent authorities or acquired by purchase, donation, inheritance, succession, ascending sharing, and exchange or through sharing. This law offers equal protection to rights over land resulting from all channels stipulated in the preceding paragraph. All types of land tenure must be in compliance with the designated land use and environmental protection measures as outlined in the Land Use Master Plan.

In addition, the present organic land law sets a legal framework for property law under articles 5 and 6 which provides for full ownership of land and permits any person that owns land (either through custom or otherwise), to be in conformity with the provisions of this law. It is important to observe however that full ownership of land is only granted upon acquisition of a land title issued by the general land registrar authority. Once the efforts to provide proper land tenure documentation are completed, ownership of land without proper documents such as land title will not be deemed lawful land ownership and thus in event of circumstances like expropriation, one will not be able to benefit from a fair and just compensation package.

3.2.2. Important resettlement legislations

The expropriation law no 18/2007 of 19/4/2007 revised in 2015 outlines rights and compensation procedures for land expropriated for public interest. The valuation law (2010) stipulates valuation methods to be applied to the expropriated assets. The following laws are important for rehabilitation and resettlement, land acquisition and compensation:

- The Rwandan constitution, promulgated in 2003 and amended in 2015;
- Organic land law n° 43/2013 of 16/06/2013 governing land in Rwanda gazette in the official gazette no special of 16/06/2013 was promulgated to determine the procedure for use and management of land in Rwanda property valuation law no 17/2010; establishing and organizing the real property valuation in Rwanda;
- Organic law n° 32/2015 of 11/06/2015 law relating to expropriation in the public interest ;
- Presidential order no 54/01 of 12/10/2006 determining the structures, the responsibility, the functioning and the composition of land commission;
- Ministry order no 001/2006 of 26/09/2006 determining the structures of land registration, the responsibilities and the functioning of the District Land Bureau (DLB) and;
- Ministerial order no 002/16.01 of 2010 on determining the reference land price outside Kigali city.

The above legal orders are briefly describe as follows:

- **The Rwanda constitution**

The constitution is the supreme law of the land. Under article 29 of the Rwanda constitution every citizen has a right to private property, whether personal or owned in association with others. Further it states private property, whether individually or collectively owned, is inviolable. However this right can be interfered with in case of public interest, in circumstances and procedures determined by law and subject to fair and prior compensation. Article 30 stipulates that private ownership of land and other rights related to land are granted by the State. The constitution provides that a law should be in place to specify modalities of acquisition, transfer and use of land (expropriation law). The constitution also provides for a healthy and satisfying environment. In the same breath every person has the duty to protect, safeguard and promote the environment.

- **Organic law N° 43/2013 of 16/06/2013 governing land in Rwanda**

The land law was initially adopted in 2005 and then revised in 2013 and was gazetted in the official gazette no special of 16/06/2013. It determines the use and management of land in

Rwanda: This is the law that determines the use and management of land in Rwanda. It also institutes the principles that are to be respected on land legal rights accepted on any land in the country as well as all other appendages whether natural or artificial. According to the law, land in Rwanda is categorized into two: individual land and public land. The latter is subdivided into two categories: the state land in public domain and the state land in private domain.

State land in public domain includes national land reserves for environment conservation; land over which administration building are erected, state roads, land containing lakes, rivers, stream and springs. State land in private domain include swamps that may be productive in terms of agriculture, vacant land with no owner, land purchased by the State, donation, land acquired through expropriation and land occupied by state owned forests.

Land in Rwanda is predominantly individual land and the law gives the owner of land full rights to exploit his or her land in accordance with the existing laws and regulations. The law also provides for expropriation which stipulates that land expropriation can be undertaken if it's for public interest. The law states that swamp land(marshland) belongs to the state and no person can use the reason that he or she has spent a long time with it to justify the definitive takeover of the land.

- **Organic law n° 32/2015 of 11/06/2015 law relating to expropriation in the public interest**

This law determines the procedures relating to expropriation of land in the interest of the public. The law stipulates that the government has the authority to carry out expropriation. However the project, at any level, which intends to carry out acts of expropriation in public interest, shall provide funds for inventory of assets of the person to be expropriated. According to the organic law, no person shall hinder the implementation of the program of expropriation on pretext of self-centered justifications and no land owner shall oppose any underground or surface activity carried out on his or her land with an aim of public interest. In case it causes any loss to him or her, he or she shall receive just compensation for it.

Eligibility for compensation is enshrined under the Rwandan constitution (article 29) and the expropriation law. The two laws regulate and give entitlement to those affected, whether or not they have written customary or formal tenure rights. The person to be expropriated is defined under article 2(7) of the expropriation law to mean any person or legal entity who is to have his or her private property transferred due to public interest, in which case they shall be legally entitled to payment of compensation.

Compensation entitlement: In case an individual suffers any loss, Article 3 of the expropriation law stipulates that he or she should receive just compensation for it, although it is not clear what comprises fair and just compensation, this being left to the judgment of independent valuers. Article 4 of this law also stipulates that any project which results in the need for expropriation for public interest shall provide for all just compensation in its budget. Through mutual arrangement, both parties can determine the mode of payment. Article 22 (2) of the expropriation law provides that through an agreement between the person to expropriate and the one to be expropriated, just compensation may either be monetary, alternative land or a building equivalent as long as either option equates to fair and just

monetary compensation. In case the determination of 'just' compensation exceeds in value the alternative land given to the expropriated person, the difference will be paid to the expropriated person.

Furthermore, the law deals with valuation of land earmarked for expropriation. The law identifies properties to be valued for just compensation to be land and activities that were carried out on the land including different crops, forests, buildings or any other activity aimed at efficient use of land or its productivity. Here the law is silent on access to economic activities on the land. The new law has added 5% of total compensation fees for disturbance allowances.

- **Law n°.17/2010 of 2010 establishing and organizing the real property valuation profession in Rwanda**

This law provides for the registration of land in Rwanda and conditions for registration. The law also allows the government to conduct valuation when mandated by their government institutions. Articles 27, 29, 30 and 31 of the law deal with valuation methods. These articles stipulate that price for the real property shall be close or equal to the market value. The valuation could also compare land values country wide. Where sufficient comparable prices are not available to determine the value of improved land, the replacement cost approach shall be used to determine the value of improvements to land by taking real property as a reference. The law also allows the use of international methods not covered in the law after approval from the institute of valuers council.

- **Ministerial order no. 001/2006 of 2006 determining the structure of land registers**

The ministerial order determines the structure of lands registers, the responsibilities and functioning of the District Land Bureau (DLB). This ministerial order determines the structure of land registers, the responsibilities and the functioning of DLB. The responsibilities of the land bureau include among others to implement land registration and manage land and update, safely keep records of land registers and monitor and approve activities pertaining to valuation of land, other immovable property and demarcate and approve land cadastral. This order does not apply to land specified in articles 12, 14, 15 and 72 of the organic law n° 8/2005 of 14/07/2005 determining the use and management of land in Rwanda.

- **Ministerial order n° 002/16.01 of 2010 on determining the reference land price outside Kigali city.**

Purpose of this order is to provide reference land prices to be used in areas outside Kigali city. This order was aimed at protecting land owners from exploitation and to prevent land speculation when the market is not developed. However with the propagation of land valuation law, the order seems to have been overtaken by events and practicability. This is due to the fact that valuation law provides for independent market rates to apply in land valuation.

3.2.3. Institutional arrangement for RAP preparation and implementation

In Rwanda, there is no single institution governing resettlement activities and social impact are assessed and managed through EIA. The institutional framework for environmental and social management is currently enshrined in the organic law determining the modalities of protection, conservation and promotion of the environment in Rwanda, published in the Official gazette n°

9 of the 1st May 2005, particularly in its chapter III relating to the establishment of the institutions, the 2013 land law and 2015 expropriation law. The responsibility of preparation and implementation is shared by different institution based on the nature of the project and the project proponent.

For the Project of rehabilitation of irrigation infrastructure in Rwamagana, the main actors responsible for development of policy, framing regulations, developing projects, monitoring and approval of issues related to resettlement and compensation are:

- Ministry of Natural Resources (MINIRENA);
- Ministry of Agriculture and Animal Resources (MINAGRI);
- Rwanda Agriculture Board (RAB);
- Rwanda Natural Resources Authority (RNRA);
- Rwanda Environment Management Authority (REMA);
- Rwanda Development Board(RDB);
- Local administration including Rwamagana district;
- Sectors and Sells in the project areas.

- **Ministry of Agriculture and Animal Resources (MINAGRI)and Rwanda Agriculture Board (RAB)**

Ministry of Agriculture and Animal Resources (MINAGRI) is the main agency involved in preparation and implementation of this RAP. While JICA will finance the construction of irrigation infrastructure, the MINAGRI will finance resettlement activities. It will act as the central agency responsible for holding all information relevant to the RAP.

The implementation of RAP shall be assigned to RAB which is the implementing authority for agriculture projects. The role of RAB will be to implement the RAP, coordination of monitoring activities, maintenance of monitoring information, building the capacity of other stakeholders in collection and analysis of monitoring data. The social safeguard officer of Project to be recruited by RAB or the person to be assigned this responsibility within RAB staffs will be the focal point and he/she will liaise with other stakeholders to implement the RAP.

- **Ministry of Natural Resources (MINIRENA)**

MINIRENA governs the implementation and application of the organic land law and the Land Use Master Plan. While the MINIRENA deals with overall land policy and the alignment with these Laws at the national level, responsibilities for their implementation locally has been devolved, following decentralization, to land commissions and committees at district, sector and cell levels. MINIRENA is also the key ministry governing resettlement arrangements in Rwanda through the Land Bureaus. They do this by working directly with the ministry/institution developing the land on which resettlement is required. MINIRENA will therefore play a critical role in ensuring that appropriate and consistent compensation is provided to all affected persons resulting from the implementation of the project.

- **Rwanda Environment Management Authority (REMA)**

REMA was established in 2004 to act as the implementation organ of environment-related policies and laws in Rwanda. REMA is also tasked to coordinate different environmental and social protection activities undertaken by environmental promotion agencies; to promote the

integration of environmental issues in development policies, projects, plans and programmes; to coordinate implementation of government policies and decisions taken by the board of directors and ensure the integration of environmental issues in national planning among concerned departments and institutions within the government; to advise the government with regard to the legislation and other measures relating to environmental management or implementation of conventions, treaties and international agreements relevant to the field of environment and social issues as and when necessary; to make proposals to the government in the field of environmental policies and strategies; etc.

- **Rwanda Development Board (RDB)**

RDB was created by organic law n° 53/2008 of 02/09/2008. It has a mission of improving the well-being of all Rwandans by fast-tracking development, catalysing sustainable economic growth, and creating prosperity for all. The responsibility for follow-up of environmental and social impact assessment studies is now under RDB, the department in charge of investment. By reviewing the EIA report RDB ensures that involuntary resettlement impact are adequately addressed. It worth to note that the environmental organic law places the responsibility of EIA review under Rwanda Environmental Management Authority but this responsibility was transferred to RDB to facilitate sustainable investment in the country.

- **Rwanda Natural Resources Authority (RNRA)**

RNRA through its department of land administration and mapping is the organ responsible for overall management and coordination of all activities related to land administration, land use planning and management in Rwanda. The role of RNRA in RAP process is to advise on matters related to land ownership and expropriation. District land bureau in close collaboration with project staff will check and approve surveys, various maps and approve land surveys carried out during valuation exercise.

- **Rwamagana district and local administration**

The article 66 of the environmental organic law specifies to establish, at the provincial, district, town, sector and the cell levels; committees responsible for conservation and protection of the environment. The organization, functioning and their responsibilities are determined by prime minister's order. The executive committee of the district is responsible to initiate the expropriation and district council implements the expropriation after considering the decision of the land commission (expropriation law, 2015).

Rwamagana district manages lands through the district land bureau. Thus, the district land bureau will be responsible for ensuring activities undertaken comply with the national and district level land use master plans and will assess the validity of land tenure rights of affected persons. In addition the officer, will be responsible for ensuring effective grievance redress mechanism is in order to reduce disputed or complaints.

- **The Institute of Real Property Valuers(IRPV)**

The responsibilities of IRPV are to:

- to analyse and find solutions to all problems related to the real property valuation profession;

- to analyse and find solutions to all problems related to the conduct of real property valuers;
- to exchange information relating to the real property valuation profession;
- to promote the real property valuation profession in Rwanda;
- to prepare regulations and guidelines governing the real property valuation profession,
- to prepare real property valuation standards; and
- to represent the interests of, and advocate for real property valuers in Rwanda and abroad.

In relation to the proposed project, upon the completion of detailed design studies, RAB will hire an independent valuar certified by IRPV to conduct final valuation.

3.2.4. RAP preparation and approval process in Rwanda

In Rwanda involuntary resettlement is governed by expropriation law and valuation law. Both laws do not have provisions on RAP preparation and approval. Instead, the expropriation defines the process of expropriation and valuation while the resettlement impacts are assessed together with the EIA report. The chapter III of the law n° 32/2015 of 11/06/2015 relating to expropriation in the public interest expropriation law defines steps to be undertaken for expropriation as follows:

- **Organs determining projects of expropriation in the public interest**

Organs which determine projects of expropriation in the public interest are the following:

- 1) the executive committee at the district level, in case such activities concern one district;
- 2) the executive committee at the level of the City of Kigali, in case such activities concern more than one district in the boundaries of the City ;
- 3) the relevant ministry, in case planned activities concern more than one district or if it is an activity at the national level, subject to provisions of item 2° of this Article.

- **Organs supervising projects of expropriation in the public interest**

Organs in charge of supervising projects of expropriation in the public interest are hereby established as follows:

- 1) the committee in charge of supervision of projects of expropriation in the public interest at the district level where the project concerns one district;
- 2) the committee in charge of supervision of projects of expropriation in the public interest at the City of Kigali level where the project concerns more than one district within the boundaries of the City ;
- 3) the committee in charge of supervision of projects of expropriation due to public interest at the national level where the project concerns more than one district or it is a project at the national level, subject to the provisions of item 2° of this article.

- **Organs approving expropriation in the public interest**

The organs approving expropriation in the public interest are the following:

- at the district level, it is the district council after considering the recommendation of the committee in charge of supervision of projects of expropriation in the public;
- at the level of the City of Kigali, where the project concerns more than one district within the boundaries of the City of Kigali, it is the council of the City of Kigali after considering the recommendation of the committee in charge of supervision of projects of expropriation in the public interest at the level of the City of Kigali;

- at the level of more than one district, the ministry in charge of land, upon proposal by the committee in charge of supervision of projects of expropriation in the public interest at national level subject to provisions of item 2 of this Article. A ministerial order shall be used;
- at the national level and in case of activities related to security and national sovereignty, the Prime Minister's Office upon proposal by the committee in charge of supervision of projects of expropriation in the public interest at the national level by way of a Prime Minister's order.

- **Procedure for expropriation in the public interest**

Procedures for expropriation are as follows:

- Request for expropriation in the public interest by project proponent/ developer;
- Consideration of the relevance of the project proposal for expropriation in the public interest by relevant committee.
- Decision on the relevance of a project of expropriation in the public interest;
- Approval of expropriation in the public interest;
- Publication of the decision on a project for expropriation in the public interest;
- Valuation of assets and agreement on compensation measures;
- Compensation.

- **RAP process for donor funded projects**

For donor funded projects, where the RAP preparation and approval is a requirement, the donor policies applies and the RAP is prepared in compliance with both international and national laws. The normal practice is as follows:

- Preparation and approval of terms of reference by both donor and implementing agency;
- Recruitment of independent consultant to prepare the RAP;
- RAP preparation by independent consultant;
- Approval of the RAP report by both donor and implementing agency;
- Implementation and monitoring of RAP by implementing agency.

3.3. International regulations

3.3.1. JICA Guidelines for Environmental and Social Considerations

The project of rehabilitation of irrigation facilities in Rwamagana district will be funded by Japan Government through Japan International Cooperation Agency (JICA) and it is very important to consider the JICA guidelines for environmental and social consideration in preparation and implementation of the RAP. The key principle of JICA's policy on involuntary resettlement is summarized below:

- Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
- When population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
- People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.

- Compensation must be based on the full replacement cost as much as possible.
- Compensation and other kinds of assistance must be provided prior to displacement.
- For projects that entail large-scale involuntary resettlement, RAPs must be prepared and made available to the public. It is desirable that the RAP include elements laid out in the WB, OP 4.12 Annex A.

During the preparation of RAP, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner and language that are understandable to the affected people. Appropriate participation of affected people must be promoted in planning, implementation and monitoring of RAPs. Furthermore, appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principle is complemented by the WB OP 4.12 (Annex Q), since it is stated in JICA Guidelines that “JICA confirms that projects do not deviate significantly from the WB’s Safeguard Policies”.

3.3.2. World Bank O.P. 4.12 on involuntary resettlement policy

The WB involuntary resettlement related policies are also critical in preparation and implementation of this RAP. The main objectives of the WB O.P. 4.12 include: avoiding or minimizing involuntary resettlement where feasible, exploring all viable alternative project design; where it is not feasible to avoid resettlement. Resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to give the persons displaced by the project the opportunity to share in project benefits.

Displaced persons should be meaningfully consulted and have opportunities to participate in planning and implementing resettlement programs. Those displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to beginning of project implementation, whichever is higher. Specifically, the production systems of a community are safeguarded to the extent that guarantees their livelihoods and that their skills base remain relevant regardless of the resettlement site. The policy objectives are also designed to minimize kinship group dislocation that might subject the affected persons to unfair competition when mutual help is diminished or lost.

The project consultant met the objective of the WB OP 4.12, by conducting public participation in the project area; evaluating project alternatives to enable minimize involuntary resettlement and developed an entitlement matrix to guide in calculation of resettlement and replacement costs.

Table 6: Gap between Rwandan laws and JICA guidelines for environmental and social considerations

JICA Guidelines	Rwandan regulation	Gaps	Measures to be taken
<ul style="list-style-type: none"> After the disclosure of the scoping drafts, project proponents etc. conduct consultations with local stakeholders*. JICA incorporates the results of such consultations into its TOR. The consultations cover the needs of projects and the analysis of alternatives. (JICA GL) 	<ul style="list-style-type: none"> Nothing mentioned 	<ul style="list-style-type: none"> There is description about consultation with stakeholders including project alternatives; however, the agenda does not cover scoping. 	JICA guidelines shall apply
<ul style="list-style-type: none"> Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL) 	<ul style="list-style-type: none"> Resettlement is acceptable for public interest. Affected persons are fully informed of expropriation issues. The law prohibit any opposition to the expropriation. 	<ul style="list-style-type: none"> Loss of means of livelihoods is not captured in the expropriation law 	JICA guidelines shall apply
<ul style="list-style-type: none"> When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL) 	<ul style="list-style-type: none"> Affected person receive fair and just compensation. However a ministerial order gives the value of land and crops. 	<ul style="list-style-type: none"> In Rwanda loss of income and compensation of illegal occupants in not provided 	JICA guidelines shall apply
<ul style="list-style-type: none"> Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL) 	<ul style="list-style-type: none"> Rwanda expropriation law stipulates a timeframe upon when the property to be expropriated must be handed over which is 90 days after compensation has been paid. 	<ul style="list-style-type: none"> JICA GL does not specify the period of payment and assistance while the Rwandan law specify payment must be done 90 days prior displacement. 	Payment should be done prior displacement.
<ul style="list-style-type: none"> The socio-economic studies should be implemented in the early stages of project preparation and with the involvement of potentially displaced people (WB OP4.12, Para 6) 	<ul style="list-style-type: none"> Census survey and asset survey shall be implemented; however, they are done after official approval of any projects. The procedures to be respected in expropriation shall not exceed a period of four (4) months from the day organs mentioned in article 10 of this law approve it. (Law N°32/2015 of 11/06/2015 Expropriation in the public interest, Art.16) 	<ul style="list-style-type: none"> JICA request the census survey for project approval while it's done after project approval in case of Rwandan, 	Provisional survey shall be done at this stage, and to be updated by final valuation stage.
<ul style="list-style-type: none"> For projects that entail large-scale involuntary resettlement, RAP must be prepared and made available to the public. (JICA GL) 	<ul style="list-style-type: none"> An application for expropriation should be prepared and submitted to the competent authority for approval the law gives the content of an application. Art 11 	<ul style="list-style-type: none"> Donor like WB supports preparation of RAP for its project. 	<ul style="list-style-type: none"> JICA has funded the preparation of RAP
<ul style="list-style-type: none"> Affected people are to be identified and 	<ul style="list-style-type: none"> A person to be expropriated shall be 	<ul style="list-style-type: none"> In other projects in Rwanda 	<ul style="list-style-type: none"> The provisional cut-

JICA Guidelines	Rwandan regulation	Gaps	Measures to be taken
<p>recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)</p>	<p>informed of the beginning of the process of the land survey and the inventory of the properties thereon. The owner of the land is not allowed to carry out any activities after the land survey and the inventory of the properties thereon and coming to terms with the beneficiaries. In case he or she carries out any activities, they shall not be valued in the process of expropriation. Art 17, expropriation law.</p>	<p>supported by WB, they set cut-off date on the census survey implementation after official approval of project implementation, not during F/S or basic design stage.</p>	<p>off date was established as the date of baseline survey. This may be reviewed upon the completion of detailed design study.</p>
<ul style="list-style-type: none"> ▪ Those who do not have formal legal rights to land at the time the census begins but have a claim to such land or assets--provided that such claims are recognized under the laws of the country or become recognized through a process identified in the resettlement plan are eligible for benefit (WB OP4.12, Para 15) 	<ul style="list-style-type: none"> ▪ Article 18 of the law requires the person who owns land intended for expropriation to provide evidence of ownership or rights on that land and presents a certificate to case. ▪ The person who owns land intended for public interest shall provide evidence to confirm that he or she possesses rights on that land and among the evidence to confirm ownership of the land, there shall be included: <ul style="list-style-type: none"> ▪ written evidence indicating that he or she purchased the land, received it as a donation or as a legacy or a successor; ▪ a document or a statement of local administrative entities indicating rights of the expropriated person on the land; ▪ a document or testimony of the neighbours; confirming the ownership of the land; ▪ a Court certificate(art 18 expropriation law).. 	<ul style="list-style-type: none"> ▪ There are some cases whereby Government provided in kinds supports, but, they were not full compensation. ▪ The WB OP 4.12 also provide eligibility of benefits including the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law) the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal rights to the land they are occupying. 	<ul style="list-style-type: none"> ▪ JICA guidelines were applied and income for illegal occupants was considered
<ul style="list-style-type: none"> ▪ Compensation based on the full replacement cost must be provided as much as possible (JICA Guideline). 	<ul style="list-style-type: none"> ▪ The land prices stipulated by "N°002/16.01 of 26/04/2010 Ministerial Order determining the reference land price outside the Kigali City" when the government expropriates land. This land unit prices are set considering market prices. 	<p>Market value vs replacements cost</p>	<p>Market value plus 5% of disturbance allowances were used.</p>

JICA Guidelines	Rwandan regulation	Gaps	Measures to be taken
	<ul style="list-style-type: none"> ▪ The compensation for disruption caused by expropriation to be paid to the expropriated person shall be equivalent to five percent (5%) of the total value of his/her property expropriated. ▪ (Law N°32/2015 of 11/06/2015 Expropriation in the public interest, Art.28) 		
<p>JG requires displaced persons to be consulted on, offered choices among, and provided with technically and economically feasible resettlement alternatives</p>	<ul style="list-style-type: none"> ▪ Through agreement between the person to expropriate and the one to be expropriated, the just compensation may be monetary or an alternative land and a building equivalent to the determination of just monetary compensation (art.23 expropriation law). 		<p>JG were used for consultations</p>
<ul style="list-style-type: none"> ▪ Provide support for the transition period (between displacement and livelihood restoration). 	<ul style="list-style-type: none"> ▪ No mention 		<p>Four seasons were considered for income loss.</p>
<ul style="list-style-type: none"> ▪ Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities, etc. 	<ul style="list-style-type: none"> ▪ No mention 	<ul style="list-style-type: none"> ▪ There some cases that LWH project gives high priority to hire such vulnerable people as project labours. 	<p>Vulnerable people should be given priority in recruitment of labour.</p>
<ul style="list-style-type: none"> ▪ In preparing a RAP, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA Guideline) ▪ Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of RAPs and measures to prevent the loss of their means of livelihood (JICA Guidelines) 	<ul style="list-style-type: none"> ▪ Public consultation is needed to be organized and the result must be included in EIA report. ▪ The Rwandan organic law on expropriation simply stipulates that affected peoples be fully informed of expropriation issues. The law prohibits any opposition to the expropriation 	<ul style="list-style-type: none"> ▪ 	<p>Public consultation was held with all project affected Person and the final assets valuation results will be displayed to People and approved by both valuer, affected person and Local Authorities</p>

CHAPTER FOUR: SOCIO- ECONOMIC PROFILE OF PROJECT AREA

This Chapter describes the current situation of the population in the project area. The first section, presents the socio-economic profile of Rwamagana population in general and the second section presents the socio-economic profile of project affected people or project beneficiaries. This section provides baseline data that will be used to evaluate project impact and livelihoods restoration during and after project implementation. At district level, data were obtained through secondary data available at district, the third and fourth integrated living condition survey (EICV 3 and EICV4) and the 4th Rwanda Population and Housing Census (PHC4). At project level, data were collected through field survey using a detailed questionnaire on a selected sample. In addition to that, the identification of all project affected persons was conducted by the surveying team.

4.1. Rwamagana district socio-economic profile

For a better understanding of socio-economic setup of the project area, it's critical to assess the socio-economic profile of the district. Therefore, this section describes demography of Rwamagana population including size and spatial distribution of the population, socio-cultural characteristics of the population, and educational characteristics of the population, economic activity characteristics of the population, household characteristics, housing characteristics, and access to socio-economic infrastructures.

4.1.1. Population size, spatial distribution, and structure

According to the PHC4, Rwamagana is the least populated district in Eastern province with about 313 thousand inhabitants, representing 12% of the total resident population of the province. Two districts which have high population density (Inhabitants/km²) are Rwamagana (460 inhabitants/km²) and Ngoma (388 inhabitants/ km²).

Furthermore, PHC4 have enumerated 313,461 residents in Rwamagana, which represents 24.7% of the total population of the Eastern province (259,5703 residents). The population of Rwamagana is predominantly female; 159,854 are women corresponding to 51% of the total population. Females are predominant in almost all sectors of the district except in Muhazi (44.3%). Kigabiro is the mostly populated sector with over 30 thousands residents. They represent 10.4% of the total population of the district. The least populated sector is Nzige (15,504 inhabitants). This represents 4.9% of the total resident population of Rwamagana.

On spatial distribution, Rwamagana population is predominantly rural whereby 91.4% of the resident population (313,461 inhabitants) lives in rural areas and only 8.6% lives in urban areas. Kigabiro is the most urbanized sector of Rwamagana with 55% of its population residing in urban areas. It is followed by Karengye (22.2%) and Gishari (7.7%). The table below presents the distribution of the resident population of the district by sector, sex and density.

Table 7: Distribution of population in Rwamagana district by sector, sex and density

Sectors	Both sexes	Male	Female	% of female	Population share (% of the total population)	Density (inhabitants/km ²)
Rwanda	10,515,973	5,064,868	5,451,105	51.8		415
Eastern Province	2595703	1258090	1337613	51.5		274

Rwamagana district	313,461	153,607	159,854	51	100	460
Fumbwe	21,682	10,467	11,215	51.7	6.9	493
Gahengeri	23,517	11,459	12,058	51.3	7.5	373
Gishali	23,033	11,088	11,945	51.9	7.3	511
Karenge	22,755	11,065	11,690	51.4	7.3	359
Kigabiro	32,730	16,206	16,524	50.5	10.4	867
Muhazi	29,505	16,444	13,061	44.3	9.4	512
Munyaga	16,207	7,479	8,728	53.9	5.2	390
Munyiginya	16,980	7,991	8,989	52.9	5.4	531
Musha	21,145	10,122	11,023	52.1	6.7	472
Muyumbu	24,242	11,978	12,264	50.6	7.7	482
Mwulire	21,829	10,451	11,378	52.1	7	394
Nyakaliro	20,196	9,916	10,280	50.9	6.4	404
Nzige	15,504	7,441	8,063	52	4.9	387
Rubona	24,136	11,500	12,636	52.4	7.7	434

Source: PHC 4, 2012 (NISR)

Furthermore, the population of Rwamagana is mostly young. 65% of the resident population of Rwamagana is under 25 years old, as shown by the age pyramid, reflecting the high level of fertility in the recent past. The elderly (60 years and above) represents 5% of the total population of the district.

4.1.2. Socio-cultural characteristics of the population

Rwamagana hosts few foreigners and only 353 residents are foreigners (out of 313,461 residents). Christianity is the predominant religion in Rwamagana district 91.4% of the total resident population. Protestants represent 39.5%, Catholics are 40.2%, Adventists are 10.9% and Jehovah witnesses are 1.0. Muslims represent 3.1% of the total resident population of the district, 1.5% of the resident population declared to be without religion.

In regard to marital status, the percentage of married and the never married people were the same in Rwamagana district (45.2%) at the time of census. Also, the percentage of widowed was the same as the percentage of separated persons (0.7%). 7.0% were widowed, while separated and divorced are (7.0 %). At the sector level, two sectors with high percentages of currently married people are Nyakaliro (48.7%) and Fumbwe (47.7%). Kigabiro sector has the highest percentage of the never married persons (51.2%) while Gishari has the highest percentage of widowed persons (8.5%).

4.1.3. Educational characteristics of the population

School attendance among Rwamagana residents varies across education levels. It is very low (26%) for preschool-age population (3-6 years), high (95.5%) for primary school-age population (7-12 years), and low (68.7%) for secondary school- age population (13-18 years). School attendance varies also across sectors where by preschool-age varies from 26% in Fumbwe to 44.6% in Muhazi, primary school-age varies from 90% in Gahengeri to 95.5% in Nyakaliro and secondary school; it varies from 68.7% in Fumbwe to 80.9% in Muhazi.

The net and gross attendance rates in secondary education are below 50% in Rwamagana district. This means that more than a half of children who are supposed to be attending

secondary school are not actually attending both gross and net attendance rates in secondary are greater for males than for females. There are also variations by sector where net attendance rate is 30.9% in Kigabiro sector while it is 16% in Munyiginya sector.

4.1.4. Labour force in Rwamagana population

The official working age in Rwanda is 16 and above. In Rwamagana, 74.7% of the residents aged 16 and above are in the labour market- either working or looking for a job (economically active). Labour force participation is more intense among males (77.6%) than among females (72.2%); in rural areas (74.1%) than in urban areas (69.4%). The labour force participation varies greatly in Eastern province: from 70.5% in Bugesera to 81.0% in Ngoma.

Labour force participation is around 40% at age of 16 (official entry age into labour market) and around 70% at age of 65 (official age for retirement). Labour force participation is intense among residents aged 25- 60 with more than 60% of the population in the labour market. The census identified some gender disparity is remarkable as males' contribution to labour force is greater than females one at all age groups.

In Rwamagana district, 3.0% of the total population into labour market was unemployed during the week preceding the census. Unemployment rate was high for females than for males (3.6% Vs 2.3%). In Rwamagana district, unemployment rate (UR) was higher in urban areas (4.7%) than in rural areas (2.8%). The figure below presents the labour force rate in Rwamagana by age and sex.

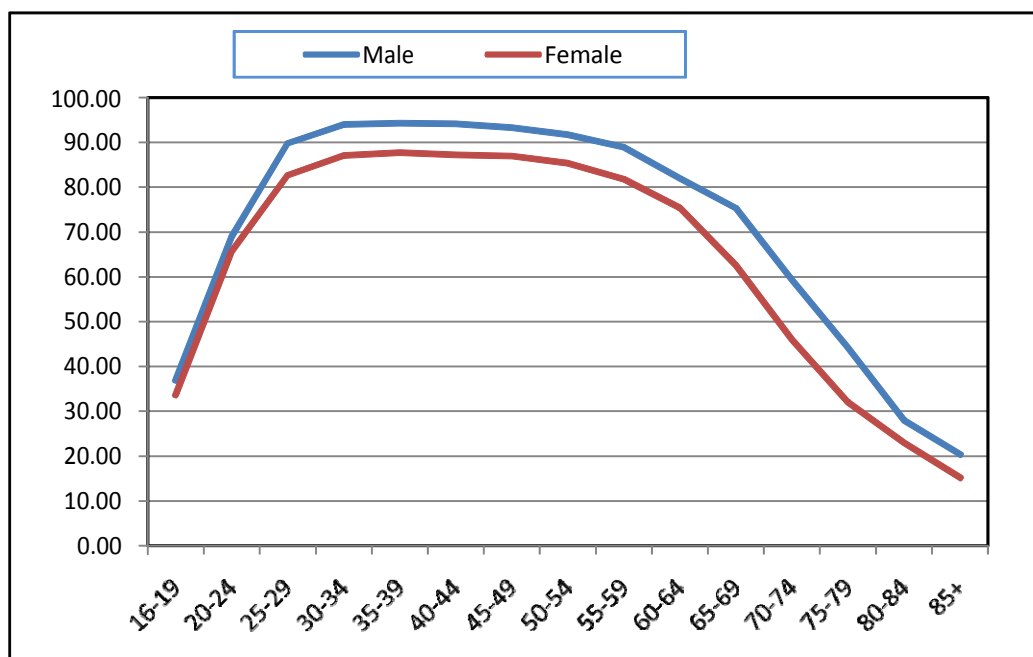


Figure 8: Labour-force participation rate in Rwamagana by age group and sex

4.1.5. Households characteristics

The average household size in Rwamagana district is 4.1 persons. Household size varies from 3.9 persons in Kigabiro to 4.4 persons in Fumbwe. While at the national level, 28.7% of private households are headed by women, the high percentages of households headed by women are found in the sectors of Munyaga (36.7%), Muhazi (36.6%) and Munyiginya (35%), while small ones are in Karende (24%), Nyakaliro (24.6%).

4.1.6. Standard of living of Rwamagana population

The poverty line defines a level of household consumption per adult below which a household is deemed to be poor. Rwanda uses a basic need approach to measuring poverty. In this report, households are classified as poor or non-poor based on annual consumption per adult equivalent compared with a total poverty line of 159,375 Frw or an extreme poverty line of 105,064 Frw annually, in January 2014 prices.

The poverty line used here is set with reference to a minimum food consumption basket, which was judged to offer the required number of calories required for a Rwandan who was likely to be involved in physically demanding work, along with an allowance for non-food consumption. An extreme poverty line was also set as the cost of buying the food consumption basket if nothing was spent on non-food at all; this line corresponds to Frw 83,000 and the poverty line corresponds to Frw 118,000 annually.

Poverty in Rwanda in 2013/14 is lowest in the three districts of Kigali City. Its incidence is notably low in Kamonyi, Rwamagana and Kayonza. The greatest concentrations of poverty in Rwanda are in the South and the West, including districts of Gicumbi and Burera from Northern Province. The regional variations of extreme poverty follow similar patterns. According to EICV4, 70% of the population in Rwamagana district is identified as non-poor, 25% as poor (excluding extreme-poor) and 5% as extreme-poor.

4.1.7. Vulnerable groups

Groups that are considered particularly vulnerable by the Government of Rwanda are children under five years old, elderly people aged 65 and over, and people with disabilities. The government delivers a core set of social protection programmes through the Ministry of Local Government (MINALOC), supported by a number of complementary initiatives delivered by other ministries. The main programme run by MINALOC, and a flagship of the Economic Development and Poverty Reduction Strategy, EDPRS 2008–2012, is the Vision 2020 Umurenge Programme (VUP) which contains three pillars: VUP public works, VUP direct support, and VUP financial services. The three pillars represent public works for the poor who are able to work, cash transfers for very poor households without labour capacity, and financial services such as the Ubudehe Credit Scheme. Rwamagana has 5.4% of people with a major disability. This percentage is above the national average of 4.5%. The district with the most people with a major disability is Burera, with 8.2%.

4.1.8. Housing and energy

The main wall material of dwellings are classified as follows: mud bricks, mud bricks covered with cement, tree trunks with mud, tree trunks with mud and cement, oven-fired brick, and other unspecified material. According to EICV3, in Rwamagana, 51% of households use mud-covered tree trunks as their wall material, ahead of mud bricks covered with cement (20%) and mud bricks (12%). At national level, 35.2% of households have mud-covered tree trunks as their wall material while in urban areas the figure is only 17.1% and 38.3% in rural areas. It is clear that Rwamagana district is still below the rural area average in terms of improving wall construction material.

The primary sources of energy used for lighting by households are categorised as follows: electricity, oil lamp, firewood, candle, lantern, battery, and other unspecified sources. In Rwamagana district, 10% of households use electricity as their main source of lighting; this ranks the district among the 10 districts in the 6–21% interval for households using electricity for lighting and it is above the rural average. On average, the urban areas have 46.1% of households using electricity as the main source of lighting while it is only 4.8% in rural areas and 10.8% at the national level.

4.1.9. Distance to key socio-economic facilities/service

Walking distance to basic services can be considered an indicator of both provision and coverage of such services and the remoteness of households' dwellings. The basic services were categorised into food market/shop, primary schools, secondary school, and health centres. Rwamagana is classified among 12 districts with a mean walking distance to a primary school within the interval of 21.6 to 28 minutes. The mean walking distance to primary school in Rwamagana district is 26.6 minutes and 40% of households are between 30 and 59 minutes from a primary school. This walking distance to a primary school in Rwamagana is above the mean distance in rural areas, which is 28.6 minutes. The mean walking distance to a primary school is 19.4 minutes in urban areas, while it is 27.2 minutes at national level.

4.1.10. Economic activity and income sources

According to EICV3, the overall employment rate is 84% of the resident population aged 16 years and above in Rwamagana district; the unemployment rate is 0.3% and the economic inactivity rate is 16%. Rwamagana district is ranked 11th last of all districts by employment rate. Most people aged 16 years and above in Rwamagana have independent farmer as their main job (68%); this is followed by wage non-farmer (13%), independent non-farm (10%) and wage farm (6%).

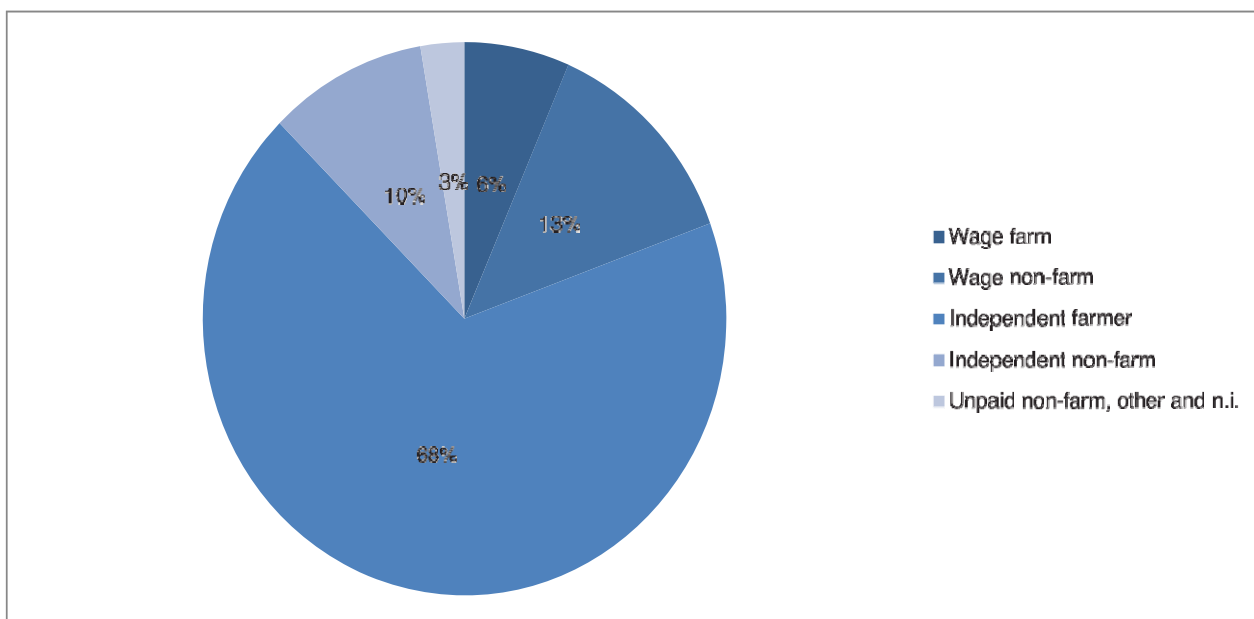


Figure 9: Employment types (usual main job) in Rwamagana

Based on all persons aged 16 and above usually working, the following figure presents the industry of usual main jobs in Rwamagana. Agriculture is shown as the main industry for 76% of the population aged 16 and above, followed by trade with 8%.

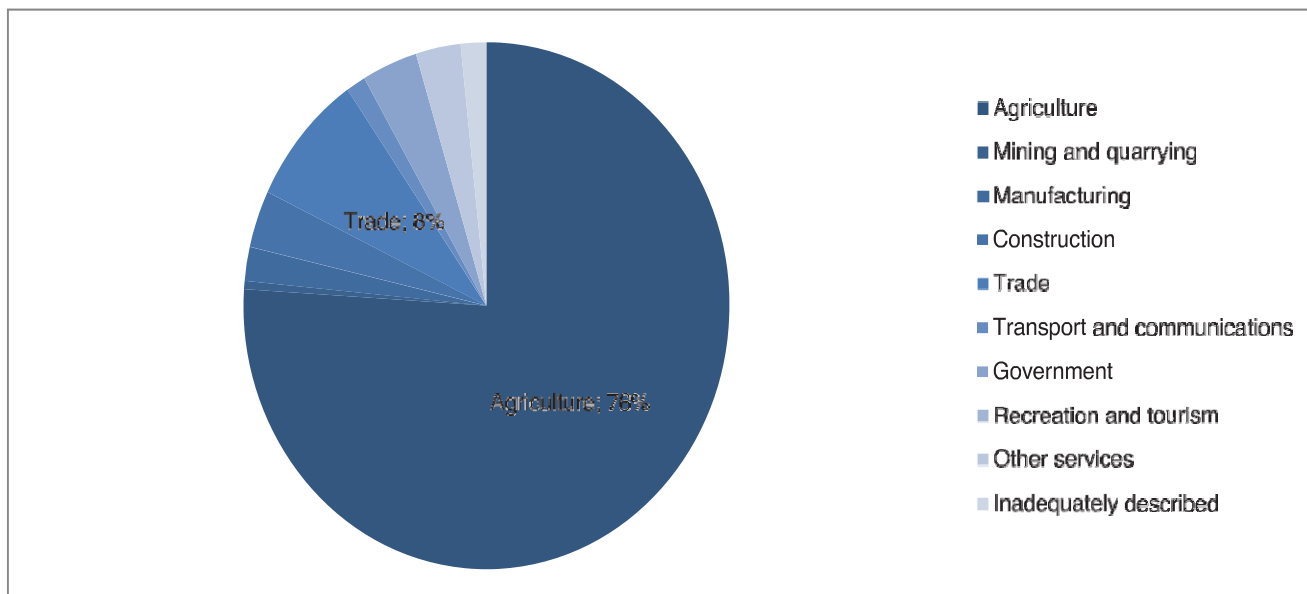


Figure 10: Industry of usual main jobs in Rwamagana

4.1.11. Source of income

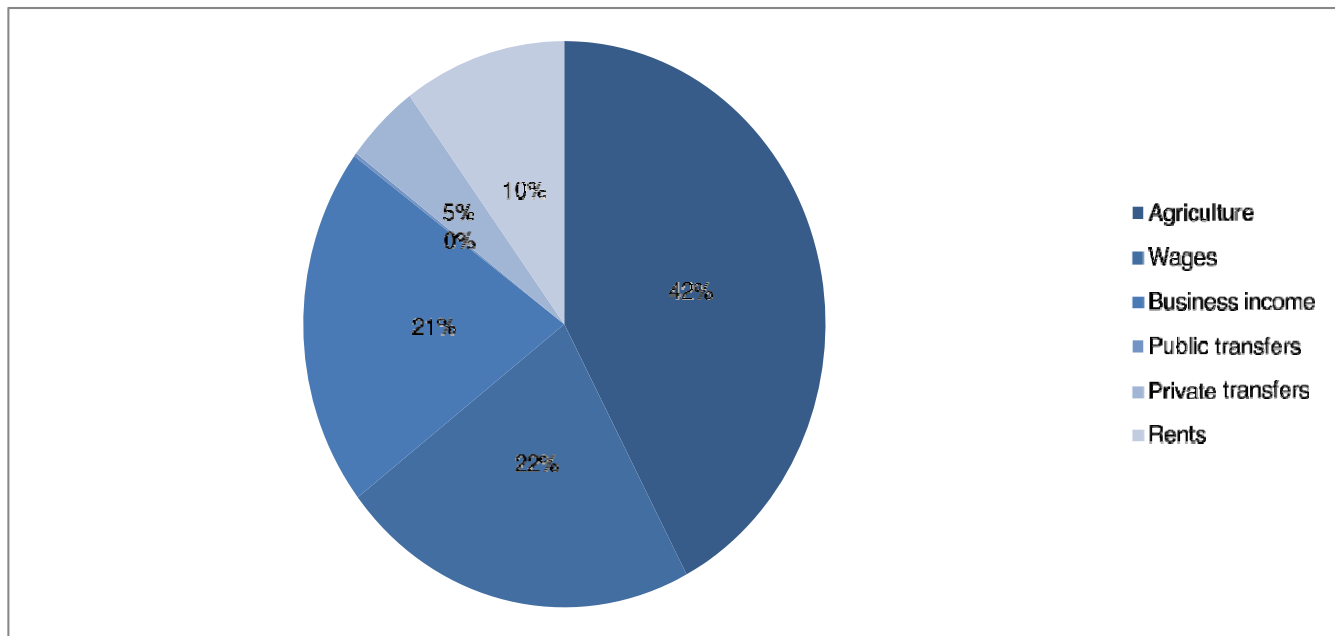
This section focuses on five main components of income: agricultural income, wage income, business income, rent income, and income from transfers.

Household agricultural income: this component is first divided into agricultural income (income from land cultivation) and livestock income. Unless otherwise specified, this report sums the two components into one agricultural component. It includes revenues from sale of crops, processed crop products, livestock products and other agricultural products, own consumption of food and non-food products, and the revenues from renting out livestock and sale of small animals. The income aggregate deducts costs on crop inputs, inputs used for processing crop products, and expenditure on livestock and the cost of renting land. Within the costs, the income aggregate includes the depreciation of land and agricultural equipment. The depreciation rate is equal to 0.2 per annum.

- **Wage income:** this includes cash and in-kind revenues received from farm and non-farm work. In-kind payments include food and other agricultural products, provision of house and other benefits received for the work.
- **Non-farm self-employment (business):** this includes income received net of labour and other inputs.
- **Income from rents:** this includes actual rents received from renting out livestock, agricultural equipment and land (rent and sharecropping), as well as imputed rental value of owner-occupied dwellings.
- **Transfers:** transfers include remittances received (cash and in-kind) and other private transfers. It also includes public transfers. Private transfers received from dowry and sales of assets and land are excluded.

The EICV3 results shows that at the national level agriculture contributes the largest share of a household's income (46%), followed by wage income (25%), business income (i.e. self-employment), transfers, and rents. The following Figure presents the household income shares in Rwamagana district. It shows that household income is driven by agriculture (42%), followed by wage income (22%), business income (21%) and rents (10%). The smallest contributor to household income in Rwamagana district is public transfer income, with 0.2%.

Figure 11: Household income shares in Rwamagana



4.2. Socio-economic profile of project affected persons/project beneficiary

This section describes the socio-economic conditions of project beneficiaries or project affected persons so as to set up the baseline that will be used in the evaluation of project impact. The consultant team used a team of surveyors to collect baseline data on socio-economic conditions of farmers who are using marshlands to be rehabilitated including rice farmers, vegetable growers and other who are using the marshlands for non-irrigated crops like suit potatoes and maize growers.

4.2.1. Population, sample size, data collection and analysis techniques and methods

The Environmental Impact Assessment (EIA) and Resettlement Action Plan (RAP) for the proposed project of rehabilitation of irrigation facilities in Rwamagana conducted on project beneficiaries and project affected people.

- **Population selection**

Purposes methods was used to determine the population since the 1019 household used as project beneficiary did not give an indication of characteristics of the said population. Since the proposed project aim at promoting irrigation rice as the priority crop in the four marshlands, and based on the fact that the project impact shall be measured mainly on the improvement of rice farmers. Initial the total number of rice farmers in the marshlands was estimated at 1019 and this number was considered as total population for the survey purposes.

- Cyaruhogo: 453
- Cyimpima : 252
- Gashara : 185 and;
- Bugugu : 129

- **Sample size**

As the population were large, the consultant has preferred to use sample from the whole population and the field results were estimated to the whole population. According to the Research Advisors (2006) ¹ accessed on, <http://www.tools4dev.org/wp-content/uploads/Sample-size-table.jpg>/retrieved on 20th September, 2016, the total sample size for this study were 716 households having parcel land in one of the four mentioned marshlands. As recommended by sampling technique, 453 households for Cyaruhogo marshland were estimated to 300 (< 450) population size to get exact sample size, 256 (>250) households for Cyimpima were estimated to 500 population size, 223 (<250) for Gashara were estimated to 200 population size and also 127 (<250) households for Bugugu were estimated to 200 population size. The consultant has used a margin error of $\pm 3\%$ or ± 0.03 for reducing bias for the study results and meets the sampling standards for the population less than 1000 population size.

- **Sampling technique**

The consultant has applied sampling without replacement, it is in that context the whole targeted sample were not met only 70.20% to total sample were assessed and remaining 29.80% were absent during the whole period of interview. For selecting and determining the sample from whole population systematic sampling were used as the consultant has a list of all household with land in each mentioned marchland.

Table 8: Households interviewed by marshlands

Marshlands	Estimated current users	Sample size	Users Reached
Cyaruhogo	413	289	224
Cyimpima	256	241	218
Gashara	223	169	158
Bugugu	127	119	116
Total	1019	818=80.27%	716=87,53%

Source: BESST Ltd, 2016

- **Data collection and analysis techniques and methods**

Data were collected using questionnaire completed by surveyors who recording the answer given by the interviewee during data collection interview period. After data collection data were summarized in form of tables as descriptive statistics and cross tabulations for assessing the level of agreement for each item assessed in each marshland.

4.2.2. Profile of respondents and socio-economic activities

For each household one person was interviewed and provided information about the whole household member. The figure below illustrates respondent main occupation.

¹ Most statisticians agree that the minimum sample size to get any kind of meaningful result is 100. If your population is less than 100 then you really need to survey all of them. The rules of thumb are perfectly acceptable for most basic surveys, sometimes you need to sound more “scientific” in order to be taken seriously. In that case you can use the table. Simply choose the column that most closely matches your population size. Then choose the row that matches the level of error you’re willing to accept in the results.

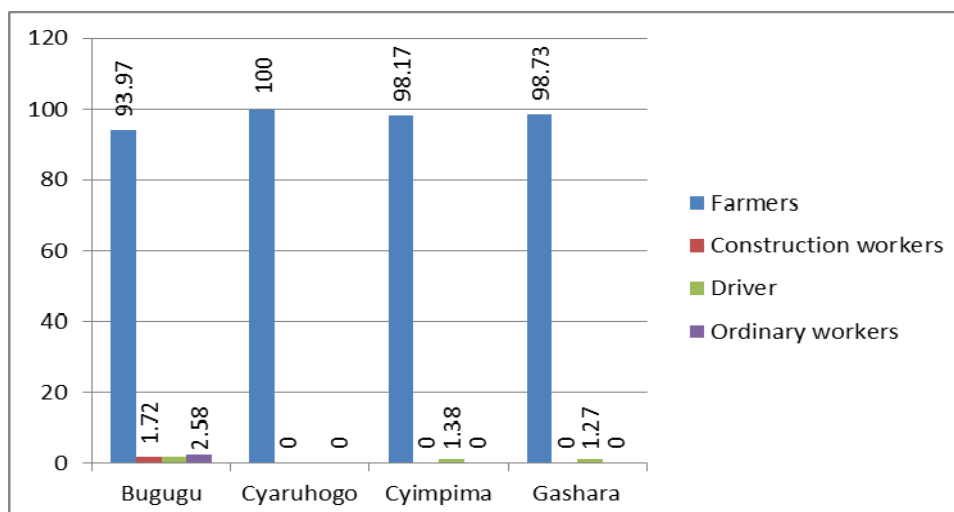


Figure 12: Occupation of respondents

From the above table, it is clear that more people in all four marshlands are farmers, 93.97% in Bugugu marshland, 97% in Cyaruhogo and 98.17% in Cyimpima and 98.73% in Gashara marshland. The field assessment revealed that the main income generating activity is field crop which represents 98.28% in Bugugu, 93.93% in Cyaruhogo, 97.71% in Cyimpima and 97.47% in Gashara.

The second main activity that provide income is livestock which represents 1.8% in Bugugu, 0.89%, in Cyimpima, 2.53%) in Gashara and 2.3 in Cyaruhogo. Other income source activities include agricultural labour in cell, Agricultural labour in town, construction worker, transportation (driver), government employee, remittance from Kigali, and remittance from abroad and any other with periodic income.

- **Annual income**

The annual income was estimated based on response provided by respondent who has income generation activity like agricultural labour in cell, agricultural labour in town, construction worker, transportation (driver), government employee, remittance from Kigali, remittance from abroad and any other with periodic income. Only a few number of respondent provided their annual income due to the nature of their main activities. To have the real annual income we used the income from rice selling since most of farmers are involved in rice farming and they are growing rice twice year though the coverage in season A depend on the availability of water. Since there was no reliable data to compare the two seasons we adopt to consider them equally.

Table 9: Annual income for households

Name of the Marshland	Number of farmers	Total production in kg/season	Total cost of produce in Frw/season	Total investment in Frw	Total benefit in Frw	Average annual income
CYIMPIMA	256	293,804	69,043,940	46,641,385	22,402,555	175,020
BUGUGU	127	160,325	37,676,375	26,892,250	10,784,125	169,829
CYARUHOGO	739	575,397	135,218,295	94,727,395	40,490,900	109,583
GASHARA	223	224,170	52,679,950	34,359,850	18,320,100	164,306
Total	1345	1,253,696	294,618,560	202,620,880	91,997,680	154,684

Source: BESST Ltd, 2016

- **Religious adherence**

The respondents are into three religion of preference where people from Bugugu marshland 29.31% are Catholic, 61.21% are Protestant, 8.62% are Muslim, in Cyaruhogo marshland 33.48% are Catholic, 61.61% are Protestant, 4.91% are Muslim, in Cyimpima marshland 30.73% are Catholic, 63.30% are Protestant, 3.67% are Muslim and in Gashara marshland are 41.77% Catholic, 52.53% are Protestant, 5.06% are Muslim.

- **Cooperative membership**

In Rwanda cooperative or association play a big role as a tool for capital accumulation and small businesses development. The assessment confirmed this tendency whereby 99.14% households are members in Bugugu Cooperative, 99.55% in Cyaruhogo, 99.08% in Cyimpima and 100% in Gashara marshland.

- **Households size**

The findings show that the average household mean size is varying from 4.7 to 5.2. In Bugugu the average household size is 5.2, in Cyaruhogo are 4.7, in Cyimpima are 5.1 and in Gashara are 4.8. This does not differ a lot to the household size in the rest of district.

- **Vulnerability**

During baseline survey, vulnerability was considered and during project implementation this group of people should be given a special attention. Were considered as vulnerable people living with disability, orphan and people above 65 years old

The vulnerability is not at high level in the assessed households, it is at 2.30% in Bugugu, 2.19% in Cyaruhogo, 4.44% in Cyimpima and 2.91% in Gashara. Detailed list of vulnerable people is presented as appendix 5. The table below presents number of vulnerable people identified in project area by marshlands and nature of vulnerability.

Table 10: Vulnerable people by marshland

Site/ Type of Vulnerability	Disability	Old	Orphan	Others
Bugugu	11	2	1	0
Cyaruhogo	5	12	6	0
Cyimpima	33	11	2	1
Gashara	14	8	0	0
Subtotal	63	33	9	1
Grand Total				106

Source: BESST Ltd, 2016

4.2.3. Asset and economic survey (Land Use & Land Tenure)

This section describes assets and economic activities and other development features of households. Here the main focus was made on the nature of housing, economic activities, type of crops, quantity produced per year and quantity produced annually, size of lands and average annual or monthly income from the grown crops or any other economic activity produced.

- **Characteristics of household residential land**

The findings show that residential lands are located on hillsides and no residential house found in marshlands or in area to be submerged. The house walls are mostly made in wood and mud in Bugugu (68.10%), Cyimpima (88.53%) and Gashara (49.37%) rather than Adobe bricks and Burnt Bricks. Adobe bricks is ate level of 23.28% of the houses in Bugugu, 55.80% in Cyaruhogo,

10.09% in Cyimpima and 49.37% in Gashara and Burnt Bricks is at 1.72% in Bugugu, 43.75% in Cyaruhogo, 1.38% in Cyimpima and 1.27% in Gashara. The preferable roof type in households is iron sheet at 93.10% in Bugugu, 99.11% in Cyaruhogo, 98.62% in Cyimpima and 100% in Gashara. Some households are not owned their residential land, only 83.05% in Bugugu, 81.70% in Cyaruhogo, 98.44% in Cyimpima and 90.51% in Gashara owned residential land. The remaining households live in grouped settlement where the land is registered to government or are renting the house they are living in.

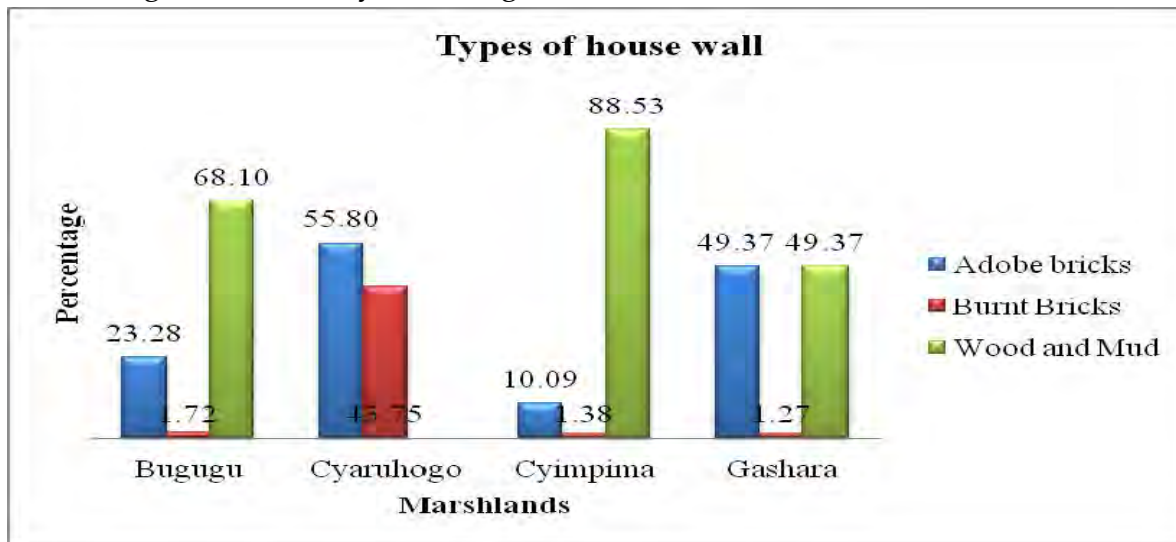


Figure 13: Type of house wall for the households

4.2.4. Characteristics of household farming land

The survey revealed that most of farmers have land in both hillsides and marshland 96.6% for Bugugu, 99.1% in Cyaruhogo, 97.2% in Cyimpima and 89.9% in Gashara. Only few households have farming land in dame site (flooded areas), only 0.86% for Bugugu, 0.45% for Cyaruhogo, 1.38% for Cyimpima and 11.39% for Gashara marshland. All farmers who have land in area to be submerged and in the marshlands were identified separately so as to assess potential impact and results are presented in the chapter on social impact assessment.

- **Farming land in marshland**

The assessment shows that the most preferred crop by farmers in marshland is Rice (Paddy) as it is grown by 98.3% of households in Bugugu, 99.6% in Cyaruhogo and 78.1% in Cyimpima. The means of irrigation are gravity (canal), manual and rain fed crops. The main rain fed crop is maize and some vegetables. Rice is grown twice per year but the favourable cropping season for rice paddy is season B¹ (71 respondents in Bugugu, 232 respondents in Cyaruhogo, 96 respondents in Cyimpima and 142 respondents in Gashara). And a larger quantity of farming outcomes mainly rice paddy are sold to the farmer Coop/Union (confirmed by 142 respondents in Gashara, 212 respondents in Cyimpima, 231 respondents in Cyaruhogo and 66 respondents in Bugugu marshland).

Though the marshland is mainly used to grow rice, some farmers are growing other crops and the figure below present the use of the land in the marshlands by crop and by owned land and but it is worth to note that farmers change crops by season.

¹ Season B means the season that start in February to end in June

Hillside land above F.W.L (Land that will not be affected)

Data shows that most of households have cropping land in hillsides that is 47.41% for Bugugu, 54.38% in Cyaruhogo, 56.42% Cyimpima and 55.70% in Gashara. It is clear that, the most developed crop in hillside is beans (incl. soya) and banana. The land in hillsides is owned by farmers all of them have land titles. The private to be affected were identified separately and results are presented in impact assessment.

- **Farming land in flooded area**

Using the questionnaire it was not easy to identify farmers in area to be submerged and the consultant used GIS expert to identify farmers who have land in the area in Cyimpima, Bugugu and Gashara farmers are mostly growing rice on the land to be submerged up stream of the dam. In Cyaruhogo the land to be submerged is owned by government but the land is leased to one farmer who in turn has farming contract with 121 farmers who are growing maize, sweet potatoes, soybeans and vegetables.

4.2.5. Living and health condition of households

- **Source of energy**

The study results show that firewood is the main source of energy for cooking with 93.62%, the second is charcoal at 5.87%, other sources of income (not mentioned) at 0.81% and the last is kerosene at 0.44% from all households assessed. The main source of household energy for lightening is battery light (54%), the second is kerosene lamp (22.8%), the third is solar battery system (9.8%), the fourth are other sources not stated by respondents (9.6%), the fifth is electricity (8.5%), the sixth is candle (2.6%), 1.7% do not have any source of lighting, 1.3% are using Nuru light, and the last are these using telephone light (0.4%).

- **Source of domestic water**

The main source of water for domestic use in rainy season in general is spring (38.92%) and to get water in rainy season takes time less than 30 minutes (48.16%), between 31-60 minutes (43.65%) and more than one hour (8.19%). In the other case, the main source of water for domestic household use in dry season is spring (59.17%), and it takes time between 31 and 60 minutes (50.19%), less than 30 minutes (50.19%) and more than one hour (11.64%).

- **Medical issues**

The study revealed that the main medical issue affecting households in four marshland (Bugugu, Cyaruhogo, Cyimpima and Gashara) is malaria (55.79%), Diarrhea (17.81%), Stomach problems (11.61%), Respiratory problems (5.44%), others (not stated) (4.55%), eye infections (3.81%), STIs/HIV/AIDs (0.93%), and Problems during pregnancy/child birth (0.06%). It was also revealed that 100% of households' members have health insurance known as « Mutuelle de santé¹» Mutual Health insurance.

¹ This is government medical insurance scheme whereby all citizens contribute in advance a certain amount of money to cover medical expenses and when is sick, the scheme cover 90% of the total medical bill. Government also put some money in the insurance fund.

4.2.6. Accident and safety

The findings show that only 31.03% of respondents in Bugugu, 29.46% in Cyaruhogo, 9.17% in Cyimpima and 0.63% in Gashara have observed traffic accident in their village. Gashara it's like none saw the traffic accident only 0.63% of respondents other (99.37%) were not. The main¹ cause of traffic accident in the villages is bicycle (41.99%), the second is Motorcycle (34.31%), the fourth is vehicle (14.67 %.)

4.2.3. Perception on the proposed Project

This study shows that, based on the consideration of all respondents, this project is very good (87.83%), relatively good (8.71%), moderate (3.40%) and the remaining percentage is appreciating the project relatively. The reason which makes farmers to appreciate project are linked to the expected solutions they will get and attributes for improving their social economic development conditions. They believe that once the rehabilitation is completed they will be able to grow rice twice per year and they will be able to use all the land in the marshland. Furthermore they are expecting to increase production and get employment during construction.

4.3. Existing infrastructure and structures in the project area

In addition to the socio-economic survey, the surveying team conducted the inventory of existing infrastructure and structures in the project area so as to assess whether some of them will be affected. Infrastructures found in the area includes water springs, rice drying grounds, cooperatives offices, water supply infrastructures and springs, cattle water trough and electrical poles. In the infrastructures identified only few springs and cattle water trough are likely to be affected as well water supply pipe at Bugugu area. The full lists of existing structures are presented in appendix 4 and the map below present their location.

¹ It important to note that If two means of transport means such as a car and a bicycle and a car, the main cause of accident is defined by the conductor who is found guilty

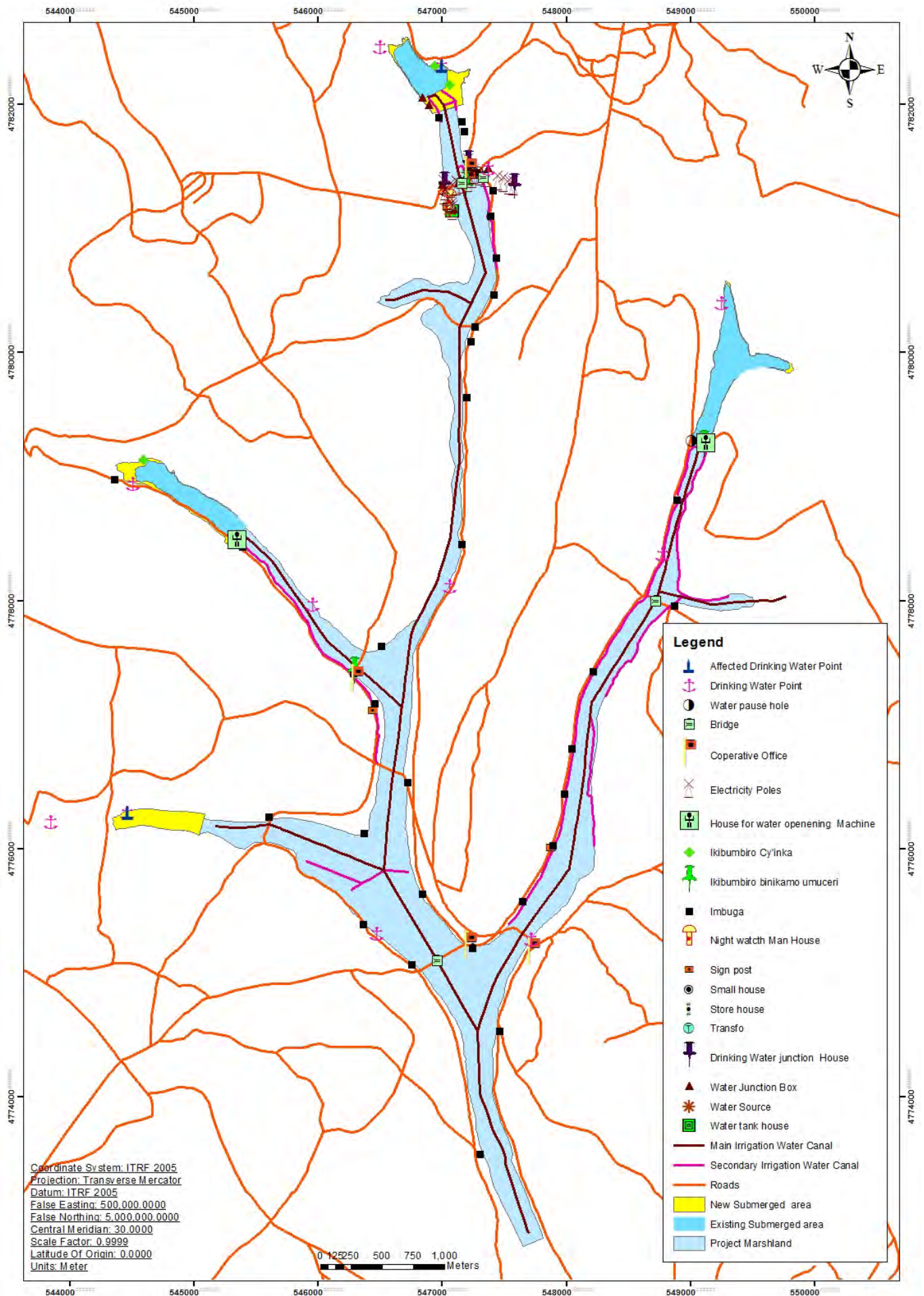


Figure 14: Map of existing infrastructures

CHAPTER FIVE: IMPACT ASSESSMENT AND COMPENSATION MEASURES

The project of rehabilitation of irrigation facilities in Rwamagana district were designed in a way that avoid or minimize resettlement impacts. However some component of the project such as the construction of new dam at Cyaruhogo marshland, disposal areas, construction yard deposit of material, establishment of campsite or access roads will required additional land hence land acquisition. Therefore some resettlement implication is expected and this chapter assess the likely impacts and proposes mitigation and compensation measures.

5.1. Expected resettlement impacts

The field survey and public consultation revealed that the rehabilitation of irrigation infrastructure in Rwamagana district will lead to some resettlement impacts. The expected resettlement impacts range from loss of land permanently or temporary, loss of perennial crops and trees, loss some social infrastructures such us water points as well as loss of economic income during construction especially rice farmers. During the impact assessment all PAPs were identified and in this identification, a surveying team identified each and every one and collected data on assets to be affected, size of the land owned or leased and the main usage of the land. This information helped the consultant to calculate the compensation package for different impacts including loss of income, loss of land trees and crops. Detailed results of this identification are presented in appendices 1, 2 and 3. Table below provide the summary of PAPs identified.

Table 11: Results of PAPs identification

Marshland	a. Submerged area	b. Borrow pits	c. Disposal areas	d. Buffer zone	e. Yard/construction camp sites	f. Access Roads	g. Income loss in marshlands	Total =SUM(a:g)
i)Cyimpima	14	1	17	34	2	5	256	329
ii)Bugugu	23	3	4	5	1	2	127	165
iii)Cyaruhogo	121	8	17	12	1	8	739	906
iv)Gashara	47	4	0	20	2	-	223	296
Total PAHs =sum (i to iv)*1	205	16	38	71	8	9	1,345	1,696
Total PAPs*2	964	75	179	334	38	42	6,322	7,971

Note:

- 1: The figures above are cumulative total number of people because there are some farmers who are to be affected plural categories.
- 2: Average household size in Rwamagana district: 4.7 persons per household is applied for estimation of total PAPs number, and decimal places are rounded. (Source: EICV3, District Profile- Rwamagana)

Source: BESST Ltd, 2016

5.1.1. Loss of private land

The construction of new dam at Cyaruhogo and rehabilitation of existing dams at Cyimpima, Bugugu and Gashara marshlands will require additional land in submerged area. Land is also required for disposal area, construction camps, borrow pit areas and new access roads. Few rice paddies will be also affected especially at Bugugu site where the dam axis will be shifted few meters downstream. The lands to be submerged are mainly owned by Government but are being used by local people for subsistence agriculture. Base on the

preliminary design study the field survey team was able to identify lands that are likely to be affected.

5.1.2. Loss of government lands

Article 19 of organic law on land use and land management states that swamp/marsh land belongs to the State. It shall not definitively be allocated to individuals and no person can use the ground of holding it for a long time to justify the definitive takeover of the land. However, it may be lent to a person based on agreement concluded between both parties. During the identification of project affected people, the field team identified farmers who are using government land in the project area and will be affected by the project in submerged area, borrow pits, disposal, buffer zone and at camp sites. These farmers are mostly growing rain fed crops including maize, sweet potatoes and some vegetables. The national expropriations recognize compensation for only work done on the government lands (crops, trees). In other similar projects though the government does not provides compensation for the land but after the rehabilitation of marshlands government provides lands to affected farmers. According the head of irrigation and land husbandry department in RAB, the government will provides lands to all affected farmers.

The table below shows the number of farmers who are losing government lands and private lands.

Table 12: Summary of affected household on government land and private land

Marshlands	Affected area	Nos of HHs		Land size (m2)	
		Private land	Government land	Private land	Government land
Cyimpima	a.Submerge	---	14	---	42,110
	b.Borrow pit	---	1	---	14,648
	c.Disposal	---	17	---	10,636
	d.Buffer	18	16	72,720	22,038
	Sub total I	18	48	72,720	89,432
	Sub total II*	56			
Bugugu	a.Submerge	4	19	36,389	35,900
	b.Borrow pit	3	---	48,898	---
	c.Disposal	4	---	22,860	---
	d.Buffer	3	2	23,074	9,852
	Sub total I	14	21	131,221	45,752
	Sub total II*	29			
Cyaruhogo	a.Submerge	8	113	52,029	74,524
	b.Borrow pit	8	---	30,329	---
	c.Disposal	17	---	21,123	---
	d.Buffer	11	1	17,440	5,628
	Sub total I	44	114	120,921	80,152
	Sub total II*	152			
Gashara	a.Submerge	12	35	12,616	86,929
	b.Borrow pit	4	---	32,628	---
	c.Disposal	---	---	---	---
	d.Buffer	14	6	38,642	9,064
	Sub total I	30	41	83,886	95,993
	Sub total II*	58			
Sub total I	106	224	408,748	311,329	
Grand Total*	295		720,077		

Note: * Figures indicate actual number of PAHs because several farmers own/use both private and government lands which are to be affected by the Project.

Source: BESST Ltd, 2016

5.1.3. Temporary loss of Land

Some land will be lost temporary during construction especially in camp sites and owners shall be provided with compensation for trees and crops but also income loss during construction period. The table below summarize the land to be acquired temporary.

Table 13: Land to be affected temporary

Marshlands	Affected area	Nos of HHs		Land size (m2)	
		Private land	Government land	Private land	Government land
Cyimpima	e. Camp sites	---	2	---	3,492
	f. Roads	5	---	4,901	---
Bugugu	e. Camp sites	1	---	5,216	---
	f. Roads	2	---	2,295	---
Cyaruhogo	e. Camp sites	1	---	7,561	---
	f. Roads	8	---	4,432	---
Gashara	e. Camp sites	---	2	---	4,690
	f. Roads	---	---	---	---
Sub Total I		17	4	24,405	8,182
Sub Total II*		20		32,587	

Note: * One farmer has a land in both candidate camp site and road. Hence, total number of PAHs becomes twenty.

Source: BESST Ltd, 2016

5.1.4. Loss of perennial crops and trees

Construction works of Cyaruhogo dam and rehabilitation of existing dams entail clearing of the vegetation inherent in the project site which includes fruit trees, trees, grass and crops that have been planted and or cultivated by the farmers. According to both national regulations and international policies on environmental and social considerations requires the compensation of affected assets including tress and perennial crops. All trees and perennial crops were counted and valued. Below is the summary of tress and perennial crops likely to be affected. Provisional detailed list of project affected Households and their assets are presented at the end of the report as appendix 2.

Table 14: Summary of perennial crops and trees to be affected

Marshlands	Affected area	Nos of HHs	Nos. of affected trees/perennial crop
Cyimpima	a.Submerged area	-	-
	b.Borrow pits	-	-
	c.Disposal area	-	-
	d.Buffer	5	625
	e.Camp sites	-	-
	Sub total I	5	625
	Sub total II*	5	
Bugugu	a.Submerged area	2	626
	b.Borrow pits	3	51
	c.Disposal area	2	163
	d.Buffer	3	57
	e.Camp sites	1	22
	Sub total I	11	919
	Sub total II*	6	
Cyaruhogo	a.Submerged area	2	29
	b.Borrow pits	5	122
	c.Disposal area	6	61
	d.Buffer	5	63
	e.Camp sites	1	22
	Sub total I	19	297
	Sub total II*	17	
Gashara	a.Submerged area	5	167
	b.Borrow pits	-	-
	c.Disposal area	-	-
	d.Buffer	4	191
	e.Camp sites	-	-
	Sub total I	9	358
	Sub total II*	9	
Grand Total*		37	2,199

Note* Figures indicate actual number of PAHs without double counting.

Source: BESST Ltd, 2016

5.1.4. Loss of infrastructures/structures

Reference made to the preliminary design it is anticipated that some structure will be submerged after rehabilitation works. Three spring water facilities which are likely to be affected by project were identified and one each is located at Cyaruhogo, Gashara, and Bugugu. An inventory of all infrastructures and structures was conducted and a list of all structures identified and their status is attached as appendix 4. The JST is identifying potential water source to replace affected water springs. The following table shows the information on people who are currently using water point to be affected.

Table 15: Water users at three springs to be affected

Site Name		Cyaruhogo	Gashara	Bugugu	
Spring Name		Rwamutanazi	Rwamunyansho ngore	Gahonogo	
Sample Number: N for 5 days survey		1,000	598	712	
Estimated Number of Daily Users (persons)		965	563	642	
Sex	F	46.2%	43.5%	48.2%	
	M	53.8%	56.5%	51.8%	
Age in Avg.	F	14.4	16.1	18.6	
	M	14.9	15.8	16.8	
Highest Education	F	1. No schooling	10.6%	29.2%	12.0%
		2. Preschool	5.0%	3.5%	0.9%
		3. Primary	77.1%	64.2%	68.5%
		4. Post Primary	3.9%	2.7%	2.6%
		5. Secondary	3.5%	0.4%	15.5%
	M	1. No schooling	10.6%	25.4%	11.4%
		2. Preschool	5.2%	4.1%	0.5%
		3. Primary	78.3%	66.9%	69.6%
		4. Post Primary	3.3%	2.7%	3.5%
		5. Secondary	2.6%	0.6%	13.8%
Frequency to come		1. More than twice a day	90.0%	72.4%	52.9%
		2. Once a day	8.1%	22.9%	33.0%
		3. Every other day	1.7%	3.0%	7.3%
		4. Others	-	1.5%	6.6%
Ave. amount taking water at one time		14.4	16.3	16.7	
Ave. minutes required from home to spring(one way)		44.5	23.4	23.4	
Type of use (Multiple answer)		1. Drinking, Cooking	98.7%	100.0%	99.2%
		2. Domestic	99.6%	93.8%	89.5%
		3. Livestock	1.1%	14.2%	14.0%
		4. Construction	-	0.3%	0.7%
		5. Irrigation	-	-	0.1%
Nos of family in HH	avg.	5.3	5.2	5.4	

Source: JST 2016

5.1.5. Temporary loss of income

Worries from farmers and sector agronomists during field visits were observed, of missing seasons of cultivation during construction. For an estimated period of 24 months¹ is required for rehabilitation works in addition to the dam filling period. This implies that the farmer losses the produce that they could have obtained that missed season hence a loss in home income and in most cases domestic food. It also affects targets of crop production set by local government officials in their performance contracts. Cooperatives and Cooperative union has expressed worries of not having enough resources to pay their employees.

- **Income loss for rice farmers;**

In total 1,345 farmers are registered by four rice cooperatives using the four marshlands. Reference made to season 2016 B (February-June) and data available in cooperative including names of farmers, size of land owned by every farmer, farmer's investment (labour, inputs, and seedlings, rental fees and other charges), farmers production (the average yield: tons/ ha in each cooperatives was used for each estimation) and unit cost of 1 kg of rice, the consultant was able to calculate the total income loss by one season. The number of seasons to be

¹ Estimated period of construction of each site is about one year and another one year after completion of the construction is to be required to fill water reservoir.

considered for income loss is project to be four that is two years of project duration. But this will be confirmed after the detailed design studies and construction schedules. During the consultation meetings, it was suggested to start construction just after the harvesting period in dry season, In June so as to shorten the number of season affected. The table below summarize the income loss by marshland. The detailed income loss by farmers is provided in appendices 3.

Table 16: Income loss for rice farmers in four marshlands by season

Name of the Marshland	Number of HHs	Area in Ha	Total production in kg/season	Total income in Frw/season	¹ Total investment in Frw/season	Net income in loss Frw/season
CYIMPIMA	256	52.47	293,804	69,043,940	46,641,385	22,402,555
BUGUGU	127	30.25	160,325	37,676,375	26,892,250	10,784,125
CYARUHOGO	739	106.56	575,397	135,218,295	94,727,395	40,490,900
GASHARA	223	38.65	224,170	52,679,950	34,359,850	18,320,100
Total	1,345	227.93	1,253,696	294,618,560	202,620,880	91,997,680

Source: BESST Ltd, 2016

As shown by this table the total income loss for one season is 91,997,680 frw. If the numbers of season lost are 4 the income loss will be 368 million frw that is around 452,000 USD (Exchange rate of 813 frw/USD). The total number of season that will be missed will be confirmed during details design studies and means of compensation shall be decided during project negotiation.

- **Income loss for cooperative and union;**

During public consultation cooperative union and cooperative leaders expressed the worry of not having sufficient resources to run their business and pay their employees. Usually cooperative and union get their budget from cooperative members whereby each member pays 5 Frw/kg to the cooperative and 4 Frw to the union, and 1 Frw to the union at national level. This means that the expected income loss by season is as follows:

Table 17: Income loss by cooperatives and union per season

Cooperative	Production per season in kg	Charges/unit(Frw)	Total charges (Frw/season)
CYIMPIMA	293,832	5	1,469,160
BUGUGU	160,325	5	801,625
CYARUHOGO	575,424	5	2,877,120
GASHARA	224,170	5	1,120,850
Union	1,253,751	4	5,015,004
Total			11,283,759

Source: BESST Ltd, 2016

The table above show that cooperative and cooperative union will register income loss estimated at 11,283,759 Frw per season. Without this money they will not be able to pay their employees and cover administrative cost. Therefore, the charges expected to be paid to the

¹ Details of investment cost are provided in appendix 3 and includes labour, fertiliser, cooperative charges, land rental fees and seedlings

cooperatives and union were excluded from the expenditure or investment cost in the above chapter. Hence, if the net income mentioned in Table 15 is gained by farmers through other created source of income especially watershed management program, charges to cooperatives and cooperative union will be paid by farmers without any problem according to their internal organization during this special period of construction.

5.2 Eligibility criteria and entitlement matrix

5.2.1. Eligibility criteria

Defining eligibility criteria is essential for the resettlement/ rehabilitation process and compensation payments. The census and property inventories provide the basis of the identification of PAPs and assets. On one hand and according the national expropriation laws the person who owns land intended for public interest shall provide evidence to confirm that he or she possesses rights on that land and among the evidence to confirm ownership of the land, there shall be included:

- written evidence indicating that he or she purchased the land, received it as a donation or as a legacy or a successor;
- a document or a statement of local administrative entities indicating rights of the expropriated person on the land;
- a document or testimony of the neighbours; confirming the ownership of the land;
- a Court certificate(art 18 expropriation law);

Furthermore, Article 27: Properties valued during expropriation in the public interest defines the properties subject to valuation for the payment of fair compensation due to expropriation in the public interest are:

- land;
- activities carried out on land for its efficient management or rational use;
- Compensation for disruption caused by expropriation which is equal to 5% of total amount of compensation;

On the other hand, JICA guidelines for environmental and social considerations request the recipient country to consider international eligibility criteria including those provided by World Bank Policy OP 4.12 on involuntarily resettlement. The WB OP 4.12 also provides eligibility of benefits including the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets, and the PAPs who have no recognizable legal rights to the land they are occupying.

The eligibility criteria used in this assessment are based on the three criteria given in clause 15 of the World Bank's Operational Policy 4.12: involuntary resettlement

- Those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country);
- Those who do not have formal legal rights to land at the time the census begins but have a claim to such land or assets – provided that such claims are recognized under the laws of the country or become recognized through a process identified in the resettlement plan;
- Those who have no recognizable legal rights or claim to the land they are occupying;

JICA requires recipient country to comply with JICA guidelines on environmental and social consideration and World Bank OP 4.12. Therefore the eligibility was determined in

compliance with these guidelines and the PAPs that were considered as eligible for compensation include the following:

- Tenants leasing privately owned land;
- PAPs losing trees and crops located on required land for the construction of irrigation infrastructures;
- Farmers that are currently using government land that will be affected;
- PAPs that will not be able to grow rice during construction as well as water filling periods.

5.2.2. Entitlement matrix

PAPs entitlement matrix is provided in table 17 below and it provides an indication of resettlement and measures for compensation and other supports to restore livelihoods impacted by the loss of land, crops and other structures. It is important to pay special consideration to vulnerable people, for instance, giving them high priority to be employed as project labourers.

Table 18: Proposed entitlement matrix

Type of Loss	No HH	Quantity	Eligibility Criteria	Entitlement
1. Loss of Private Land				
1.1. Permanent Loss of Private Land (1) in Reservoir area (2) along roads (3) in borrow pit (4) in disposal site (soil only) (5) in buffer zone	106	40.9 ha	Land owners where the proposed facilities will be constructed permanently	Compensation in kind (land) or by cash for loss of land
1.2. Temporary Loss of Private Land (1) in Construction yard (2) along temporary const. road (3) Other Temp. Facilities	17	2.4 ha	Land owners where the proposed facilities will be constructed temporarily	Cash compensation for temporary loss of land
2. Loss of Government Land				
2.1. Permanent loss (1) in Reservoir area (2) along roads (3) in borrow pit (4) in disposal site (soil only) (5) in buffer zone	224	31.1 ha	Current users of affected marshland	Provision of alternative lands. It is expected the new irrigable land will be secured by RAB Other means of in kind compensation where alternative lands are unavailable
2.2. Temporary loss (1) in Construction yard (2) along temporary const. road (3) Other temp. facilities	4	0.8 ha	Current users of affected marshland	Provision of alternative lands or other means of in kind supports where alternative lands are unavailable
3. Loss of assets in the private land (1) Perennial trees	37	2,199 trees	Various rights and interest holders Share croppers and lessees	Cash compensation
4. Loss of irrigation water	1345	227.9	Current users	Supported by Watershed

during the construction in the government land		ha		management program by RAB
5. Loss of Public facilities / Infrastructure Spring water facilities	-	3	Current users	Construction of alternative facilities.
6. Vulnerable people	106	-	Elder, handicapped, marginal and others	Consideration during the final valuation and/or payment process

5.3. Assets valuation and compensation

5.3.1. Cut-off date

The cut-off date is the date on which assets inventory starts and for the Project the provisional date was fixed on August 25th, 2016 the date on which field survey started. This date was communicated to all potential PAPs in the project affected area with sufficient time for these people to ensure their availability for the census. To ensure all the stakeholders and PAPs are informed, communication was done through cooperatives and community leaders and representatives of PAPs was charged with the responsibility to notify their members about the established cut-off date and its significance.

However, this date is provisional and may be revised depending on the progress of the project and a new date will be required before the final valuation, because the land expropriation law for public interest states that the expropriation shall become null and void if approved compensation was not paid within 120 days. The establishment of a cut-off date is required to prevent opportunistic invasions/rush migration into the chosen land areas. Persons who encroach on the area after the cut-off date are not entitled to compensation. It should be noted that the cut-off date should be determined before the census is conducted and agreed by all the stakeholders especially the PAPs.

5.3.2. Assets valuation

The consultant has conducted initial assets inventory and has estimated the value of different assets and properties likely to be affected. However upon the completion of final detailed design, RAB should hire an independent valuer to carry out the final assets valuation. Reference made to the law n°17/2010 of 12/05/2010 establishing and organising the real property valuation profession in Rwanda, the valuation of land and property incorporated thereon shall be conducted by valuers certified by the Institute of Real Property Valuers in Rwanda (IRPVR).

The district must inform the persons to be expropriated in the public interest of the expected start date of measurement of land and inventory of property incorporated thereon. The valuation of land and property incorporated thereon shall be conducted in the presence of land owner and that of the owner of property incorporated on land or their lawful representatives and in the presence of representatives of local administrative entities.

The owner of land designated for expropriation in the public interest shall provide land titles and documentary evidence that he/she is the owner of property incorporated on land. He/she shall also provide a civil status certificate and a document evidencing his/her chosen

matrimonial regime in case of a married person. However, a person dispossessed of land or unlawfully occupying land or having developed activities on land on which such activities are prohibited after the enactment of relevant laws shall receive no compensation.

The properties subject to valuation for the payment of fair compensation due to expropriation in the public interest are:

- land;
- activities carried out on land for its efficient management or rational use;
- Compensation for disruption caused by expropriation. The new law has added 5% of total compensation fees for disturbance allowances.

Article 27 of valuation law allows the independent valuer to apply one or more valuation methods provided by this law or any other method accepted by the IRPVR Council. Valuation methods proposed by the law include:

- **Comparable prices methods** where by the proposed price for the affected property shall be close or equal to the market value. The valuer shall compare prices by referring to the prices recently assigned to a real property that is similar or comparable to the real property subject to valuation.
- **Comparison of land values countrywide as an alternative land valuation method:** Where comparable prices are not available for land in a particular area, the valuer may use comparable prices of similarly classified land from other areas of the country. Prices shall vary depending on the quality and location of the land. The valuer shall fulfil his/her valuation duties in compliance with principles and regulations governing the valuation profession and the Council.
- **Replacement cost approach as an alternative valuation method for improvements:** Where sufficient comparable prices are not available to determine the value of improved land, the replacement cost approach shall be used to determine the value of improvements to land by taking real property as a reference;
- **Use of multiple valuation methods** where real property valuation requires special skills, the valuer shall use whatever combination of the methods he/she considers best suited to determine the current market value. The methods used shall be clearly explained in the valuation report.
- Upon approval by the council, a valuer may use any other relevant worldwide methods not provided in this Law in order to carry out the assigned work.

To comply with both national and international policies such as World Bank OP. 4.12 on involuntary resettlement and JICA guidelines on environmental and social considerations, the consultant recommend to use the replacement cost approach as an alternative valuation method. This method does not consider only the assets value but also administrative cost and other costs required to have a new assets or property.

5.3.3. Compensation

When the land owner or the owner of property incorporated on land is satisfied with the

valuation, he/she shall sign or fingerprint the approved fair compensation reports. The deadline for signing or fingerprinting approved fair compensation reports may not be less than seven (7) days or more than twenty- one (21) days from the publication of the valuation report.

Within seven (7) days after the approval of the valuation report by the expropriator, any person to be expropriated who is not satisfied with the assessed value of his/her land and property incorporated thereon shall indicate in writing grounds for his/her dissatisfaction with the valuation report. Any person contesting the assessed value shall, at his/her own expense, engage the services of a valuer or a valuation firm recognized by IRPVR to carry out a counter-assessment of the value. The counter-assessment report must be available within ten (10) days from the application for counter valuation by the person to be expropriated.

Compensation can be paid in monetary form in the Rwandan currency or in any other form mutually agreed upon by the expropriator and the person to be expropriated. In reference to national laws, WB OP 4.12 and JICA guidelines for environmental and social consideration the consultant recommend the following compensation measures.

a) Compensation for land

Land for land compensation is desirable where feasible; however, it can be challenge for Rwamagana district to arrange alternative lands for the persons to be expropriated, because district does not have enough free lands. Therefore, cash compensation based on the replacement cost may be provided if there is no free land available. The value should be based on the prevailing market value in the locality and in reference to other compensation done recently in the project area. In addition, any associated costs of purchasing the land including land rates, registration fees will need to be included in the compensation calculation. Where land lost is only a small proportion of total land owned by the PAP, but renders the remaining land as unusable, the compensation provided should be calculated based on the total land affected (the actual land lost plus the remaining unusable land). Disturbance allowances equivalent to 5% will be provided.

During Public consultation some PAPs expressed the need of considering borrow pits and disposal area as temporary loss of land and prefer to be paid rental fees and given back the land after construction and rehabilitation. Others prefer to consider the land in disposal and borrow pits as permanent loss of land and to be is compensated as such. Since no concession found on this issue the assets valuar will assess case by case and made decision with PAPs and district land bureau.

b) Compensation for crops and trees

PAPs will be encouraged to harvest their produce before the construction start or before the area is submerged. In order to ensure that this is possible, there needs to be sufficient consultation beforehand so that harvesting can be properly planned. In the event that crops cannot be harvested, compensation for loss of crops and trees including value of fruit trees will be provided as follows.

- Provision of cash compensation for value of crops lost, at current market value;
- Provision of seed or seedlings appropriate for the resettled areas;

The cash compensation will be equivalent to the value of crop production lost, until the replacements are yielding to the same level (i.e., the period until the replacement seed/seedlings are producing whether the same year for annual crops, or longer in the case of shrub or tree crops).

- For fruit trees that take longer to mature and yield and are seasonal, the cost of the yields for the period that the tree will take to mature should be calculated including future price.

c) Calculation of income loss for agricultural activities

The income loss for agricultural activities is calculation of the income amount expected from production minus investment cost times the number of affected seasons.

d) Temporary land loss

The value for temporary land loss should consider the main activities done on the land and the time required to get back the land.

e) Calculation of income loss for cooperatives and union

The income loss for cooperatives and Cooperative union is equal to the expected charge of farmer's production. That is 5 Frw/kg for cooperative and 4 frw/kg for union times number of missed seasons.

CHAPTER SIX: PUBLIC CONSULTATION

6.1. Overview

Public consultation and stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an on-going process that involves the following elements; stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism and on-going reporting to affected communities. The public consultation was integral part of EIA and RAP preparation.

6.2. Purpose

- To prepare communities on potential emergency scenarios that could be caused by the project and can affect the community.
- To build a trusting relationship with the affected communities and other interested stakeholders based on a transparent and timely supply of information and open dialogue.
- To ensure effective engagement with local communities and other key stakeholders throughout all phases of the project.
- To actively build and maintain productive working relationships, based on principles of transparency, accountability, accuracy, trust, respect and mutual interests with affected communities and other stakeholders.

6.3. Public consultation and participation

Public participation and community consultation has been taken up as an integral part of RAP and EIA process for this project. Consultation was used as a tool to inform stakeholders about the proposed action both before and after the development decisions were made. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process helped in reducing the public resistance to change and enabled the participation of the local people in the decision making process. Initial public consultation has been carried out in the project areas with the objectives of minimizing probable adverse impacts of the project and to achieve speedy implementation of the project through bringing in awareness among the community on the benefits of the project.

As part of the project consultations, efforts were made to consult with the decision making official at central level as well as a number of local authorities, to determine their thoughts, opinions and feedback on the impact of the project of rehabilitation of irrigation facilities in Rwamagana district. Information and comments collected from the public early in the study process were of use. Local communities especially farmers who are currently using the marshlands were also consulted to give them the opportunity to express their views and concerns. As part of the process, they were also provided with relevant and sufficient information on the project prior to its start - up.

6.3.1. Stakeholders

Discussions with decision making bodies, key stakeholders, sector institutions and experts were made on the very concepts and nature of the proposed project, giving emphasis on levels of public participation, role of key stakeholders and joint contributions of these actors to the success of the project. In addition, the scope of the proposed project and possible means of maximizing local communities' social, economic and environmental benefits from the project implementation were underlined. Key stakeholders and authorities with whom consultations made at the project study areas were:

At national level:

- Ministry of Natural Resources: Director of environment, water and forest and legal specialist;
- Ministry of Agriculture and Animal Resources: irrigation and marshlands development specialist ;
- Rwanda Natural Resources Authority: Director of water resources management;
- Rwanda Environment Management Authority(REMA): In charge of pollution control
- Rwanda Development Board: Environmental Review Specialist;
- Rwanda agriculture Board: different member of irrigation and mechanization department;
- MINAGRI/SPIU for marshlands and hillsides irrigation projects (Environment officer, Irrigation engineer, Social safeguards specialist).

At local level:

- Rwamagana district authorities and staffs(Vice-Mayor in charge of economic affairs, Agronomist, Land valuar, Statistician, Environment officer and Director of planning);
- Sector agronomist;
- Cooperatives and Union leaders;
- Local mediators known as «Abunzi»

List of consulted people are attached in different appendices

6.3.2. Public participation - methods and process

During the public consultation, the study team applied different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD) and official meetings with stakeholders. Stakeholders consulted were informed on the proposed project and by using the key guiding questionnaires, the study was able to guide discussions and obtain relevant information on the likely impacts of the project activities.

During these consultations stakeholders and the communities were explained about the project, its benefits, social and environmental impacts. The participants were encouraged to (i) be open and make known their concerns and claims. The presentation highlighted the project background, objectives, expected upcoming activities, social economic information, environmental concerns and land acquisition process.

6.4. Consultative meeting with stakeholders and communities

Different meeting was organized by the study team from the earliest stage of project planning so as to present to all stakeholders the proposed project. In addition to public consultation meeting

with project beneficiaries or project affected persons, the study team held technical meeting and one to one meeting with stakeholders as well. Meetings and consultation continued throughout the study period and shall continue during the implementation phase.

6.4.1. Project Introductory meeting of 12th July 2016 at Cyaruhogo marshland

This meeting was organizing by JST which is conducting the preparatory survey on the Project. The meeting was organized with all stakeholders in order to introduce the project, planned activities and the need of cooperation from the beneficiaries (farmers, cooperatives and Union). The meeting took place on 12th July 2016 at «Cooperative de Riziculteurs de Cyaruhogo (CORICYA) office». The meeting was attended by the executive committee of the four cooperatives and the president of union of cooperatives, JST and their subcontractors for geotechnical investigation and topographic survey, and local authorities on district, sector and cell level. The pictorial views are presented below and attendance list attached as appendix 10.

After the welcome note provided the district representative, the JST introduced the project and provided details on rehabilitation of Rwamagana scheme project. He explained that the whole project shall consist at rehabilitation of the existing three dams and construct a new one for Cyaruhogo scheme, including main canal lining and establishment of strong cooperative through capacity building as well as irrigation water users association to ensure the sustainability of rehabilitated irrigation infrastructure.

The Africa Drilling & Exploration Company explained different type of drilling and pit tests soon to be done. He promised that farmer’s field which will be affected by the testing activities will be compensated for the damaged crop and his work will provide remunerable job to the community. The topo company explained the way the topo survey will be conducted and it will provide some work to the community.

After these presentations, participants were provided with time for question and discussions. The table below gives the main questions/concerns and explanations/answers as well some resolutions:

Table 19: Issues and answers recorded during initial consultation meeting

Questions/concerns	Answers/explanations
His concern was that there will be a missing rice cropping season during the rehabilitation of irrigation infrastructure and farmers has to be informed in advance to avoid the loss of their crop.	The consultant team told them that after preparation of the entire necessary, farmer will be informed the date of rehabilitation in advance so that the activity will begin with no crop in their field.
He asked if the sediments available in the reservoir of Cyimpima dam cannot be excavated in order to increase the retention capacity. For the rehabilitation of main canal, he asked too if the paddy field	He was answered that it is not ease to excavate around 46,000 m ³ of sediments in each affected three existing reservoirs and to find a place to put them. The current proposed solution is to raise the

upstream of the dam will be concerned.	height of the dam. For the upstream dam paddy field are not concerned by this project (out of scope).
Her concerns were about the sedimentation of Gashara Dam reservoir and fields. She asked too if the damaged Gaseke sub-dam, complementary to Bugugu dam to avail sufficient water, will be rehabilitated.	The consultant team answered that the current proposed solution for silted reservoir is to raise the height of dam instead of excavation. Again the sub-dam and field are out of scope of this project and will not be rehabilitated.
When the new dam will be constructed, some are have to be submerged by reservoir. How the affected farmers by losing the farm will be compensated?	The explanation of this question was given by District agronomist. All lands in marshland or valley are belonging to the government and farmers use the land through a rental basic. In case there is common development interest, the government requests the farmer to handover the land. In addition, he said that an inventory will be made to identify the current upper surface crops in order to avoid farmers who will plant some valuable crop or install some infrastructure by thinking to be expropriated with money.

After the presentation and discussion, participant to the meeting found the project interesting as it will resolve the insufficient irrigation water problem and hope to increase their rice productivity. Cooperative representatives were requested to convey the message to all cooperatives members and were requested to be supportive in order to conduct this survey successful.

6.4.2. EIA&RAP kick-off meetings

After the recruitment of the subcontractor for EIA and RAP study two kick off meeting were organized at RAB and Rwamagana district offices respectively. The two meetings aimed at introducing the EIA/RAP consultant and sharing available information on the proposed project.

The kick-off meeting at RAB office were attended by Managing director of Bureau for Environmental and Social Studies/BESST Ltd, the environment and social consultant from JST and, the representative of Irrigation, Land Husbandry and Mechanization Department in Rwanda Agriculture Board (RAB).

Points discussed in the meeting, include the proposed entitlement matrix, requested data from RAB and JST, size of environmental buffer zone, terms for GIS land use map and schedule for the further study and meetings. The table below summarize the outcome of the meeting.

Table 20: Outcome of the keck-off meeting at RAB office

Item	Discussion	Conclusion/agreement
Proposed Entitlement Matrix	Key point discussed include: <ul style="list-style-type: none"> - Responsibilities of compensation - Land ownership - Gaps between national and international regulations related to 	<ul style="list-style-type: none"> - Land expropriation and compensation are fully responsibility of the recipient government; - Land in the marshlands is government land and farmers are users;

	compensation	<ul style="list-style-type: none"> - Land for land compensation will be the first option and then comes cash compensation at replacement cost as much as possible for those who will lose his/her farming lands
		<ul style="list-style-type: none"> - The disturbance allowance is to be 5% of the total compensation cost. In addition, the RAB agreed to prioritize PAPs to be hired as construction labour during the construction period so as their income is to be restored
Requested Data from RAB and JST	<p>The following data were requested from RAB</p> <ul style="list-style-type: none"> - List of farmers who are currently using these marshlands and or Cooperatives - Selected/priority crops in these marshlands; - Any agreement with cooperatives who are using these marshlands(like Water fees); - Previous study conducted for these marshlands to be rehabilitated if An 	<ul style="list-style-type: none"> - RAB provided contact details for Cooperatives leaders who will provides the lists, - Rice is the priority crop selected - No agreement between RAB and cooperative - No study available
	<p>From JST:</p> <ul style="list-style-type: none"> - Preliminary studies/design/drawings of planned structure with their sizes/structure (dam and canals, reservoirs); - Materials to be used during constructions; - GPS coordinates and Maps for the location of dam axis and reservoir 	<p>JST shared GIS data including (1) shape files of marshland, land use, cadastral map, and contour line, (2) Typical cross section of four dams, and (3) JICA's ESCs guidelines (2010 in English version).</p>

After the kick of meeting at RAB, another meeting was held at Rwamagana district office and the JST EIA expert together with BESST Ltd team met with district staffs including the district agronomist, the district environment officer, the district statistician and the district coordinator of planning. The meeting aimed at introduction the EIA/RAP consultant and to request the district support for the study. In the meeting, the district staffs were explained the planned studies including the EIA, RAP and baseline data collection. After discussion, district staffs expressed their commitment to provide the full support and to avail different documentation. In the meeting with the district agronomist it was decided to have a meeting with farmers who are using the four marshlands.

6.4.3. Consultative meeting of August 23rd, 2016

The meeting was held on Tuesday, August 23rd, 2016, in Cyaruhogo marshland, Rwamagana. The objective of the consultation meeting was to discuss with stakeholders, project affected persons and local authorities the proposed project of rehabilitation of Cyaruhogo, Cyimpima, Gashara and Bugugu, environmental and resettlement impacts associated with the projects, preparation of resettlement action plan, project baseline data collection and creation of the irrigation Waters users associations (IWUOs).

The meeting agenda included:

- Presentation of the projects;
- Presentation on the creation of IWUO;
- Discussions on environmental impacts;
- Involuntary resettlement impacts;
- Discussion on compensation and grieves redress mechanism

The public consultation meeting was attended by 60 persons including 47 men and 13 women and was attended by the representatives from local authorities, projects affected persons, and cooperatives that use the marshlands as well as the project proponent and study team. Below are categories of participants:

- Representatives of projects affected persons/ farmers representatives;
 - Representatives from Rwamagana district (Agronomist, district environment officer and in charge of cooperatives);
 - JICA study team;
 - EIA& RAP study team;
 - Representative of RAB Eastern zone;
 - Sector agronomist;
 - Representatives mediators known as " Abunzi";
 - Executives committee of rice cooperative union;
 - Executive committee of 4 rice cooperatives(CORICYA, COCURICYI, COCURIGA and COCURIBU); and
 - Representatives of other marshlands users (association of water supply in Rwamagana).
- The full list of participants is attached as appendices 9.

- The meeting was introduced by district agronomist who made a brief presentation of the proposed project which includes rehabilitation of Cyimpima, Gashara, Bugugu and Cyaruhogo irrigation infrastructure. He pointed out that the project is being prepared by Japan International Cooperation Agency (JICA) and the Ministry of Agriculture and Animal Resources (MINAGRI) through RAB. The project will consist at rehabilitation of three existing dams at Cyimpima, Gashara and Bugugu with associated main irrigation canals. The project also includes the construction of new dam at Cyaruhogo Marshland. He explained that on-going study will include project technical design study, EIA and RAP including baseline data studies. After the presentation of the project, three presentations were provided including:

- the creation of irrigation water users association(IWUO)
- EIA, RAP preparation
- Compensation and grievance redress mechanism.

The first presentation was provided by the one in charge of water users association in RAB, Eastern zone and was supported by JST. The presentation focused on the objective of the creation of IWUO, the composition of different committees of IWUO, process and procedures of electing these committees, differences between organs of rice cooperative and organs of IWUO. It was highlighted that water users association are set-up to ensure that water are used in accordance with established plan and irrigation infrastructure are protected and maintained by farmers who regularly pay water use fees. Irrigation association will ensure the use of available water in consideration of different users, need water and in accordance to established calendar.

The second presentation focused on EIA and RAP preparation including baseline data study. The consultant presented the legal framework of EIA/RAP studies at both national and international level including JICA's new guidelines for environmental and social considerations. He explained the importance of public consultation in EIA/RAP process whereby project affected persons and other stakeholders are provided with information on the project and given time to express their views and concern.

Reference made to other similar projects, the consultant presented anticipated positive and adverse project impacts. Anticipated adverse impact include gradual soil acidification from unregulated fertilizer application, soil and water contamination from oil spillage of construction equipment, air and noise pollution, soil erosion and landslides from construction works, fire outbreaks, loss of biodiversity at dam reservoir on hillsides and valleys to project activity, land and crops, mostly to the reservoir, farmer's income lost by missing cultivation season during construction works, diseases contracted from interactions during construction, loss of existing infrastructure (portable water points, power lines), increase of HIV and other STD.

Among positive impacts the consultant mentioned job creation and income generation, knowledge transfer, increased production from farming all year round, market access for agricultural products, affordability of medical insurance and education as will have more resources, flood control, creation of habitat for fish at the reservoir.

The final presentation focused on compensation and grievance redress mechanism where the RAP expert from BESST Ltd focused on the process of RAP preparation with emphasize on compensation of project affected person and PAPs identification. She highlighted key anticipated impacts including the loss of land, loss of crops and trees as well as the loss of income. She mentioned that, although the project funds will be provided by JICA, compensation fees is the responsibility of the recipient country and both international and national involuntary resettlement policies and regulations will be complied with. The GoR will provide the

compensation of affected assets and the replacement cost will be calculated by independent valuar as provided by valuation law.

On the compensation measures, land for land compensation is the first option especially for land based impact and where this is not possible, cash compensation may be considered. In addition to the compensation, projects affected persons are given priority in jobs during construction.

In relation to the grievance redress mechanism, she pointed out that GRM committee will be established at site level and at district level and other administrative conflict resolution mechanism like mediators “abunzi”⁸ will be used. She concluded her presentation by urging PAPs, project beneficiary and other stakeholders to provide the required information. She also urged PAPs to participate in different RAP committee including GRM and resettlement committee. It was agreed that the cut-off date is August 25th, 2016 when baseline data collection starts. After each presentation, participants were provided with opportunity to express their views and concerns.

Table 21: Key questions/concerns and response provided.

Gender	Question	Answer
M	Who are members of executives	The executive committee of IWUO is made of eleven member including: <ul style="list-style-type: none"> - Executive committee(5) - Audit committee(3) - Conflict resolution committee(3)
	How does the manager of IWU work with the current Manager of Cooperatives?	These are two different institutions and there should be no conflict of responsibilities among them. The manager of cooperatives will collect water fees from cooperative members and deposits them to the IWUO account. The manager of IWUOs will manage the use of these fees. In addition he will ensure that all fees are paid and work with other institutions to recover unpaid fees.
	Who are eligible candidates for making IWUOs committees?	Only cooperatives members who do not have leading role in cooperatives are eligible for IWUOs committees. This is to avoid conflict of interests between users and water user’s managers.
	Who will elect the executive committee of IWUO? How election will be conducted?	The executive committee of IWUOs is elected by the three members from each farmers group who are eligible and will elect the 11 members of the executive committee.

⁸ Mediators«abunzi» is a judicial organ established by the law and are only used for cases that do not involve State or any other institution with legal personality

M	How other waters users will be represented in IWUO committees? What about other waters users?	Other users will be represented different committees.
	Should they pay water fees?	Other users who are not in farmers cooperatives will have to pay water fees in accordance with IWUO internal regulations
M	How the project is planning to compensate people who will lose production due to dam rehabilitation/construction since water will be stopped?	Affected people will be provided with employment in dam construction and they will be allowed to cultivate crops which do not need much water.
M	What about water points/springs that will be affected in dam reservoir?	By principle is to replace affected water points and expert from JST will identify potential water sources. Negotiations are on-going between RAB and JICA to know who will cover the cost. JST informed participant that so far, it's anticipated that Rwamutanazi, Cyaruhogo, Gahonogo spring are likely to be affected.
	She asked about the land that will be used as construction camp she wanted to know if owners will be provided with compensation.	All affected person will be compensated whether it's at dam sites, quarries site, construction camps and material deposit sites as long as the owners prove her/his ownership;
	Asked participants if there are farmers who have lands at Cyaruhogo dam reservoir.	Though the land at dam reservoir is government lands but farmers are using the land it will be checked if no farmers have land title in the affected area.
	He also wanted to know have the information provided in the meeting will be shared.	The information will be shared through farmer's group meeting and village meeting to be organized respectively by group and village leaders who were in the meeting.

6.4.4. One to one consultation

In addition to the public consultation meeting, the consultant team conducted one to one interviews with different official to discuss the projects and collect their views, concern and recommendation. Consultation conducted also allowed the team to collect different data and information related to the projects like existing laws, standards and policies helped. Below are the key stakeholders consulted?

- Ministry of Natural Resources: Director of environment, water and forest;
- Ministry of Agriculture and animal Resources: irrigation and marshlands development specialist ;

- Rwanda Natural Resources Authority: Director of water resources management, legal officer, in charge of water quality,
- Rwanda Environment Management Authority (REMA): in charge of pollution control
- Rwanda Development Board RDB: Environmental Review Specialist.
- Rwanda agriculture Boards: different member of irrigation and mechanization department
- MINAGRI/SPIU for marshlands and hillsides irrigation projects(Environment officer, irrigation engineer, social safeguards specialist)

Key issues identified during one to one consultations include:

- Pollution of water bodies during construction and from non-point sources during project implementation, Soil erosion, Sedimentation of river due to excavation around the river, Possibility of loss of property , crops and trees, Disturbance of water table, loss of biodiversity.
- Likelihood of delays in compensation of PAPs, which could escalate into disputes, Execution period, Employment for their citizen, cost and accessibility of potable water waste management and disposal, Source of construction material, health insurance; connectivity to the existing network, cost of land acquisition and eligibility criteria.;
- Possibility of low wages to local workers during construction works;
- Payment of water fees;
- Roles and responsibilities in implementation and monitoring of ESMP/RAP;

The results of these consultations were the basis of the preparation of mitigation measures, monitoring parameters and institution arrangement.

6.5 Additional public consultation at draft stage

At drafting stage further consultation meeting were conducted with PAPs and key stakeholders. These meeting discussed key findings of the assessment and compensation alternatives.

6.5.1. Consultative meeting with the head of land husbandry and irrigation in RAB

The meeting was held in the office of the Head of Land husbandry Irrigation and Mechanization department, Rwanda Agriculture Board (RAB) on October 17th, 2016. The main purpose of this meeting was to meet head of Lim, RAB and argue on the progress of the preparatory survey on the Project and upcoming work on site. There were two agenda for this meeting:

- Hydro-geology and resistivity survey on site; and
- Compensation to farmers who will be affected by this project.

On the hydro geophysics, the meeting observed that there is need of some data to be acquired. According to the previous experience, it was not easy to acquire the requested data when this was done by the foreigner company to the government institutes. He asked to make list of necessary data and give it to RAB. Then RAB will make request to the concerned Ministries or institutes especially to Rwanda Natural Resource Authority (RNRA).

In relation to farmers that will be affected during construction, the JST informed the meeting that new JICA guidelines on environmental and social considerations requires project to align with not only the domestic laws and regulations, but international standards like JICA and WB's operational policy, while the previous one just requested to align with the domestic laws and regulations in general. According to this new guidelines, the farmers whose means of livelihoods are to be affected due to lack of irrigation water during the construction are subjected to be compensated regardless of availability of land title. On this issue he recommended to make a list of farmers to be affected, nature of impact its cost. Above information should be presented on RAP report which will be submitted to RAB. The full minutes are presented in appendix 12.

6.5.2 Meeting with cooperatives members

Two general meeting were organised with cooperative members one in Gashara on November 10th and another in Cyaruhogo on November 11th, 2016. The two meeting discussed the findings of impact assessment, key impacts identified as well as alternative compensation measures. People who attended the meeting were mainly farmers who will lose income during construction due to lack of irrigation water. In total 156 People attended both meetings and attendance list are attached as appendix 13.

After consultant presentation, PAPs were provided time to ask questions and provide suggestions. The table below summarize key concern/issues raised and answers provided.

Table 22: Questions asked and answers provided during Gashara meeting

No	Sex	Question/comments	Answer provided by Consultant
1	M	Farmers who are growing other crops in upland near the marshland will be affected? Will they continue to grow their crops during construction	Only crops that require irrigation water will be affected. Farmers will continue to use this land during construction (consultant).
2	F	Shall we use the land in rice scheme for other crops?	Most of farmers who attended the meeting prefer to not use the land for other crops because it may have negative impact on rice (Farmers).
3	M	How many seasons are we going to miss?	The number of season to be missed will be known after final design study and construction schedules. However reference made to other similar number of missed season range between 2 and 4 (consultant).
4	M	He expressed the concern related to cooperatives and union that will not be able to pay their employees during Construction	The issue shall be considered in RAP and loss calculation and means of compensation will be proposed in RAP. (Consultant).

5	F	Is there any compensation for the income loss during construction?	The income losses during construction have been estimated and means of compensation shall be proposed in the RAP including jobs during construction and other possible assistance to be agreed between RAB and farmers (consultant).
6	M	Will it be possible to share the land with People who will lose land in submerged area?	According to RAB and reference made to other similar project, all farmers who will lose land will be compensated whether in cash or land for land (consultant).
7	M	Is there any land redistribution planned after construction?	This will be decided after rehabilitation and this will depend on new irrigation land secured. This has been done for some marshlands developed under RSSP 3
8	M	Are we going to be given Jobs during construction?	Project affected person will be given priority in during recruitment of labour.

Source: BESST Ltd, 2016

Table 23: Question asked and answers provided in Cyaruhogo meeting

No	Sex	Question/comments	Answer provided by Consultant or farmers
1	M	The road between Cyimpima and Cyaruho is preventing water to rich plots in Cyaruho marshlands. Is there any plan to widen waterways under the Roads?	There was no plan to rehabilitate this Road but the issues will be brought to relevant institution (consultant).
2	M	In Cyaruhogo we are using rain water. Are we going to be affected during construction?	Crops that depend only on rain will not be affected but the water from the stream will be affected during filling of the dam and this should be considered.
3	M	Asked whether works will start at the same time at all marshlands? My recommendation is to start works at the same time and complete it as soon as possible.	This will be decided during final design and during the establishment of construction schedule (consultant).
4	M	He appreciated the initiative of rehabilitation of these infrastructure because there will be able to use all the marshlands and have two full season.	
5	F	She was worried about payment of their employees because they	The income loss has been calculated for both farmers and Cooperatives and the results will be

		depends on farmers contributions.	brought to RAB and shall be discussed together with other compensation for income loss.
6	M	He raised the issue related to floods from Lac Mugesera and water from Cyaruhogo and Cyimpima	The construction of dam at Cyaruhogo and the rehabilitation of Cyimpima dam as well as the rehabilitation of intakes will help to control floods downstream (consultant).
		Is there any plan to rehabilitate dryers?	So far, only dryers that will be used during construction will be rehabilitated.
8	M	He suggested starting construction in dry season after harvesting as a way of reducing income loss.	This will be considered during final design and establishment of project schedule consultant).
9	F	He asked whether they are going to pay rental fees during construction	Usually rental fees is paid when the farmers is using the land. Cooperative leaders shall request the district to suspend these fees during construction.

Source: BESST Ltd, 2016

6.5.3. Consultative meetings with land owners

Special attention was paid to PAPs who will lose their land, trees and crops and the consultant organized specific meetings with project affected people especially those who are likely to lose their trees, crops and land whether temporary or permanently in submerged area, disposal, borrow pit and construction camp sites. These meetings aimed at providing them with information on the size of land to be affected and their compensation rights. It was also the time to confirm the initial identification and make sure that all PAPs are identified.

The consultant explained to the PAPs the proposed activities in line with the rehabilitation of irrigation facilities and impact so far identified. Among the identified impacts, the consultant highlight loss of land whether temporary or permanently, loss of crops and trees as well as loss of income due to loss of water during construction. The consultant explained also the provision of expropriation law, the valuation and compensation process in the country but also provisions of international policies related to involuntary resettlement including JICA guidelines on environmental and social considerations. After the presentation, PAPs were provided with time for questions and comments.

Below are photos taken during consultation and summary of questions and answers or comments recorded during consultation meetings.

The following table summarize key questions and response provided in these meetings.

Table 24: Questions and answers provided during consultation Meeting with PAPs

No	Question/comments	Answers provided by consultant
Consultative meeting in Cyimpima marshland		
1	How are we going to know the value of our properties?	RAB in collaboration with Rwamagana District will hire an independent valuer who will agree with assets owner the compensation value.
2	When the project implementation will start so that we can plan for our agriculture activities?	It is anticipated that construction will start in 2018, but upon the completion of final design studies, farmers will be informed on construction schedule. Just after the year 2017. There is no problem in the whole year 2017. People can cultivate as usual.
3	Will the project gives us the jobs or it will use machines?	Though some activities will require the use of machines, other works will be performed by people and affected people will be given priority.
4	What are the mechanisms that are you putting in place to ensure that local are provided with jobs?	First of all, locals will be provided with information on time but also during the preparation of construction contract RAB shall emphasize the use of local resident in construction work where possible.
Gashara consultative meeting		
1	Sometimes the fees paid as compensation is not enough to buy another land. What are you planning to address this issue?	There will be compensation for land owners and Special attention will be taken on these who are going to lose government land. RAB will hire an independent valuer to provide the replacement cost. For the person who disagrees with the value assignment to his/her property appealing measures are provided.
2	When are we going to get results of your data collection?	This exercise is the initial identification of assets and PAPs and results will be included in RAP report which will be made public. However a final asset valuation will be conducted and every PAP will sign on the valuation form after verification of his attest and its value
3	Where beacons have been installed in dam area is the last limit of the land to be	Beacons were used to establish the full water level and using this line will be used

	acquired?	to determine the land to be submerged.
5	Will farmers allowed to continue to use the land located after full water level?	Yes, but a buffer of 20 m will be required for dam protect. Farmers who have land in these meter will receive compensation
6	The road has been placed in the buffer, but even before we had fear that heavy cars could fall in swamp. Is there any plan to relocate the Road?	This will be checked on engineering design document. If found that it is the case, measures will be provided.
7	What about the water point that will be affected? Said: Executive Secretary of Nawe Cell	The design study is conducting field survey to identify potential source of water and affected water point shall be replaced.
9	One PAPs wanted to know the size of his land that will be taken.	All affected land has been measured by GIS expert and though the final design are not yet completed everyone who wants to see his affected land can consult the GIS expert after the meeting. This was done.
Bugugu consultative meeting		
1	Will our land be taken without compensation?	Private land will be compensated and care will be taken to the ones who will lose government land.
2.	What kind of compensation will you give us?	Compensation measures will be provided based on eligibility criteria and the nature of Impact and the compensation may include land for land compensation or monetary compensation. Especially for crops and trees.
3	When shall the construction start?	The final date for construction is not yet fixed but construction works are expected to start in 2018. Farmers will be informed about construction schedule in due time.
4	I f one people has two plots in marshland will be counted two times or will be merged.	If the land is for the same use and fall in the same category these areas are to be summed up in order to avoid double counting.
5	We cannot be against public interest but, but what are the support are we going to receive from the government?	Compensation will be provided to the affected people and job opportunities will be provided during construction.
Consultative meeting at Cyaruhogo		
1	We were living for our land. What do you think for us when the project starts?	Owners of private land will be compensated. These who live by government land in affected area will be

		considered for different supports and follow of their living conditions. Depending on available land, RAB will provide land to those who were using government land.
2.	Will all marshland be prepared?	The project will rehabilitate dams and main canals. Secondary canal and marshland levelling is the responsibility of farmers and Cooperatives.
3.	Existing water point is serving five villages:Nyagatare, Rusenyi, umurehe, Kabuye and Nawe, is it going to be replaced?	Yes, affected water points will be replaced and the identification of potential source is on-going.
4	The Government has given me the land by lease, but I have done some expropriation. Will that land be taken freely?	The provision of leasing agreement will be considered and any investment made on the land provided.

NB: Attendance list are presented in appendix 14

6.5.4. Consultation meeting with big land owners at district office

Most of the big land owners did not attended consultative meeting and the consultant discussed with their representatives met on the site but it was deemed necessary to meet the big land owner so as to get their views on proposed project and discuss with them proposed measures. The meeting was organised by Rwamagana district and held on Tuesday November 29th, 2016 in Rwamagana district office. Fourteen (14) participants were present in the meeting including 12 men and 2 women and only one person from all invited project affected persons didn't attend the meeting due to personal reason.

The meeting was supposed to be opened and chaired by the Vice Mayor in charge of economic affairs but PAPs did not attend on the time and he delegated the district agronomist since the Vice-mayor had another meeting. In his opening remarks, he appreciate the participants to attend the meeting and briefly explain the purpose for the meeting including the presentation of the project to the PAPs, presentation of key resettlement impacts, presentation land required by participant, legal provisions and proposed entitlement matrix. After the opening remarks, detailed presentation was provided by EIA and RAP team lead by the study team leader.

In his presentation, he provide a brief background of the project, EIA and RAP preparation process and progress and highlighted the importance of public consultation in EIA and RAP preparation. Both national and international policies related involuntary resettlement were described and key provision highlighted including eligibility criteria, compensation measures, rights and obligations of different stakeholders involved in involuntary resettlement.

Furthermore, the consultant explained the object of the EIA and RAP studies including avoiding adverse impacts of the project; reducing these impacts when avoidance is impossible and providing compensation for affected assets. The consultant pointed out key resettlement impacts identified and their proposed major. Among the identified impacts he mentioned loss of land whether temporary or permanently, loss of trees and crops, loss of income and loss of some infrastructure such water points. After the general presentation, the consultant explained the specific land required from every participant using maps that show the location and size of the land.

After the presentation, participant was provided time for question, clarifications and all of them supported the project but requested the district to provided appropriate compensation for their loses not only for the land and trees but also their investment. The table below summarize the questions/clarifications and answers recorded in the meeting where as the full minutes and attendance list are provided in appendix 15

Table 25: Question and answers provided in the meeting

No	Question	Answer/Comments provided
1	He began giving thanks to JICA and Rwamagana district for information about the project and he asked if he will get some assistance apart from compensation due to the big investment of sixty millions Rwanda francs (60,000,000Frw) from the bank he put on his project and currently he harvest the production of about ten millions Rwanda francs (10,000,000Frw) annually.	The representative of Rwamagana district, replied that there will be particular discussions between district authority and the PAPs about their affected assets including investment made. He requested him to put together all documentation related to his investment
	He continued asking District authority to help him to address direct impacts due to some village leaders who are telling people that he has no longer right on his land	He promised to work with village leaders and local authority to handle this issue.
	He also requested the district to consider 122 farmers that he was using on his land	On these issues the Consultant BESST Ltd explained that those farmers were considered together with other farmers who are losing government land and will be considered.
	He requested to rectify the map showing the land in buffer zone as some part was left out.	This will be rectified (consultant)

2	She had worries about valuation methods to be used during assets valuation of assets if they are only considering land and trees without considering big investment they put on their project.	Team Leader BESST LTD answered her that as provided by both national and international policies, the independent valuer shall use different valuation methods including replacement cost. ⁹
	She asked another question concerning buffer zone, if they can use it for their livestock after project implementation.	The allowed activities on buffer zones are the ones that cannot affect the dam and if it's found that their activity is not suitable for dam protection, then they will be compensated.
	She also asked question about the size of buffer zone.	Though the law request 50m for lakes, the proposed buffer zones is 20m from FWL and all activities should be done after this distance.
	She asked another question related to the inconsistency about the land they have and the one appearing on land title and which one will be considered during compensation.	All people with land titles with errors should approach district land bureau and correct them early before assets valuation for the land area that will be considered is the one on land title (land officer).
3	He asked how long the rehabilitation of borrow pit will take and if it will really become like it was before project implementation so that they may use it for the same activities as before.	The answer was that if he prefers to get his land after construction he will be provided with compensation for temporary loss up to full rehabilitation of the land (consultant).
4	He clarified that some of the lands on the map should be clearly separated.	This will be rectified.
5	They say that they are okay with explanations but requested the contact number for further clarifications if the people they are representing need more clarification.	They got the phone number of district agronomist, District Vice mayor in charge of Economic Affairs and the Consultant.
6	He suggested that all land in buffer zones should be compensated and managed by the district for effective protection.	This recommendation will be included in both EIA and RAP (consultant).

⁹ The estimated cost in the report is based on the value of affected assets in reference to similar projects. The replacement cost shall be used by independent valuer and PAPs will have to justify the investment made on the land.

CHAPTER SEVEN: RAP IMPLEMENTATION ARRANGEMENTS

The overall coordination of the RAP implementation will be provided by the MINAGRI through Rwanda Agriculture Board. Stakeholders that will be involved in the implementation of the RAP are described in detail below. The implementation arrangement builds on responsibilities already in place to ensure that the requirements of this RAP are met. At local level, Rwamagana district is the responsible institution of RAP implementation.

7.1. National level implementing institutions

7.1.1. Ministry of Agriculture and Animal Resources (MINAGRI)

MINAGRI is the main agency involved in implementation of the Rwamagana irrigation project and will have overall responsibility for implementation of the RAP. The Ministry will be the one to sign the financial agreement on behalf of the Government of Rwanda and shall request the required funds for compensation from Ministry of Finance.

7.1.2. Ministry of Natural Resources/MINIRENA

MINIRENA governs the implementation and application of the organic land law and the Land Use Master Plan. While the Ministry deals with overall land policy and the alignment with these laws at the national level, responsibilities for their implementation locally has been devolved, following decentralization, to Rwanda Natural Resources Authority (RNRA), district land bureau, commissions and committees at district, sector and cell levels. MINIRENA is the institution that has the authority to lease marshland and in this RAP will therefore play a critical role in ensuring that appropriate and consistent compensation is provided to all affected persons resulting from this project and provides data where there is grievance on land ownership and local authority fail to solve it.

7.1.3. Rwanda Agriculture Board

The project of rehabilitation of irrigation facilities in Rwamagana district will be implemented by Rwanda Agriculture Board (RAB). Therefore, RAB will be the leading institution in the implementation of the RAP. The role of RAB will be to implement the RAP, coordination of monitoring activities, maintenance of monitoring information, building the capacity of other stakeholders in collection and analysis of monitoring data. RAB will designate social safeguard specialist or assign this role to one of its current staff and the assigned person will be the focal point for RAPs implementation and will liaise with other stakeholders. RAB will also act as the central agency responsible for holding all information relevant to the RAP.

The designated staff will ensure that procedures and requirements of the Rwandan laws, JICA guidelines for environmental and social consideration as well as the requirements under OP 4.12 are complied with. A key role will be to implement the RAP and other resettlement-related activities and to ensure that all procedures have been adhered to and that there is consistency in approach between sub-projects activities. He/she will also undertake the main monitoring and evaluation role of resettlement activities during and post implementation.

7.1.4. Rwanda Natural Resource Authority/ RNRA

RNRA through its department of land administration and mapping is the organ responsible for overall management and coordination of all activities related to land administration, land use planning and management in Rwanda. The role of RNRA in RAP process will be to advise on matters related to land ownership and expropriation. District land bureau in close collaboration with project staff will check and approve valuation forms, various maps and approve land surveys carried out during valuation exercise. After compensation RNRA will also participate in the process of transferring land titles as appropriate.

7.2. Implementation arrangement at district level

The direct implementation of RAP is done at district level and different key player are presented below.

7.2.1. Rwamagana district

Reference made to the section 3.6 of land law, the District Land Bureau (DLB) is a district based institution authorized by law to manage land. The DLB will be responsible for ensuring activities undertaken comply with the national and district level Land Use Master Plans. They will assess the validity of land tenure rights of affected persons and eventually provide the land use permit for the new activity proposed by the sub-project. In addition they will be responsible for ensuring effective grievance mechanisms are in place. They will also be used in the implementation of RAP as much as possible in order to ensure that community buy in is present at an early stage hence reducing disputed or grievances. Their activities will be monitored by the district Executive Committee.

The DLB will play a major role in RAP implementation by:

- Monitor and approve activities pertaining to valuation of land and other immovable property;
- Demarcate and approve land cadastral;
- Establishing project level resettlement and compensation committees at Site and district levels;
- Clarifying the policies and operational guidelines of these resettlement and compensation;
- Establishing standards for unit rates of affected assets and compensation estimates, according to the standard units appended to the RAP, adjusted for local conditions where necessary; and
- Coordinating and supervising implementation of RAP as stipulated in the RAP,

The land Bureau will be supported with land office at sector level and community development officer at cell level.

7.2.2. District Resettlement and Compensation Committee

The Rwamagana district will work closely with Rwanda Agriculture Board in the implementation of this RAP. A team that includes District Community Development Officer, a Civil Engineer, District Land Bureau officer, and Social Safeguards specialist from RAB, Executive secretaries of affected sectors and PAPs representatives will be responsible for resettlement and ensure that the RAP is properly applied across all sites. The team will be supported by the project Social Safeguards officer based at RAB office.

7.2.3. Resettlement and compensation committees at site level

Based on the spatial location of project sites, it is proposed to have a committee at each marshland. District Land Bureau will be responsible for electing members of site resettlement and compensation committees. This committee will be constituted for the sole purpose of RAP implementation arrangements, and will operate at site level. It is proposed to be supported technically by in charge of land and settlement at sector level and community development officer at cell level. The committee would comprise the following:

- Representative from sectors
- Representative of cells that are affected
- Representative from any other key sector office involved in the project;
- Two representatives of PAP by cells (equal gender representation).
- Representative of rice cooperative and non-rice farmers cooperative.

The Resettlement and Compensation Committee would have responsibility for:

- Verifying PAPs documentation;
- Validate inventories of PAPs and valuation of affected assets;
- Allocate land, where required, to permanently PAPs;
- Monitor the disbursement of funds;
- Facilitate conflict resolution and addressing grievances; and
- To ensure the support and assistance to vulnerable groups including disable, orphans, and the old persons among others.

This committee should meet on a regular basis (as determined by the needs of the project) to ensure that compensation activities are appropriately designed and executed.

7.2.5. Project Affected Persons

This group of people will also help identify community projects that will lead to the uplifting of the lives as well as share in Rwamagana Project benefits. PAPs will also participate in planning and implementing resettlement programs. They will also participate in different meetings; provide information during assets valuation as well as in GRM process.

Table 26: Summary of institutional responsibilities for RAP implementation

Institutions	Responsibilities
MINAGRI	<ul style="list-style-type: none"> - Collation of information regarding Rwamagana Project, including RAP documentation. - Review and approval of related documentation from project (screening forms, RAP reports etc.) to ensure consistency and compliance.; - Overall monitoring and evaluation of resettlement implementation (i.e., annual audits; - Ensuring that RAPs are implemented in accordance with Rwandan laws and OP 4.12, as well as JICA guidelines
RAB	<ul style="list-style-type: none"> - Designate a social safeguard specialist(s) who will be the focal point for RAPs implementation and will liaise with other stakeholders. - Initiate the expropriation process and compensation requirements; - Preparation and signature of compensation grant agreement with the

Institutions	Responsibilities
	<ul style="list-style-type: none"> district; - To establish Resettlement and Compensation Committee in consultation with District Land Bureau; - Have a representation in District Resettlement and Compensation Committee - Provision of capacity building and technical support relating to expropriation and compensation activities; - Ensure funds allocated appropriately, according to RAP; - Prepare the RAP closure report and file all documentation related to RAP implementation; - Hire independent assets valuar upon the completion of final detailed design study.
MINIRENA	<ul style="list-style-type: none"> - To ensure that the expropriation process is done in compliance with land policies, land law and expropriation law; - Ensure the RAP is within the context of national land use plan.
RNRA	<ul style="list-style-type: none"> - To advise on matters related to land ownership and expropriation activities; - To participate in verification of land ownership and land titles.
District	<ul style="list-style-type: none"> - Verify land owners from records of land register; - Monitor and approve activities pertaining to valuation of land and other immovable property; - Approve land expropriated land surveys; - Coordinate the establishment of Resettlement Committees; - Work in collaboration with the Resettlement and Compensation Committees to ensure that the valuation and compensation is done in accordance with the law and the requirements of this RAP. - To facilitate the PAPs to purchase new land; - Facilitate the transfer of land titles after;
District Resettlement Committee	<ul style="list-style-type: none"> - Verifying PAPs - Validate inventories of PAPs and valuation affected assets; - Allocate land, where required, to permanently affected households; - Facilitate conflict resolution and addressing grievances.
Site resettlement Committee	<ul style="list-style-type: none"> - Help in creating awareness on expropriation process; - Monitor the implementation of expropriation closely with environment protection committees to monitor the use of marshlands and reserved areas; - Conflicts resolution; - Help in land demarcation confirm holders of land rights during land resettlement process, participate in the identification of community settlement sites, identify and list escheat land, and serve as witnesses in compensation and resettlement
Mediators/ Abunzi	<ul style="list-style-type: none"> - Resolving disputes - Provide grievances mechanism following land acquisition. - Help in designing RAP at the community level to ensure community buy in.

Institutions	Responsibilities
Project Affected Persons	<ul style="list-style-type: none"> - Be present when the land survey and inventory is being carried out - Provides all required information in regards to resettlement activities - Participate in expropriation activities

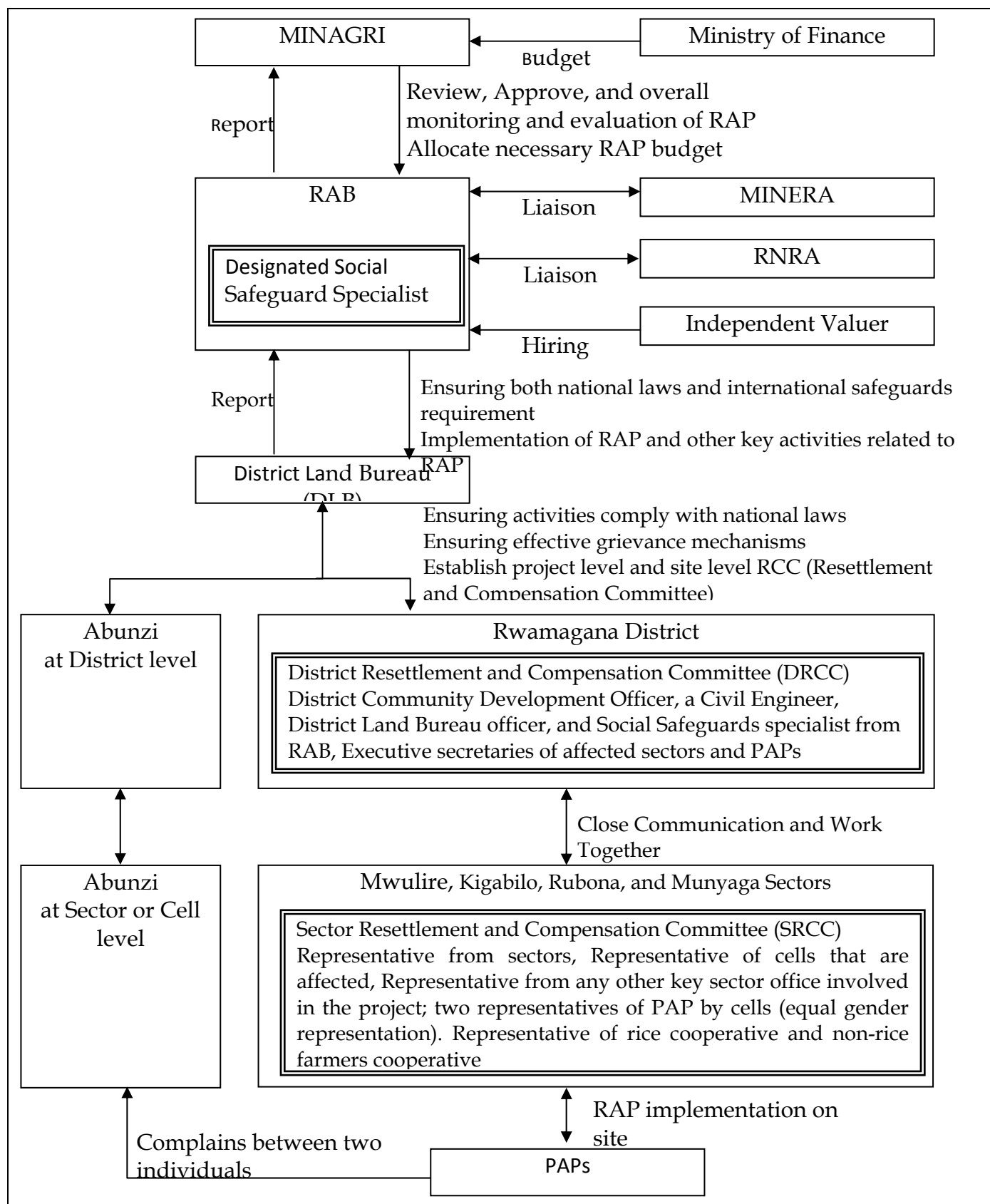


Figure: RAP implementation flow

7.3. Grievance Redress Mechanism (GRM)

The district of Rwamagana is an acknowledged institution for which the PAPs have been made aware of as avenues for expressing discontent and disapproval to the resettlement and compensation process. Article 26 of the expropriation Law N0 18/2015 of 19/04/2015 provides complaints procedures for individuals dissatisfied with the value of their compensation. The law stipulates that dissatisfied persons have a period of 30 days after project approval decision has been taken to appeal (Article 19).

Grievance procedures are required to ensure that PAPs are able to lodge complaints or concerns, without cost, and with the assurance of a timely and satisfactory resolution of the issue. The procedures also ensure that the entitlements are effectively transferred to the intended beneficiaries. Stakeholders will be informed of the intention to implement the grievance mechanism, and the procedure will be communicated at the time that the RAPs are finalized. Grievances may arise from members of communities who are dissatisfied with eligibility criteria use, community planning and actual implementation or compensation.

7.3.1. Process of grievance

The overall process of grievance is as follows:

1. During the initial stages of the valuation process, the affected persons will be given copies of grievance procedures as a guide on how to handle the grievances.
2. The process of grievance redress will start with registration of the grievances to be address for reference, and to enable progress updates of the cases.
3. The project will use a local mechanism, which includes resettlement committees, peers and local leaders of the affected people. These will ensure equity across cases, eliminate nuisance claims and satisfy legitimate claimants at low cost.
4. The response time will depend on the issue to be addressed but it should be addressed with efficiency.
5. Compensation will be paid to individual PAPs only after a written consent of the PAPs, including both husband and wife.

7.3.2. Procedure of grievance

The aggrieved person should file his/ her grievance, relating to any issue associated with the resettlement process or compensation, in writing to the sub-project Resettlement and Compensation Committee. The grievance note should be signed and dated by the aggrieved person. The designated RAB officer and the Resettlement and Compensation Committee will consult to determine the validity of claims. If valid, the Committee will notify the complainant and s/he will be assisted. The Resettlement and Compensation Committee will respond within 7 days during which time any meetings and discussions to be held with the aggrieved person will be conducted. If the grievance relates to valuation of assets, a second or even a third valuation will be undertaken, until it is accepted by both parties. These should be undertaken by separate independent valuers than the person who carried out the initial valuation.

If the aggrieved person does not receive a response or is not satisfied with the outcome within the agreed time, she/he may lodge his/her grievance to the relevant local administration such as the District Land Bureau, also mandated to help resolve such matters. If requested, or

deemed necessary by the subproject Committee, the District Project Coordination officer will assist the aggrieved person in this matter.

The relevant Local Administration will then attempt to resolve the problem (through dialogue and negotiation) within 30 days of the complaint being lodged. If no agreement is reached at this stage, then the complaint is dealt with through the local courts (Abunzi) where possible. Where matters cannot be resolved through local routes, the grievance will be referred to higher authorities at the national level. The Resettlement and Compensation Committee will provide assistance at all stages to the aggrieved person to facilitate resolution of their complaint and ensure that the matter is addressed in the optimal way possible.

If administrative ways of grievance redress is not enough to address the complaint, then the unsatisfied person may refer to judicial system. Based on the nature of complaints, the process will start from mediators for assets below 3 million Rwandan francs and if the value is more than three million, the process will start from intermediate courts, high court and to Supreme Court. The proposed grievance redress system is as illustrated follows:

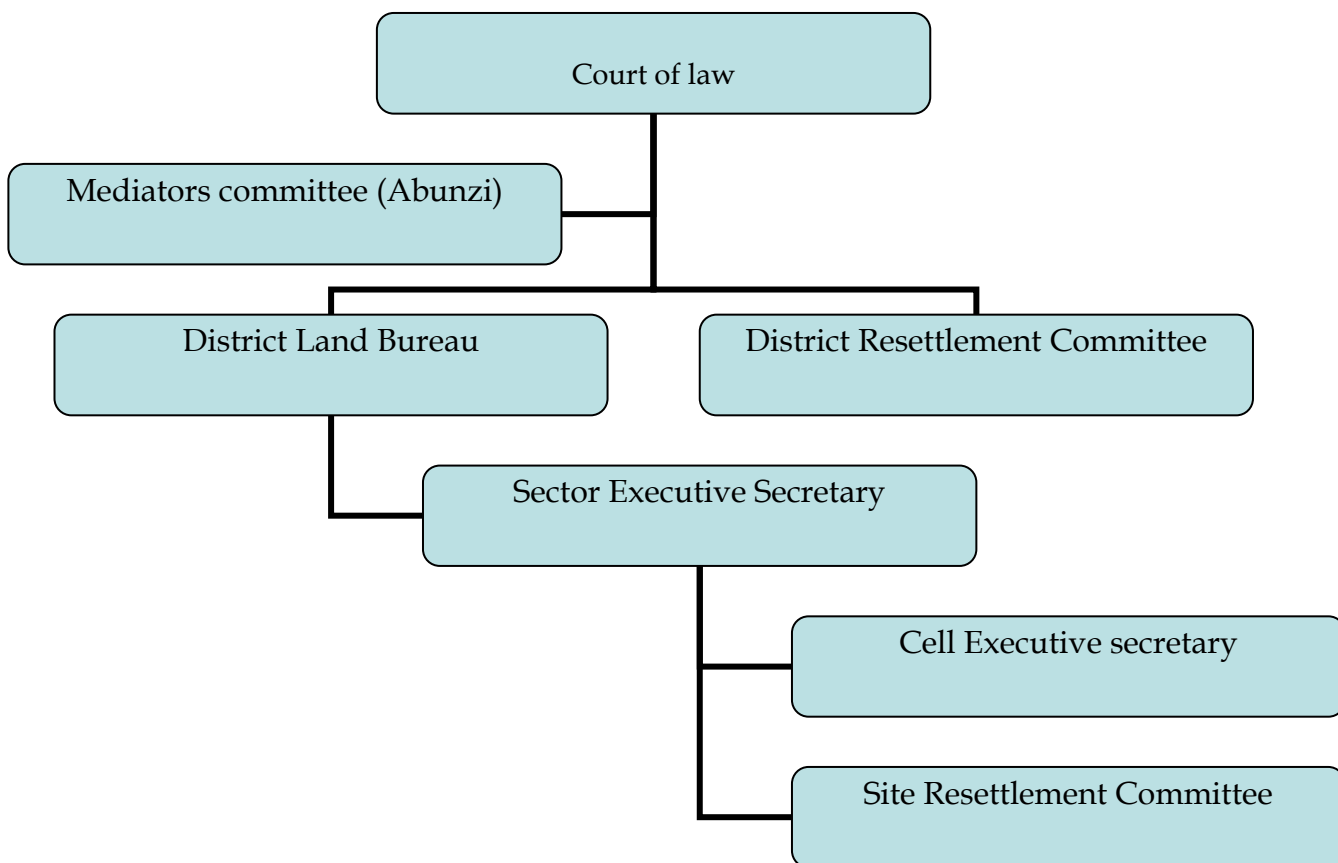


Figure 15: Proposed GRM flow chart

7.3.3. Grievance log

The District Land Bureau will ensure that each complaint has an individual reference number, and is appropriately tracked and recorded actions are completed. The log will contain record of the person responsible for an individual complaint, and records dates for the following events:

- Date the complaint was reported;
- Date the Grievance Log was added onto the project database;
- Date information on proposed corrective action sent to complainant (if appropriate);

- The date the complaint was closed out; and
- Date response was sent to complainant.

The District Project Coordination officer will be responsible for:

- Providing the resettlement and compensation committee with a weekly report detailing the number and status of complaints;
- Any outstanding issues to be addressed; and
- Monthly reports, including analysis of the type of complaints, levels of complaints, actions to reduce complaints and initiator of such action.

Implementation schedule has not been fixed yet at this point; however, after the approval of official agreement between Rwandan Government and Japanese Government, the implementation will started. There will be several steps to be followed during the preparation; the schedule has yet to be fixed, though. The proposed implementation RAP after the project approval is as shown in the following table.

Table 27: RAP preparation and implementation schedule

Item	year	2017						2018												2019												2020				
		Month	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Month accumulated		1	2	3	4	4	5	6	7	8	9	10	11	12	13	14	14	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Final detailed design and tendering																																				
Final cut-off date																																				
Establishment of resettlement committee																																				
Final assets valuation																																				
Compensation agreement																																				
Compensation																																				
Construction																																				
Monitoring and grievance redress (for 2 years minimum)																																				
RAP closure report																																				

7.5. Monitoring

The objective of the monitoring and evaluation process will be to determine whether PAPs have been paid in full and before implementation of the subproject, and people who were affected by the subproject have been affected in such a way that they are now living a higher standard than before, living at the same standard as before, or they are they are actually poorer than before. The arrangements for monitoring the compensation activities will fit into the overall monitoring program of the entire Rwamagana Project, which will fall under the overall responsibility of the JICA and MINAGRI.

7.5.1. Monitoring indicators

A number of indicators would be used in order to determine the status of affected people (land being used compared to before, standard of house compared to before, level of participation in project activities compared to before, how many kids in school compared to before, health standards and so on). Therefore, the resettlement and compensation plans will set two major socio-economic goals by which to evaluate its success: Affected individuals, households, and communities are able to maintain their pre-project standard of living, and even improve on it; and the local communities remain supportive of the project. In terms of the resettlement process, the following indicators could be used to understand the success of the measures identified and the working of the relevant parties in implementation the RAP:

- Percentage of individuals selecting cash or a combination of cash and in-kind compensation;
- The number of contentious cases as a percentage of the total cases;
- The number of grievances and time and quality of resolution;
- Number of impacted locals employed by the civil works contractors; and
- General relations between the project and the local communities.

These will be determined through the following activities:

- Questionnaire data will be entered into a database for comparative analysis at all levels of local government;
- Each individual will have a compensation dossier recording his or her initial situation, all subsequent project use of assets/improvements, and compensation agreed upon and received.

The District authorities will maintain a complete database on every individual impacted by the sub-project land use requirements and compensation, land impacts or damages; and RAB should prepare Resettlement Completion Reports for RAP, in addition to other regular monitoring reports.

The project Resettlement and Compensation Committee will facilitate coordination of information collation activities (such as surveys, supervising documentation) in accordance with procedures put in place. RAB will provide training, technical support and funds to ensure that this happens. In order to assess whether these goals are met, the RAP will indicate parameters to be monitored, institute monitoring milestones and provide resources necessary to carry out the monitoring activities.

7.5.2. Monitoring of livelihood restoration

The purpose of socio-economic monitoring is to ensure that PAPs are compensated and recovering on time. A number of indicators will be used to determine the status of affected people and appropriate parameters and verifiable indicators will be used to measure the resettlement and compensation plans performance. As part of the preparation of RAP a baseline study was conducted this will provide baseline data against which to monitor the performance of the RAP.

7.5.3. Monitoring of RAP implementation

Local government authorities from district level will assist in compiling basic information from the project, and convey this information to RAB, on a quarterly basis.

They will compile the following statistics:

- Number of households and individuals physically or economically affected;
- Length of time from project identification to payment of compensation to PAPs;
- Timing of compensation in relation to commencement of physical works;
- Amount of compensation paid to each PAP household (if in cash), or the nature of compensation (if in kind);
- Number of people raising grievances in relation to project; and
- Number of resolved grievances.
- Number of unresolved grievances.

Table 28: Sample format for monitoring

Work	Planned in total	Progress in quantity	Progress in percentage
Identification of final PAPs			
Preparation of RAP			
Announcement to the affected people			
Cost estimation for expropriation			
Consultation meeting			
Revise of the RAP and signing based on the feedback at the consultation meeting			
Compensation in cash			
Compensation by land			
Social supports such as job training			
Number of unresolved grievances.			

RAB will scrutinize these statistics in order to determine whether the compensation arrangement is done as planned in the RAP. The project team will alert RAB, if there appears to be any discrepancies. MINAGRI will directly monitor compensation and loss of wages. Financial records will be maintained by the district land bureau to permit calculation of the final cost of resettlement and compensation per individual or household. The indicators that will be used to monitor implementation of the RAP include.

- Outstanding compensation cases;
- Grievances recognized as legitimate out of all complaints lodged;

- Grievance resolved and unresolved by levels

Financial records will be maintained by Project District officers and MINAGRI, to permit calculation of the final cost of resettlement and compensation per individual or household.

7.5.3. Record keeping

Each PAP household will be provided with a signed report recording his or her assets and compensation agreed upon and received. At the same time, before compensation all household heads representing the PAPs will be required to provide passport size photographs. The Local Authority and project management team will maintain a complete database on every individual impacted by the project land use requirements including compensation, land impacts or damages.

Each recipient of compensation will have a record containing individual bio-data, number of household dependents and amount of land available to the individual or household when the report is opened. Additional information to be acquired for individuals eligible for resettlement and/or compensation include the level of income and of production, inventory of material assets and improvements in land and debts. Each time land is used by a sub-project; the report will be updated to determine if the individual or household is being affected to the point of economic non-viability and eligibility for compensation or its alternatives.

CHAPTER 8: COST ESTIMATION FOR RAP IMPLEMENTATION

Based on the impacts described earlier, this section present the budget estimates according to the aforementioned valuation methodologies and unit value rates. The estimated budget for RAP is implementation summarized in the following table.

Table 29: Cost estimation for RAP implementation

No	Item description	Nos. HHs*	Unit	QTY*	Unit cost (Rwf)	Total (RWF)
1	Cost of compensation**					
1.1	Permanent Loss of Private Land	106	m2	408,748	168	68,669,664
1.2	Temporary Loss of Private Land	17	m2	24,405	50	1,220,250
1.3	Permanent Loss of Government Land***	224	m2	311,329		0
1.4	Temporary Loss of Government Land***	4	m2	8,182		0
1.5	Loss of Assets	37	Pcs	2,199	different	9,336,300
1.6	Loss of Income for Four Seasons****	1345	Seasons	4	91,997,680	367,990,720
	Sub-total of compensation					447,216,934
2	Training of officers involved at local level for grievance settlement*****	NA		2	2,500,000	5,000,000
3	Staffing (Social Safeguards Officer)	N/A	Man Month	24	500,000	12,000,000
4	Final Assets valuation	NA		1	FF	30,000,000
	Sub-Total (from 2 to 3)					47,000,000
						494,216,934
5	Contingencies(10% of sub-total)					49,421,693
	Total					543,638,627

Notes:

*Area to be affected and number of PAPs: JST (2016)

** Unit price of land: ministerial order no 002/16.01 of 2010 on determining the reference land price outside Kigali City.

Above figures are calculated for cash compensation as a reference.

*** Loss of government lands shall be compensated in kind such as alternative lands, etc.

Necessary budget for compensation shall be secured by RAB where necessary.

**** PAPs whose means of livelihood are to be affected shall be supported by watershed management program by RAB.

***** Training cost for officers: training cost of other projects (RSSP & LWH) applied.

Table 30: Estimated monitoring cost

Activity	Indicator	Qty	Unit cost (FRW)	Total Cost (FRW)
Meeting for set up resettlement committees	Established committee	5	100,000	500,000
Follow up valuation and compensation process	Field report	7	360,000	2,520,000
Meetings for grievance redress	Meetings/ grievance resolved	12	100,000	1,200,000
PAPs Livelihoods assessment	Assessment report	1	5,000,000	5,000,000
Sub -total				9,220,000
Contingency (10%)				922,000
Total				10,142,000

CHAPTER 9: RAP DISCLOSURE

JICA and other international policies on environmental and social safeguards require the implementing agency to disclose publicly the RAP. Therefore, Rwanda Agriculture Board will disclose this RAP by making copies available at its head office and at District and sector offices. The RAP will be disclosed to the MINAGRI Ministry and RAB Websites and the Government of Rwanda will also authorize JICA to disclose this RAP electronically.

A completion report of the entire resettlement/compensation process for this project will be prepared and will include a hand over certificate which will ostensibly provide a verification of when the compensation and assistance were undertaken and to whom these services were provided as well as to indicate that indeed all the compensation has been delivered. This report will be prepared and submitted to JICA and MINAGRI 6 months after the end of compensation payment by RAB. The RAP implementation report should include (but not be limited to) the following information:

- Background of the RAP preparation including a description of the project activities, scope of impacts, number of affected persons, and estimate budget;
- Update of its implementation with actual numbers of displaced persons by segments; compensation paid, issues/complaints raised and solutions provided;
- Complains status;
- Early assessment of the impacts of resettlement and compensation on affected categories at the time of the report production;
- Total sum disbursed;
- Lessons learned from the RAP implementation;

Suggested annexes:

- List of people affected as per the RAP report;
- List of people compensated during implementation;

APPENDICES

Appendix 1: Existing Structures in the Project Area and Anticipated Project Impacts

BUGUGU MARSHLAND						
No	X	Y	Z	Infrastructure	Owner	Project Impact
1	547215	4781477	1386 m	Store House	Cooperative	None
2	547222	4781456	1385 m	Drying ground	Cooperative	None
3	547207	4781531	1390 m	Drinking water junction	SHIMUZI Project	None
4	547175	4781786	1389 m	Drying ground	Cooperative	None
5	547237	4781436	1387 m	Water junction house	SHIMUZI project	None
6	547233	4781432	1386 m	Sign post	RSSP Project	None
7	547223	4781433	1385 m	Electricity pole	SHIMUZI project	None
8	547242	4781410	1384 m	Electricity pole	SHIMUZI project	None
9	547211	4781375	1382 m	Electricity pole	SHIMUZI project	None
10	547185	4781359	1382 m	Rice seed wet-bed	COCURIBU	None
11	547163	4781359	1381 m	Electricity Pole	SHIMUZI project	None
12	547154	4781360	1382 m	Bridge	Public	None
13	547126	4781360	1381 m	Water Junction House	SHIMUZI project	None
14	547114	4781349	1382 m	Electricity Pole	SHIMUZI project	None
15	547116	4781347	1382 m	Electricity Pole	SHIMUZI project	None
16	547068	4781329	1382 m	Electricity pole	SHIMUZI Project	None
17	547012	4781359	1385 m	Drinking water junction	SHIMUZI Project	None
18	547012	4781352	1387 m	Electricity Pole	SHIMUZI Project	None
19	546997	4781350	1391 m	Water Tank House	SHIMUZI Project	None
20	547023	4781308	1385 m	Electricity Pole	SHIMUZI Project	None
21	547020	4781295	1384 m	Water junction box	SHIMUZI Project	None
22	547025	4781292	1384 m	Water junction box	SHIMUZI Project	None
23	547017	4781277	1385 m	Electricity pole	SHIMUZI Project	None
24	547039	4781261	1383 m	Electricity pole	SHIMUZI Project	None
25	547039	4781261	1383 m	Electricity pole	SHIMUZI Project	None
26	547056	4781214	1384 m	Electricity pole	SHIMUZI Project	None
27	547063	4781182	1384 m	Transformer	SHIMUZI Project	None
28	547073	4781170	1383 m	Electricity pole	SHIMUZI Project	None
29	547081	4781145	1382 m	Electricity pole	SHIMUZI Project	None
30	547081	4781145	1382 m	Water tank House	SHIMUZI Project	None
31	547063	4781150	1384 m	Water Source	SHIMUZI Project	None
32	547055	4781151	1390 m	Night watchman house	SHIMUZI Project	None
33	547044	4781181	1387 m	Sign post	RSSP	None
34	547255	4781450	1386 m	Small House	Cooperative	None
35	547276	4781442	1388 m	Drying ground	Cooperative	None
36	547285	4781458	1389 m	Small House	Cooperative	None
37	547366	4781483	1387 m	Water Tank House	SHIMUZI Project	None
38	547255	4781443	1386 m	Electricity Poles	SHIMUZI Project	None
39	547301	4781427	1386 m	Electricity Poles	SHIMUZI Project	None
40	547349	4781411	1384 m	Electricity Poles	SHIMUZI Project	None
41	547323	4781414	1384 m	Water Junction Box	Public	None
42	547326	4781409	1384 m	Bridge	Public	None

43	547408	4781311	1386 m	Drying ground	Public	None
44	547054	4782158	1392 m	Cattle Water Trough	Public	To be affected
45	546995	4782315	1395 m	Drinking Water Point	Public	To be affected
46	546938	4782312	1397 m	Cattle Water Trough	Public	To be affected
47	547154	4781864	1386 m	Drying ground	Public	None
48	546973	4781895	1386 m	Drying ground	Public	None
49	547443	4781387	1386 m	Electricity Pole	Public	None
50	547492	4781373	1384 m	Electricity Pole	Public	None
51	547538	4781356	1387 m	Electricity Pole	Public	None
52	547575	4781349	1393 m	Electricity Pole	Public	None
53	547579	4781346	1394 m	Drinking Water Junction	Public	None
54	547387	4781105	1386 m	Drying ground	Cooperative	None
55	547435	4780768	1378 m	Drying ground	Cooperative	None
56	547415	4780469	1373 m	Drying ground	Cooperative	None
57	547263	4780208	1370 m	Drying ground	Cooperative	None
58	547226	4780093	1373 m	Drying ground	Cooperative	None
59	547198	4779638	1368 m	Drying ground	Cooperative	None
60	547176	4779416	1364 m	Drinking Water Point	Cooperative	None
61	547157	4778459	1357 m	Drying ground	Cooperative	None
62	546503	4782464	1396m	Drinking water point	Cooperative	None
CYARUHOGO MARSHLAND						
1	546721	4776539	1349 m	Drying ground	Cooperative	None
2	545601	4776259	1352 m	Drying ground	Cooperative	None
3	546370	4776129	1354 m	Drying ground	Cooperative	None
4	546835	4775634	1343 m	Drying ground	Cooperative	None
5	546951	4775099	1343 m	Drying ground	Cooperative	None
6	546362	4775395	1349 m	Drying ground	Cooperative	None
7	546476	4775319	1345 m	Drinking Water Point	Public	None
8	546751	4775071	1345 m	Drying ground	Cooperative	None
9	546751	4775071	1345 m	Drying ground	Cooperative	None
10	547241	4775198	1342 m	Drying ground	Cooperative	None
11	547224	4775228	1340 m	Cooperative Office	Cooperative	None
12	547245	4775227	1341 m	Store House	Cooperative	None
13	547303	4773542	1336 m	Drying ground	Cooperative	None
14	547461	4774530	1343 m	Drying ground	Cooperative	None
15	547719	4775273	1340 m	Drinking Water Point	Public	None
16	544459	4776295	1402 m	Drinking Water Point	Public	None
17	543841	4776221	1369 m	Drinking Water Point	Public	To be affected
CYIMPIMA MARSHLAND						
1	547737	4775188	1351 m	Cooperative Office	Cooperative	None
2	547644	4775577	1345 m	Drying ground	State	None
3	547879	4776012	1349 m	Sign Post	MINAGRI	None
4	547891	4776030	1349 m	Drying ground	Cooperative	None
5	547983	4776445	1349 m	Drying ground	Cooperative	None
6	548036	4776809	1352 m	Drying ground	Cooperative	None
7	548044	4776807	1352 m	Rice seed wet-bed	Cooperative	None

8	548211	4777428	1353 m	Drying ground	Cooperative	None
9	548871	4777957	1354 m	Drying ground	Cooperative	None
10	548719	4778001	1351 m	Drying ground	Cooperative	None
11	548778	4778375	1356 m	Drinking water point	State	None
12	548891	4778814	1362 m	Drying ground	Cooperative	None
13	549118	4779272	1362 m	Small House	Cooperative	None
14	549110	4779269	1363 m	Rice seed wet-bed	Cooperative	None
15	549139	4779288	1368 m	Sign Post	Cooperative	None
16	549006	4779293	1369 m	Water Pause Hole	Public	None
17	549253	4780402	1372 m	Drinking Water Point	Public	None
GASHARA MARSHLAND						
1	545345	4778497	1364 m	House for water opening Machine	Cooperative	None
2	545386	4778439	1363 m	Drying ground	Cooperative	None
3	544355	4778976	1379 m	Drying ground	Cooperative	None
4	545955	4777975	1354 m	Drinking Water Point	State	None
5	546283	4777419	1355 m	Drying ground	Cooperative	None
6	546317	4777379	1353 m	Cooperative Office	Cooperative	None
7	546504	4777634	1355 m	Drying ground	Cooperative	None
8	546289	4777441	1355 m	Rice seed wet-bed	Cooperative	None
9	546442	4777121	1356 m	Sign Post	Cooperative	None
10	546451	4777171	1353 m	Drying ground	Cooperative	None
11	547062	4778119	1354m	Drinking Water Point	Public	None
12	544511	4778946	1337 m	Drinking Water Point	Public	To be affected
13	544590	4779139	1373 m	Rice seed wet-bed	Cooperative	None
14	54459	4779139	1372m	Cattle Water Trough	Public	To be affected

Appendix 2: Proposed rate for asset valuation

GUHA AGACIRO IMITUNGO YAHAGENEWE IBIKORWA BIFITE ABATURAGE INYUNGU RUSANGE HAKURIKIJE IBICIRO BIRI KU ISOKO

CULTURES ET BOISEMENTS (IMYAKA N'AMASHYAMBA)

A CULTURES (IMYAKA)/trees and crops

Nature de la culture Ubwoko bw'ibihingwa	Production kg/are Umusaruro	Unit price	Unit cost per are
		Igicro ku kiro kimwe cg ku giti Kimwe	Igicro kuri are
Ibishyimbo (Haricots)	10		10,000
Amashaza (Petits pois)	6.5		10,000
Ubunyobwa (Arachides)	8		15,000
Ingano (Fromen,orge)	8.5		10000
Amasaka (Sorgho)	60		6,500
Ibigori (Maïs)	12		65,000
Uburo (Eleusine)	5		3,200
Ibirayi (Pomme de terre)	6.5		6,000
Amateke (Colcase)	35	200	7,000
Ibikoro (Igname)	55	500	33,000
Ibijumba (Patate douce)	50		10,000
Imyumbati (Maniocs)	54	300	20,500
Isombe (Maniocs-légumes)	-	500	
Soya (Soja)	8		13000
Intabire (Labour)			10000
Amashu (Choux)	300Plats/ are	120	90,000
Ibitunguru (Oignons)	1kg/m ²		50,000
Inyanya (Tomates)	2kg/m ²		80,000
Intoryi (Aubergine)	5kg/m ²		100,000
Karoti (Carotte)	1,2kg/m ²		50,000
Saladi (Salades)	Pieds	120	90,000
Sereli (Céleris)	Pieds		81,000
Izindi mboga (Autres légumes)	Pieds		81,000
Inzuzi (Courges)	Pieds	5,000	
Inanasi (Ananas)	1	500	50000
Ipamba (Ipamba)	8		36000
Umuceri (Riz)	54		65,000
Itabi (Tabac)	15 Feuilles/pied	200	30000
Ibisheke (Canne à sucre)	Pieds	500	50,000

B. Fruit Trees /ibiti byera imbuto ziribwa

Species/Ubwoko bw'ibiti	Age/Imyaka gifite	Prix/ Pces/ Igicro ku giti kimwe	
Marakuja/ Amatunda	de 0 à 1 an	1000/2000	
Prunier de Japon(Ibinyomoro)	1à 2 ans	1000&2000	

	Coeur de Boeuf (Umutima w'imfizi)	2 à 3 ans	500&5000	
	Ipapayi yera (Papayier)	Pied	2000&3000	
	Indimu n'Amacunga (Citronier et Oranger)	Pied	3000&4000	
	Igiti cy'Avoka (Avocatier)	Pied	12000&15000	
	Igiti cy'Ipera (Goyavier)	Pied	3000&4000	
	Igiti cy'Umwembe (Manguier)	Pied	5,000	
	Ibindi biti by'imbuto (Autres arbres fruitiers)	Pied	3,000	
C) perennial crops and trees/ ibihingwa n'ibiti nkundabutaka				
	Nature de la culture	Unite	Age	
	Ubwoko bw'ibiti		Imyaka gifite	
	Ikawa (Caféier)	Pc	0 - 3 ans	1 000
			4 - 30 ans	2 500
			Plus de 30 ans	4 000
	Ibireti (Pyrètres)			
	Icyayi (Théier)	PC	0 - 3ans	1 000
			4 - 30ans	2 500
			Plus de 30 ans	4 000
	Ikinini (Quinquina)	Pc	3ans et plus	5000& 8000
			0 à 1 ans	1000
			2 à 3ans	1000
			4 à 5 ans	1000
			6ans à 7ans	1000
			8 à 9 ans	1000
	urutoki rwa kizungu/ifite igitoki	insina(Inguri ntirenza insina 3)		3500/10000
	Urutoki (Bananeraie)/ifite igitoki	Insina imwe		1500/4000
	Urusenda (Pili-pili)			1000
	Vetiveri (vétivers)	MI		200
	Urubingo (Roseaux-Péniscetum)	MI		1000
	Tiribusakumu (Tripsacum)	MI		200
	Sitariya (Sétaria)	MI		200
	Mucyayicyayi (Ciyronnelle)	MI		200
	Umugwegwe (Sisal)	Pc		3000
	Umugano (Bambou)	Pc		3000
	Imiyenzi (Euphorbes)	muto (jeune)		300
		mukuru (moyenne)		500
		ukuze (grosses)		1000
	Urugo rw'imiyenzi (Enclos)	muto (jeune)		1000/ml
		mukuru (moyenne)		1000
		ukuze (grosses)		1000
	Urugo rw'imivumu (Ficus)	PC	0 - 5	1 000
			6-30ans	4 000

			Plus de 30 ans	4000
	Imihati (Dracaenas)	muto (jeune)		200
		mukuru (moyenne)		600
		ukuze (grosses)		1000
	Urugo rw'imbingo(Enclos)			1000
	Urugo rwa Sipure(Haie cyprès) 150/500 Frw/m			2000
	Uruzitiro rw'imitobotobo	muto (jeune)		200
	Umuko	Pc		2000
	Icyiha	muto (jeune)		500
	Umubirizi	mukuru (moyenne)		300 Frw/ 1 200
	Umusave	ukuze (grosses)		1500&3000
	Ikibonobono	Pc		2000
	Imigenge	mukuru (moyenne)		500&2000
	Imikunde	ukuze (grosses)		1000
	Umwange			1000
	Umukoni			1000
	Utundi duti tutavuzwe (Autres)	pc		500
	Barakatsi Black-Wattle	PC	0 - 3 ans	1 000
			4 - 10 ans	3 000
			Plus de 10 ans	6 000
	Inturusu (Eucalyptus)	PC	0 - 2	800
			3-5ans	3,000
			6-10ans	6,000
			10-20ans	12,000
			Plus de 20 ans	20, 000
D.	BOIS D'OEUVRE (IBITI BIBAZWA)			
	Acasiya, cedrela, Jacaranda	PC	Sérables	7000
	Umusave, Umunyinya, Mcadamia			8000
		PC	0-2ans	700
			3-5ans	1,000
			6-10ans	3,000
			10-20ans	7 000
			Plus de 20 ans	9 000
	Indogo			6500
	Resena	PC	0-2ans	600
			2-5ans	2 000
			5-10ans	3 000
	Caliandra	PC	0-2ans	800
			2-5ans	2 000
			5-10ans	3500
	Alnus	PC	0-2ans	800
			2-5ans	3 000
			5-10ans	5 000

			10-20ans	6 000
			Over 20 ans	10 000
	Grevellia	PC	0-2ans	800
			2-5ans	2 000
			5-10ans	4 000
			10-20ans	6 000
			Plus de 20 ans	9 000
	Cypres	PC	0-2ans	900
			2-5ans	2000
			5-10ans	3000
			10-20ans	5 000
			Plus de 20 ans	8 000
	Pinus	PC	0-2ans	300
			2-5ans	800
			5-10ans	2,000
			10-20ans	6,000
			Plus de 20 ans	12, 000
Philao	PC	0-2ans	900	
		2-5ans	1000	
		5-10ans	3,000	
		10-20ans	6,000	
		Plus de 20 ans	12, 000	
Hakeya	PC	0-2ans	500	
		2-5ans	1 000	
		5-10ans	2 500	
		Plus de 10 ans	3 500	
Cedrella	PC	0-2ans	800	
		2-5ans	1 000	
		5-10ans	2 000	
		20-Oct	4 000	
		Plus de 20 ans	8 000	
Ibindi biti by'imitako	PC	-	3,000	
Boberi	PC	-	4,000	
E.	Ibiti by'indabo (arbres ornementaux) ornamental trees			
	Indabo (Fleur)	90 / 100Frw/ Plat		200
	Pasiparumu (Pasparum)	100/200 Frw/m ²		500

Appendix 3: Assets inventory form
Republic of Rwanda



MINISTRY OF Agriculture and animal Resources
Rwanda Agriculture Board

Umushinga /Project : Rehabilitation of irrigation facilities in Rwamagana district
Form title/izina rya fishe: ibarura n'igenagaciro ry'umutungo wangijwe n'ibikorwa by'umushinga mu karere ka (valuation of assets affected in district of).....

Amazina ya nyiri umutungo:..... Nimero ya telefone/Phone Number..... Nimero y'indangamuntu/Id Number Nimero ya konti/Account Number:..... Izina rya banki/name of the bank..... Akarere/DistrictUmurenge/Sector:..... ... Akagali(cell):.....Umudugudu/Village:.....					Byemejwe n'Akarere ka/Approved by the District Names:..... Signature & Stamp		Amazina n'umukono ry'umugenagaciro wemewe/Names and signature of certified valuator Names:..... Signature & Stamp:	
No	Affected area	Location	Umutungo wangijwe	Igipimo /Unit	Ingano/Q uantity	Imyaka bimaze	Igicro cya kimwe/unit cost	Igicro cya byose Total cost
1								
2								
.								
.								
IGITERANYO CYA BYOSE/ GENERAL TOTAL								
Amazina n'umukono bya nyir'umutungo/Names and Signature of owner		Amazina n'umukono by'Umuyobozi w'Akagali/Names and signature of executive secretary of cell			Amazina n'umukono by'Umukozi w'umurenge ushinze imitungo/ Names and signature of sector agronomist or in charge of land and resettlement		Izina n'umukono by'Umunyamabanga Nshingwabikorwa w'Umurenge/ Names and signature of Sector Executive Secretary	

Appendix 4: Sample grievance redresses form

Grievance Form		
Grievance Number		Copies to forward to:
Name of the recorder		(Original) Receiver Party
District/ Sector/Cell		(Copy)- Responsible Party
Date		
INFORMATION ABOUT GRIEVANCE		
Define The Grievance		
INFORMATION ABOUT THE COMPLAINANT		Forms of Receive
Name-Surname		Phone line
Address		Community/ Information meetings
Village/ Cell		Mail
Sector/ District		Informal
Signature of Complainant		Other

Details of Grievance

6.Incidents Regarding Expropriation and Compensation (Specify)	7.Resettlement Process (specify)	8.EmDPCO yment and recruitment (Specify)	9.Construction Camp and Community Relations <ul style="list-style-type: none"> • Nuisance from dust • Nuisance from noise • Vibrations due to explosions • Misconduct of the project personal/worker • Complaint follow up Other 	10.Other (specify)
---	---	---	--	---------------------------

Grievances Close Out Form

Grievance Number:.....

Define immediate action required:.....

Define long term action required (if necessary).....

Verification of corrective action and sign off

Corrective action taken	Due date

Responsible Party

Notes: This part will be filled in and signed by the complainant when he/she receives the compensation or file is closed out

Complainant:.....

Name and Signature.....

Date

Representative of Responsible Party

Title, Name and Signature.....

Date:.....

ANNEX 7 ボーリング調査結果

Annex 7 Results of Drilling Survey

1. Location and Coordinates

List of Drilling Survey

(Survey done from July of 2016 to August of 2016)

Dam-site	No.	Location	GPS			Depth(m)
			N-S	E-W	Elevation	
Cyimpima	Cyim.BH-1	Reservoir middle, upstream slope-end of existing dam	01-59-45.1	30-26-28.6		10
Cyaruhogo	Cyar. BH-1	River-bed, right-side	02-01-27.2	30-24-18.1		10
	Cyar. BH-2	River-bed, middle	02-01-26.3	30-24-18.5		10
	Cyar. BH-3	River-bed, left-side	02-01-25.6	30-24-18.7		10
	Cyar. BH-4	Spillway chute	02-01-28.9	30-24-19.0		10
Gashara	Gas. BH-1	River-bed, middle slope-end of existing dam	02-00-11.3	30-24-28.2		10
Bugugu Existing dam-site	Bug. BH-1	River-bed, middle	01-58-15.0	30-25-19.4		10
Bugugu new site	Bug. BH-2	River-bed, middle	01-58-19.2	30-25-21.6		10
	Bug. BH-3	River-bed, left-side	01-58-18.8	30-25-23.2		10

2. Lithologs

(1) Cyimpima site

1) Cyim BH-1 (Upstream slope-end of existing dam, center of reservoir)

- 0-0.05m loose embankment soil of exiting dam
- 1.0m embankment, mixed clayey soil with reddish laterite and dark clay, soft.
- 3.8m embankment of existing dam body, Spot soil is reddish laterite
- 5.6m dark grey clayey soil, probably basement soil of existing dam.
- 6.0m grayish dark silty soil
- 10m dark to grey fine sand

LIST OF SPT TEST (CYIM. BH-1)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	2	1	3	1	1	5
2	2	2	1	1	2	1	4
3	3	3	2	4	3	2	9
4	4	2	1	2	1	1	4 (Sample slipped)
5	5	8	7	9	10	5	26
6	6	4	8	5	6	2	19 (Sample slipped)
7	7	6	4	9	11	5	24 (Sample slipped)
8	8	8	10	11	13	3	34 (Sample slipped)
9	9	10	14	18	16	5	48 (Sample slipped)



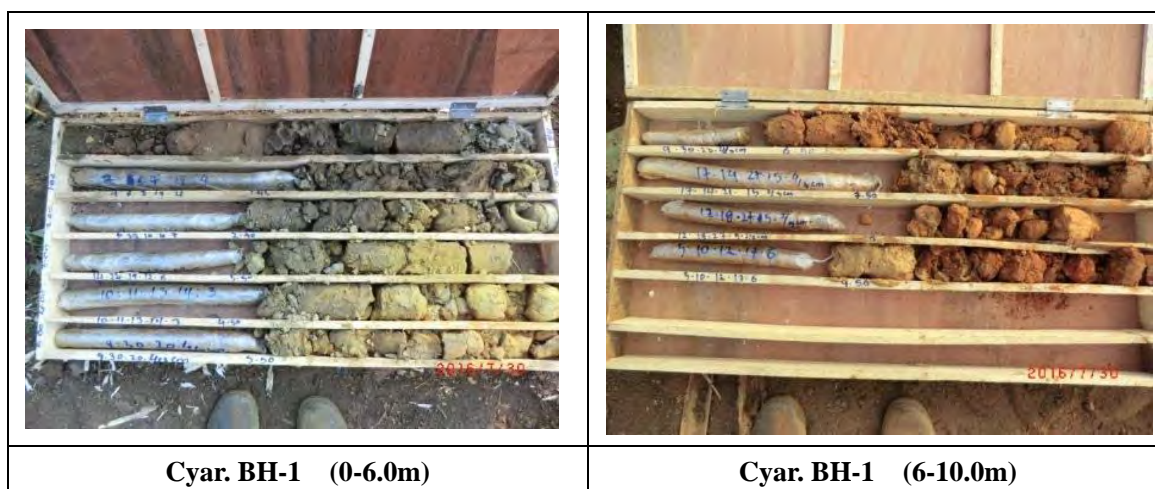
(2) Cyaruhogo site (River-bed, right-side at new dam center)

1) Cyar. BH-1

- 0-0.9m surface soil, blackish clay
- 1.5m dark grayish silty soil
- 1.9m dark brown silty soil
- 2.0m yellowish grey silty soil
- 2.8m dark grayish silty to clayey soil
- 5.0m light weight, yellowish grey silty to clayey soil
- 5.6m clay contains small gravel
- 6.5m yellowish grey silty to clayey soil
- 7.0m reddish brown clayey soil
- 7.6m grayish clayey soil
- 9.8m alternation of yellowish clayey soil and brown clayey soil

LIST OF SPT TEST (CYAR. BH-1)

S. NO	SPT At depth in meters	First step No of strokes/15c m depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	7	6	7	19	4	32
2	2	8	22	10	10	7	42
3	3	14	24	19	12	6	55
4	4	8	9	10	11	6	30
5	5	21	17	20	23	4/3cm	60
6	6	9	30	20	4/3cm		54
7	7	17	14	21	15	4/2cm	50
8	8	12	18	27	5	2/2cm	50
9	9	5	10	12	17	6	39



2)Cyar. BH-2 (River-bed, middle at new dam center)

- 0-1.5m surface soil, dark grayish clayey soft soil
- 2.8m grey clayey soil
- 3.6m clayey soil mixed with dark grayish gravels
- 4.0m compacted whitish grey silty very impervious clay, somewhat dry
- 4.6m dark grayish clayey soil mixed with gravels
- 4.7m yellowish grey silty soil
- 5.1m grayish colored compacted layer
- 6.0m dark grayish clayey soil mixed with small gravels
- 6.8m grayish clay
- 7.5m reddish brown clayey soil mixed with small gravels
- 8.0m same as upper layer, but stiff as soft impervious rock layer, somewhat dry
- 9.0m clayey soil contains yellowish quartz gravel (D3cm)
- 9.6m stiff brown clay contains gravels
- 10m reddish brown clay contains gravels

LIST OF SPT TEST (CYARU. BH-2)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	4	6	5	4	3	15
2	2	10	13	8	10	6	31
3	3	30	50				50
4	4	7	12	19	19	10	50
5	5	27	7	8	16	6	31
6	6	25	50				50
7	7	17	12	21	14	22	47
8	8	17	18	23	17	10	58
9	9						



Cyar.BH-2 (0-6.0m)



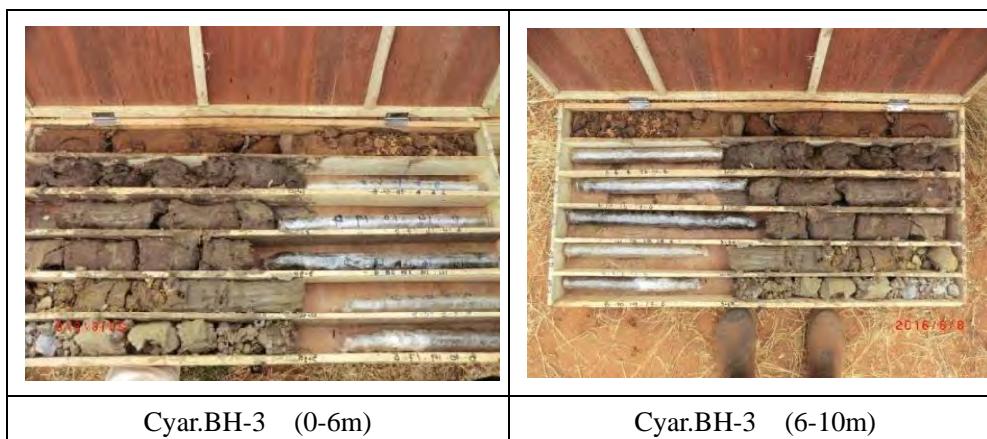
Cyar.BH-2 (6-10.0m)

3)Cyar. BH-3 (River-bed,left-side at new dam center)

- 0-0.05m surface soil
- 0.95m silty dry soil
- 1.5m dark grayish clayey soil
- 1.5m dark clayey soil
- 3.0m grayish clayey soil
- 4.8m grayish silty soil
- 5.7m grayish silty to clayey soil contains gravels
- 6.5m clayey soil contains hard gravels, SPT cannot penetrate
- 7.7m clayey soil contains gravels, some leakage
- 7.8m silty soil contains yellowish gravels
- 8.0m dark grayish silty soil contains gravel
- 8.8m dark grayish silty to clayey soil
- 9.5m grayish stiff clay layer

LIST OF SPT TEST (CYAR. BH-3)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	6	8	10	10	8	28
2	2	8	4	10	19	4	33
3	3	5	8	6	10	5	24
4	4	8	10	19	17	6	46
5	5	8	10	19	17	6	46
6	6						refusal
7	7	14	10	9	16	5	35
8	8	14	20	30	2/3cm		52
9	9	20	50				50



4)Cyar.BH-4 (Spillway chute line)

0-0.4m	surface soil, dry
-2.5m	reddish laterite soil, wet condition
-3.0m	laterite, stiff reddish clay
-4.0m	laterite, dark brown silty clay
-5.9m	dark brownish laterite
-9.0m	brownish letrite clay
-10.0m	stiff yellowish laterite

LIST OF SPT TEST (CYARU. BH-4)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	6	6	7	8	4	21
2	2	4	7	8	7	3	22
3	3	5	5	7	8	4	20
4	4	6	7	6	8	5	21
5	5	4	6	6	9	3	21
6	6	8	6	8	8	5	22
7	7	6	10	11	18	8	39
8	8	17	21	34	4/3cm		59
9	9						



Cyar.BH-4 (0-6m)



Cyar.BH-4 (6-10m)

(3) Gashara site (middle of river-bed at downstream slope-end)

1) Gas. BH-1

- 0-.5m surface soil
- 2.7m soft dark grayish silty to clayey soil
- 4.5m dark-gray gravelly sand
- 4.8m dark grayish silt
- 6m dark-gray gravelly sand
- 6.5m gravel layer with angular to semi-angular gravels
- 9m gravelly sand
- 10m whitish gray sand with gravel

LIST OF SPT TEST (GAS. BH-1)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	2	1	1	2	1	4
2	2	1	1	1	1	2	3
3	3	20	50				50
4	4	1	8	9	10	5	27
5	5	16	19	20	11	9	50
6	6	50					Refusal
7	7	2	2	9	3	2	14 (Sample slipped)
8	8						
9	9						



Gas.BH-1 (0-6m)



Gas.BH-1 (6-10m)

(4) Bugugu site (Middle of river-bed at existing dam site)

1) Bug. BH-1

- 0-0.5m surface soil, dark grayish silty clay
- 3.5m grey silty soil
- 5.0m light grey clayey soil
- 9.2m grayish clayey soil
- 10m light brown clayey soil

LIST OF SPT TEST (BUG. BH-1)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	10	6	14	18	7	38
2	2	13	27	19	15	6	61
3	3	15	8	14	7	9	29
4	4	8	15	8	12	8	35
5	5	12	8	14	17	9	39
6	6	10	13	10	8	5	31
7	7	14	18	13	19	9	50
8	8	11	10	11	3	6	24
9	9	22	18	32	20	51	70



Bug. BH-1 (0-4m)



Bug. BH-1 (4-8m)



Bug. BH-1 (8-10m)

2) Bug. BH-2 (Middle of river bed at new dam site)

- 0-0.6m surface soil
- 0.6-3.0m dark grayish clayey silt
- 3.0-3.5m light grayish clayey silt, impervious
- 5.0-6.0m sandy silt
- 6.0-8.0m gravel layer contains thin clay layer
- 8.0-8.5m not sampling (probably sand layer)
- 9.0-9.5m soft sand
- 9.0-10m gravel layer

LIST OF SPT TEST (BUG. BH-2)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	3	4	5	6	11	15
2	2	2	1	1	30	30	32
3	3	47	42	24	4		68
4	4	8	10	10	13	9	33
5	5	11	20	10	10	13	40
6	6						SPT Refused
7	7	10	14	16	14	8	44
8	8						
9	9						



Bug. BH-2 (0-4m)



Bug. BH-2 (5-8m)



Bug. BH-2 (8-10m)

3) Bug. BH-3 (left-side of river-bed at new dam site)

- 1-2m fine-sandy clayey soil
- 2-4m sandy to silty clay
- 4-4.8m gray clay, somewhat soft
- 5-6m sand layer
- 6-7m sand layer
- 7-8m gravelly sandy layer
- 8-9m sandy to clayey soil
- 9-10m gravelly layer(angular gravels)

LIST OF SPT TEST (BUG. BH-3)

S. NO	SPT At depth in meters	First step No of strokes/15cm depth	Second step No of strokes/10 cm depth	Third step No of strokes/10 cm depth	Fourth Step No of strokes/10 cm depth	Fifth step No of strokes/5cm depth	Total strokes for 30 cm
1	1	2	1	2	1	1	4
2	2	11	13	14	17	22	44
3	3	14	17	22	20	26	59
4	4	4	5	3	4	4	12
5	5	12	9	14	11	6	34
6	6						
7	7	7	6	5	4	5	15
8	8						
9	9						



Bug. BH-3 (0-4m)



Bug. BH-3 (4-8m)



Bug. BH-3 (8-10m)

