

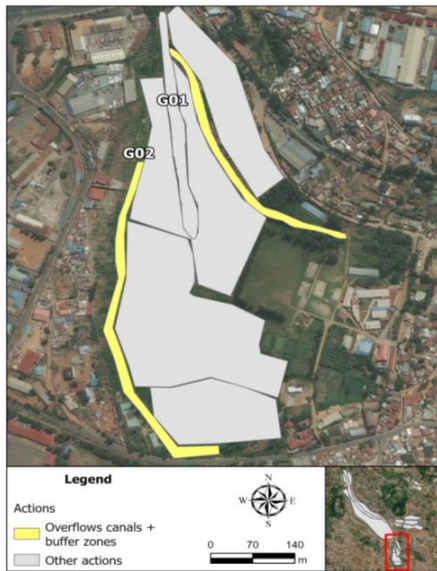
Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet

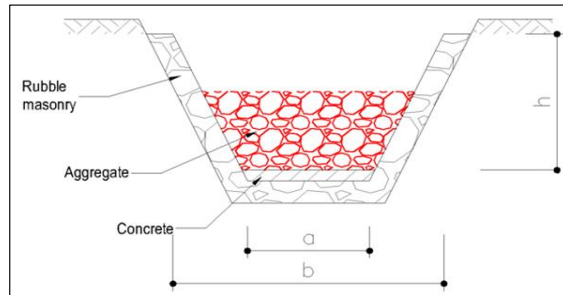
Action 1.G

Name	Raising the water level in the outfalls
Action target	Water filtration, Biodiversity, Flood mitigation
Wetland	Gikondo

Location (map) G01 - G02



Photos / examples



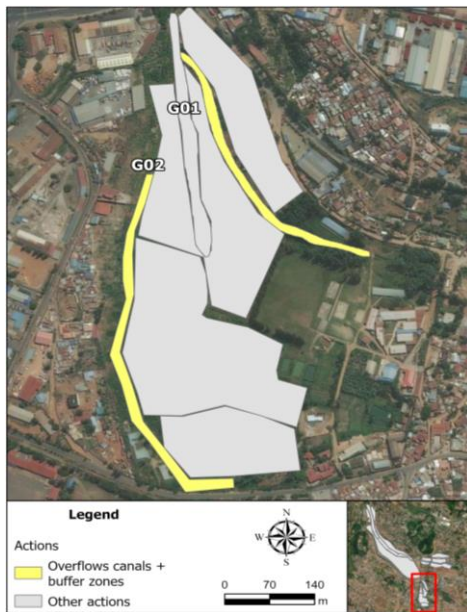
Characteristics	Rough cost estimate	Priority	Objectives
G01 : recharge the end of the channel over 200 m with different diameter aggregates	4 600 USD	2 - Medium-term 2035	<ul style="list-style-type: none"> - Limit the drainage of the wetland - Favor overflow over the concrete channel and the river beds - Reduce the water quantity and velocity downstream - Favor aquatic environment in the wetland
G02 : recharge the end of the channel over 200 m with different diameter aggregates	14 700 USD	2 - Medium-term 2035	
Comments			
Maintenance need	Needs to be defined according to the monitoring management report		
Management monitoring	<p>The work will be the subject of a technical file of the works carried out with the plans of the built installations. A follow-up of the profile of the restored banks and the minor bed will be carried out 6 months after the end of the work and then the year that follows. The frequency will be adapted according to the possible disorders observed and the results of this follow-up.</p> <p>On the basis of the technical file, the following will be identified</p> <ul style="list-style-type: none"> - Possible movements, departures or contributions of blocks; - All possible traces of erosion, scouring on the resumed zones as well as on the transition zones and the zones peripheral to the development not impacted by the works. <p>All the elements of this follow-up will be recorded in a report. In conclusion, recommendations will be made on possible rework, the frequency of monitoring, and on future developments.</p>		

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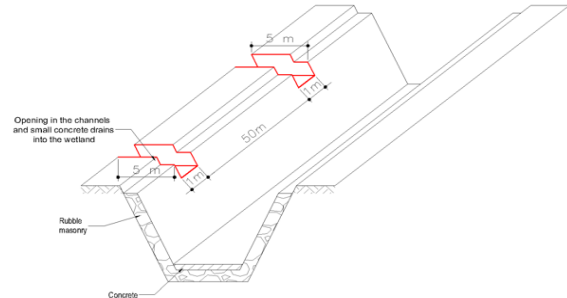
Action sheet

Action 2.G	Name	Creation of overflows on the two concrete canals to ensure overflow of water into the wetland during rainfall
	Action target	Water filtration, Biodiversity
	Wetland	Gikondo

Location (map) G01 - G02



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G01: make 10 openings (each 50 m) in the existing channel and build small concrete drains	6 000 USD	2 - Medium-term 2035	<ul style="list-style-type: none"> - Limit the drainage of the wetland - Favor overflow the concrete channel and the river beds - Reduce the water quantity and velocity downstream - Improve water quality - Favor aquatic environment in the wetland
G02: make 13 openings (each 50 m) in the existing channel and build small concrete drains	7 800 USD	2 - Medium-term 2035	
Comments	Renvoi vers plans détaillés si besoin		
Maintenance need	<ul style="list-style-type: none"> - Maintenance of the concrete drains (prevent from solid waste accumulation): twice per year (including one before the rainy season) - Other needs to be defined according to the management monitoring report 		
Management monitoring	<p>The work will be the subject of a technical file of the works carried out with the plans of the built installations. A follow-up of the profile of the restored banks and the minor bed will be carried out 6 months after the end of the work and then the year that follows. The frequency will be adapted according to the possible disorders observed and the results of this follow-up.</p> <p>On the basis of the technical file, the following will be identified</p> <ul style="list-style-type: none"> - Possible movements, departures or contributions of blocks; - All possible traces of erosion, scouring on the resumed zones as well as on the transition zones and the zones peripheral to the development not impacted by the works. <p>All the elements of this follow-up will be recorded in a report. In conclusion, recommendations will be made on possible rework, the frequency of monitoring, and on future developments.</p>		

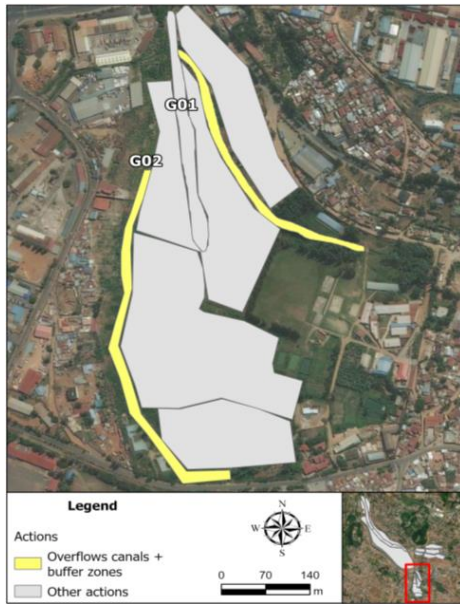
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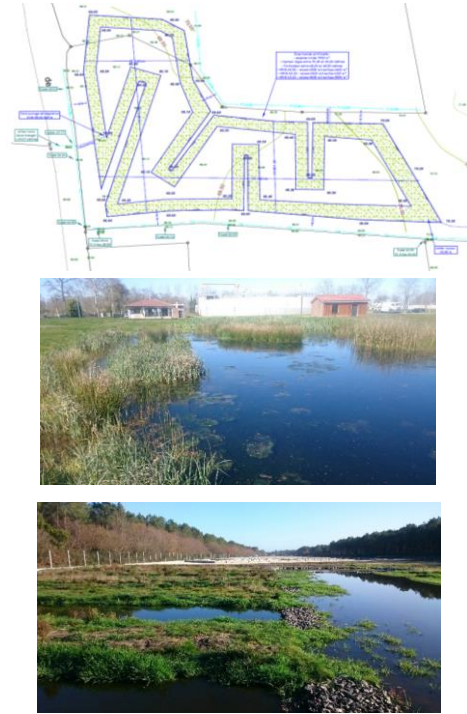
**Action
3-G**

Name	Creation of buffer zones (filtering wetlands)
Action target	Biodiversity and Water Quality
Wetland	Gikondo

Location (map) G01 - G02



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G01 Surface : 6 300 m ²	37 800 US Dollar	2 - Medium-term 2035	The structure will have the same operating principles as a retention basin with the difference that the leakage rate will be variable according to the water level. It will be fed by rainwater and overflows from peripheral outfalls. The preliminary studies require a detailed analysis of the contributing catchment area (surface area of the catchment area, land use, etc.).
G02 Surface : 9 600 m ²	57 600 US Dollar	2 - Medium-term 2035	<p>In summary, the creation of a buffer zone is carried out in 3 stages</p> <ul style="list-style-type: none"> - Feasibility study to identify the environmental issues and take them into account in the design: topographic surveys, soil studies, hydraulic studies of the watershed... - Design study including: execution plans of the buffer zone, hydraulic dimensioning of the works and integration of the educational supports... - Works and follow-up of the construction site requiring the intervention of qualified partners for the realization of the civil engineering (earthworks to create the various compartments, creation of dikes to lengthen the hydraulic path...), of the ecological engineering (choice of materials, planting of the vegetable species...) and of a qualified work manager. <p>A safety margin of 0.30m (minimum difference between the highest water level and the top of the compartment crest) is provided for during periods of maximum compartment filling. To achieve this objective, overflows will be installed at the top of the compartment crest.</p>
Comments	<ul style="list-style-type: none"> - The wetland buffer cannot be effective if it collects untreated wastewater. - Maximum depth of the compartments fixed at 1,20m 		

Maintenance need	<p>Annual management by mowing in August, before the rainy season</p> <p>The management of the buffer zone leads to be vigilant on the following hydraulic phenomena</p> <ul style="list-style-type: none"> - Creation of hydraulic plugs at the level of hydraulic structures that can lead to overflows (loading of the system) and a reduction in residence time. - Reduction of the residence time and the treatment capacity of the system by short circuits and the filling of the volume of the basins. - Risk of invasive plants or plant dieback. <p>A management plan also aims to</p> <ul style="list-style-type: none"> - Ensure the cutting of plants with export of green waste - Maintain a high level of biodiversity in the water compartments by applying a differentiated vegetation management method. - Perpetuate the landscape quality of the site and its potential to welcome the public.
Management monitoring	<p>Monitoring of the evolution of vegetation and hydraulics twice a year, during dry and rainy seasons, by an expert in ecological engineering, for 30 years (n+1, n+2, n+3, n+5, n+7, n+10, n+15, n+20, n+25, n+30)</p>

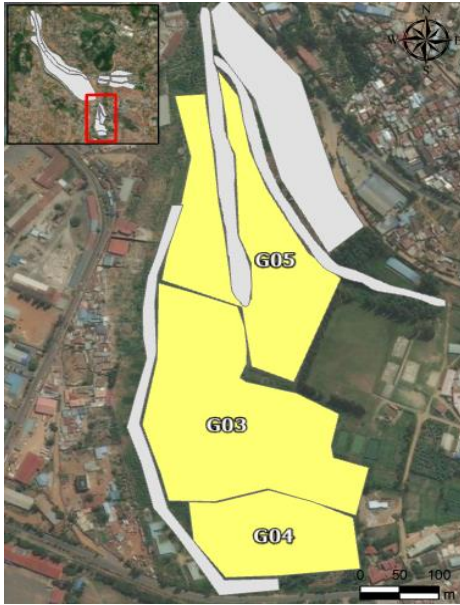
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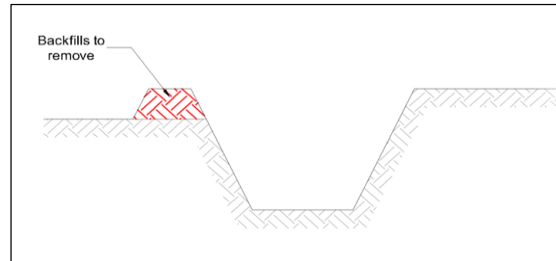
**Action
4.G**

Name	Removal of existing backfills
Action target	Water filtration, Biodiversity
Wetland	Gikondo

Location (map) - G03 - G04 - G05



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G03: Removal of 67 m3 of existing backfills	500 USD	2 - Medium-term 2035	<ul style="list-style-type: none"> - Ground levelling - Enhance the storage capacity of the wetland - Reduce the water quantity and velocity downstream, limit the peak discharge
G04: Removal of 53 m3 of existing backfills	400 USD	2 - Medium-term 2035	
G05: Removal of 420 m3 of existing backfills	3 100 USD	2 - Medium-term 2035	
Comments			
Maintenance need	No needs		
Management monitoring	No needs		

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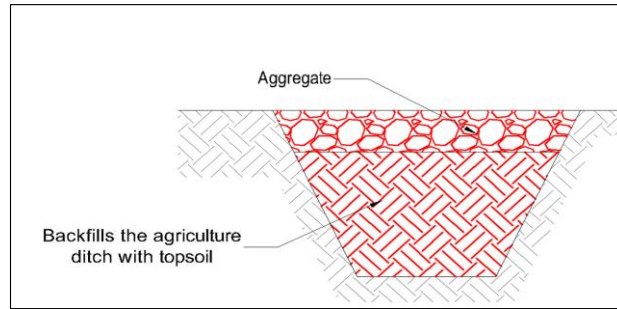
Action sheet

Action 5.G	Name	Blocking of surface and subsurface drains
	Action target	Water filtration, Biodiversity
	Wetland	Gikondo

Location (map) G03 - G04 - G05 - G10 - G11 - G12 - G13



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G03: backfill the agricultural drains with approximately 830 m3	3 800 USD	2 - Medium-term 2035	<ul style="list-style-type: none"> - Limit the lowering of the groundwater - Increase the residence time of the water in the wetland - Homogenise the wetland ground - Enhance the storage capacity of the wetland - Reduce the water quantity and velocity downstream
G04: backfill the agricultural drains with approximately 1 500 m3	6 700 USD	2 - Medium-term 2035	
G05: backfill the agricultural drains with approximately 1 12 000 m3	53 800 USD	2 - Medium-term 2035	
G10: backfill the agricultural drains with approximately 1 10 000 m3	46 500 USD	2 - Medium-term 2035	
G11: backfill the agricultural drains with approximately 1 15 000 m3	65 000 USD	2 - Medium-term 2035	
G12: backfill the agricultural drains with approximately 7 800 m3	35 900 USD	2 - Medium-term 2035	
G13: backfill the agricultural drains with approximately 11 000 m3	42 500 USD	2 - Medium-term 2035	
Comments			
Maintenance need	No needs		
Management monitoring	No needs		

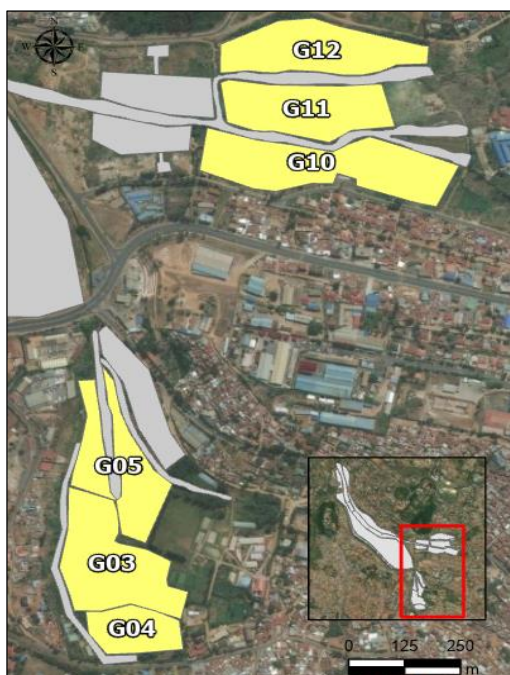
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Action sheet

**Action
6.G**

Name	Planting of native plant species adapted to the wetland environment
Action target	Biodiversity
Wetland	Gikondo

Location (map) G03 - G04 - G05 - G10 - G11 - G12



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G03 Surface : 51 600 m ²	180 600 US Dollar	2 - Medium-term 2035	<p>This action aims at recovering a herbaceous cover on all these surfaces, composed of a characteristic flora of wetlands and typical of Rwandan wetlands. For that, the first step consists in a preparation of the ground, with a decompacting of the ground in place on the first 15 centimeters in order to reactivate the seed bank and to support the rooting. The second step consists of planting with native species typical of local wetlands, such as Indian pennywort (<i>Centella asiatica</i>), Urugaga (<i>Cyperus dives</i>), Urukanganga/Epiphytic flatsedge (<i>Cyperus latifolius</i>), Carolina dichondra (<i>Dichondra micrantha</i>), Ubwungu/Heartleaf drymary (<i>Drymaria cordata</i>), Urufunzo/Papyrus (<i>Cyperus papyrus</i>), Umuberanya/Southern Cattail (<i>Typha domingensis</i>), Carex mildbraediana, Urukirakenja/Jointed flatsedge (<i>Cyperus articulatus</i>), Umujangaja/winged sedge (<i>Cyperus denudatus</i>), Carolina dichondra (<i>Dichondra micrantha</i>), Urujenone (<i>Enhydra fluctuans</i>), Gutwikumwe/Floating pennywort (<i>Hydrocotyle ranunculoides</i>), Ubusuna/Common rush (<i>Juncus effusus</i>), Urukembagufa/Cut grass (<i>Leersia hexandra</i>), Ikirogora (<i>Brillantaisia cicatricosa</i>), Umuzigangore (<i>Ludwigia abyssinica</i>), Igorogonzo/Watersmart weed (<i>Persicaria decipiens</i>), Igorogonzo/Watersmart weed (<i>Persicaria pulchra</i>), Urutaretare/ (<i>Pycnus macrostachys</i>).</p> <p>The plantings will aim to adapt the location of the species according to their need for water and the water conditions of the soil, in order to favour their development. The seedlings must come from a local source, which is necessary both ecologically and economically: ecologically, because the plants present in a given territory necessarily have the appropriate genetics for that land and are therefore adapted to local</p>
G04 Surface : 20 600 m ²	72 100 US Dollar	2 - Medium-term 2035	
G05 Surface : 39 100 m ²	136 900 US Dollar	2 - Medium-term 2035	
G10 Surface : 60 600 m ²	212 100 US Dollars	2 - Medium-term 2035	

<p>G11</p> <p>Surface : 43 400 m²</p>	<p>151 900 US Dollars</p>	<p>2 - Medium-term 2035</p>	<p>conditions, and economically, because local actors are more in demand than foreign suppliers.</p> <p>The planting will take place in December, once the rainy season is over.</p> <p>The clods will be installed in a hole made with a tiller, a planter or a pickaxe and carefully positioned in the hole thus made. Before planting, the plants will be soaked in water before installation and then packed in the soil. The plants in cups will be distributed by spots at a rate of 2 plants per m². All plants supplied by the landscaper shall be of the species and variety requested, free of wounds and pest attacks. They shall be separated by destination compartment and by species to facilitate distribution and verification. The plants must be replanted as soon as possible after delivery.</p>
<p>G12</p> <p>Surface : 45 800 m²</p>	<p>160 300 US Dollars</p>	<p>2 - Medium-term 2035</p>	
<p>Comments</p>			
<p>Maintenance need</p>	<p>Annual management by mowing in August, before the rainy season</p>		
<p>Management monitoring</p>	<p>Monitoring the evolution of the vegetation twice a year, during the dry seasons, by botanical expert, over 30 years (n+1, n+2, n+3, n+5, n+7, n+10, n+15, n+20, n+25, n+30).</p>		

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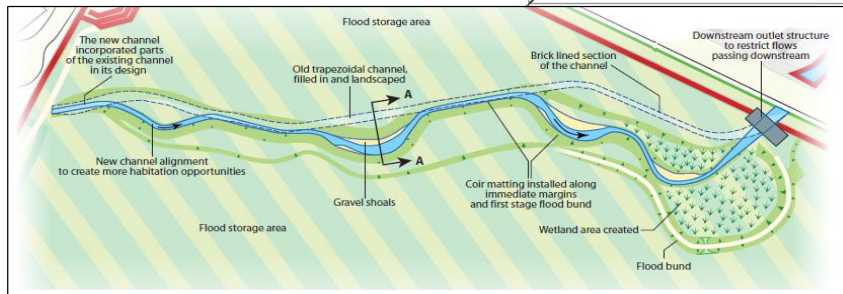
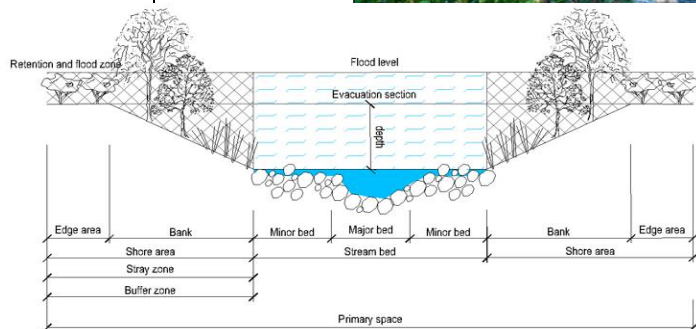
Action 7.G

Name	Re-profiling of the river with the creation of meanders and banks with different levels
Action target	Water filtration, Biodiversity
Wetland	Gikondo

Location (map) G06 - G09 - G15



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G06 : Creation of meander and banks along 400 m	50 700 USD	2 - Medium-term 2035	- Improve the water quality and decrease the water quantity flowing downstream (slowing the flow) - Enhance the biodiversity - Promote recreational area
G09 : Creation of meander and banks along 1 500 m	212 700 USD	2 - Medium-term 2035	
G15 : Creation of meander and banks along 2 200 m	690 600 USD	1 - Short-term 2025	

Comments

Maintenance need

Needs to be defined according to the monitoring management report

Management monitoring

The work will be the subject of a technical file of the works carried out with the plans of the built installations. A follow-up of the profile of the restored banks and the minor bed will be carried out 6 months after the end of the work and then the year that follows. The frequency will be adapted according to the possible disorders observed and the results of this follow-up.

On the basis of the technical file, the following will be identified

- Possible movements, departures or contributions of blocks;
- All possible traces of erosion, scouring on the resumed zones as well as on the transition zones and the zones peripheral to the development not impacted by the works.

All the elements of this follow-up will be recorded in a report. In conclusion, recommendations will be made on possible rework, the frequency of monitoring, and on future developments.

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet

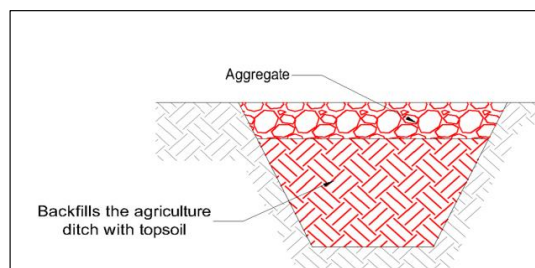
**Action
8.G**

Name	Recharge of the river bed with aggregate
Action target	Water filtration, Biodiversity
Wetland	Gikondo

Location (map) G06 - G09 - G15



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G06 : filling the watercourse with aggregates of different diameter and topsoil	18 700 USD	2 - Medium-term 2035	- Recover a space favorable for planting - Development of natural habitats
G09 : filling the watercourse with aggregates of different diameter	118 600 USD	2 - Medium-term 2035	
G15 : filling the watercourse with aggregates of different diameter	347 900 USD	1 - Short-term 2025	

Comments

Maintenance need Needs to be defined according to the monitoring management report

Management monitoring

The work will be the subject of a technical file of the works carried out with the plans of the built installations. A follow-up of the profile of the restored banks and the minor bed will be carried out 6 months after the end of the work and then the year that follows. The frequency will be adapted according to the possible disorders observed and the results of this follow-up. On the basis of the technical file, the following will be identified

- Possible movements, departures or contributions of blocks;
- All possible traces of erosion, scouring on the resumed zones as well as on the transition zones and the zones peripheral to the development not impacted by the works.

All the elements of this follow-up will be recorded in a report. In conclusion, recommendations will be made on possible rework, the frequency of monitoring, and on future developments.

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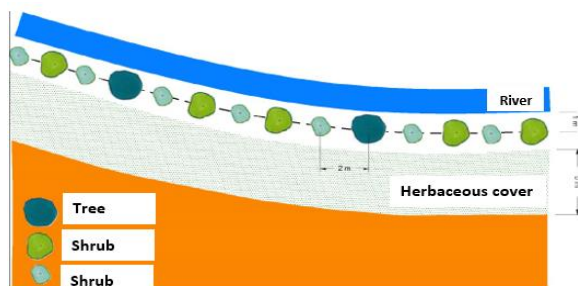
**Action
9.G**

Name	Planting the banks with native plant species
Action target	Biodiversity
Wetland	Gikondo

Location (map) G06 - G09 - G15



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G06 Surface : 7 700 m ²	26 950 US Dollar	2 - Medium-term 2035	<p>This action aims at recovering a herbaceous cover composed of a flora characteristic of wetlands and typical of Rwandan wetlands on all the banks and edges of the main rivers. To do this, the first step consists of soil preparation, with decompaction of the soil in place on the first 15 centimeters to reactivate the seed bank and promote rooting. The second step consists of planting native species typical of local wetlands, matching the water requirements of these species with the water conditions of the soil or the frequency of overflowing of the stream (depending on the stream levels). The species planted could be : Indian pennywort (<i>Centella asiatica</i>), Urugaga (<i>Cyperus dives</i>), Urukanganga/Epiphytic flatsedge (<i>Cyperus latifolius</i>), Carolina dichondra (<i>Dichondra micrantha</i>), Ubwungu/Heartleaf drymary (<i>Drymaria cordata</i>), Urufunzo/Papyrus (<i>Cyperus papyrus</i>), Umuberanya/Southern Cattail (<i>Typha domingensis</i>), Carex mildbraediana, Urukirakenja/Jointed flatsedge (<i>Cyperus articulatus</i>), Umujangaja/winged sedge (<i>Cyperus denudatus</i>), Carolina dichondra (<i>Dichondra micrantha</i>), Urujenone (<i>Enhydra fluctuans</i>), Gutwikumwe/Floating pennywort (<i>Hydrocotyle ranunculoides</i>), Ubusuna/Common rush (<i>Juncus effusus</i>), Urukembagufa/Cut grass (<i>Leersia hexandra</i>), Ikirogora (<i>Brillantaisia cicatricosa</i>), Umuzigangore (<i>Ludwigia abyssinica</i>), Igorogonzo/Watersmart weed (<i>Persicaria decipiens</i>), Igorogonzo/Watersmart weed (<i>Persicaria pulchra</i>), Urutaretare/ (<i>Pycrus macrostachys</i>).</p> <p>In addition, on the banks, it will be possible to plant shrub or tree species, adapted to wetlands, in order to form a ripisylve along the stream. This will stabilize the banks and strengthen the ecological corridor. This riparian buffer will be created on one side of the stream only, in order to maintain sufficient light and facilitate stream maintenance.</p> <p>The plants must come from a local source, which is necessary both ecologically and economically: ecologically, because the plants present in a given territory necessarily have the appropriate genetics for that</p>
G09 Surface : 42 000 m ²	147 000 US Dollar	2 - Medium-term 2035	

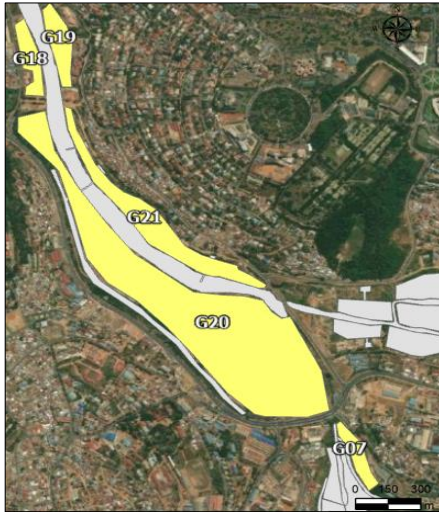
<p>G15</p> <p>Surface : 158 200 m²</p>	<p>553 700 US Dollar</p>	<p>1 - Short-term 2025</p>	<p>land and are therefore adapted to local conditions, and economically, because local actors are more in demand than foreign suppliers.</p> <p>The planting will take place in December, once the rainy season is over. For the herbaceous species, the clods will be installed in a hole made with a rototiller, a planter or a pickaxe and carefully positioned in the hole thus made. Before being planted, the plants will be soaked in water before being installed, then tamped into the soil. The plants in the cups will be distributed in patches at a rate of 2 plants per m².</p> <p>For trees and shrubs, plants shall be placed in a hole at least 40 cm deep and staked.</p> <p>All plants supplied by the landscaper must be of the species and variety requested, free of wounds and pest attacks. They shall be separated by destination compartment and species for ease of distribution and verification. Plants shall be replanted as soon as possible after delivery.</p>
<p>Comments</p>			
<p>Maintenance need</p>	<p>Annual management by mowing in August, before the rainy season. Maintenance of the rypisilve every year : removal of dead wood, pruning as needed, ...</p>		
<p>Management monitoring</p>	<p>Monitoring the evolution of the vegetation twice a year, during the dry seasons, by botanical expert, over 30 years (n+1, n+2, n+3, n+5, n+7, n+10, n+15, n+20, n+25, n+30).</p>		

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet

Action 10.G	Name	Possible development of recreational activities: Gikondo Eco-Valley
	Action target	Landscape / Recreational activities
	Wetland	Gikondo

Location (map) G07, G18, G20, G19, G21



Photos / examples



Characteristics	Rough cost	Priority	Objectives
G7, G18, G20, G19, G21 : GIKONDO ECO VALLEY Divided into different habitats/zones			
Package 1 - Allowing access and delimitating spaces: - Pedestrian/cycling circuits 4m wide (5km linear, gravel paving) - Benches every 500m (10x) - Accessible pedestrian bridges (2x) - Solar light poles every 20m (250x) - Planting of native species (5 000m ²) - Interpretation trail (natural habitat awareness signage)	RWF 1 234 081 387,00 USD 1 250 000,00	1 - Short-term 2025	To create an attractive recreational area with multiple uses: sports, nature preservation, walking, food, culture, etc. Economic activities managed by private operators are included in the programme in order to contribute to the sustainability and durability of investments.
Package 2 : Economic activities (attracting private actors) - Playgrounds (5x) - Food kiosks (5x) - Picnic tables (20x) - Bike rental kiosk - Toilets - Crafts/souvenir kiosks (5x) - Visitor centre point with gift shop	RWF 612 498 000,00 USD 600 000,00	2 - Medium-term 2035	
Package 3 : Boosting attractiveness and quality of spaces - Outdoor gym areas (5 areas of 60m ²) - Open air amphitheater for cultural events - Sports grounds - football (FIFA), volleyball, basketball (NBA) - Bird watching decks (2x)	RWF 816 664 000,00 USD 800 000,00	3 - Long-term 2050	
Comments	- See detailed plan provided in annex - Some of the existing pipelines implemented in the wetland will be reused for the water supply of the recreational activities		
Maintenance need	Annual for equipments and infrastructures and quarterly for green spaces with nature evolution		
Management monitoring	Involvement of private operators for the day-to-day management of certain facilities (food stalls, craft stalls). Possibility of private operation also for sports grounds and events areas. Involvement of public players (site cleanliness, waste collection and management, etc.), to manage and enforce contracts, ensure coordination for the management of the site (internal regulations) and ensure security of the site		

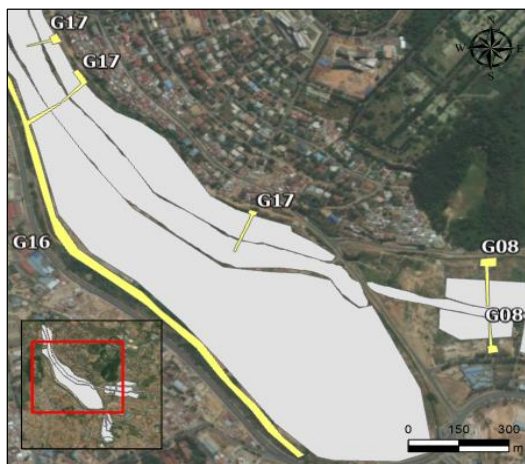
Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet

**Action
11.G**

Name	Riprap at the outlet of urban discharge
Action target	Flood control / Water filtration
Wetland	Gikondo

Location (map) G08 - G16 - G17



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G08 Number of riprap : 2 Volume : 100 m3	4 500 US Dollar	2 - Medium-term 2035	<p>This action consists of placing boulders just at the outlet of the urban drains, in order to break the incoming flow and improve the diffusion of water towards the downstream wetland and other hydraulic outlets.</p> <p>These riprap will be made of stones of size between 200 and 1000 mm, depending on the flow of water arriving and the speed of flow, so that they can ensure their anti-erosion role. For each riprap, it will be used stones of different dimensions so that the small stones occupy the empty spaces between the larger stones. They will be placed one on top of the other, so as to form a homogeneous entity and in phase with the width of the drains.</p> <p>The installation of the riprap will take place in dry periods, outside of rainy periods.</p>
G16 Number of riprap : 10 Volume : 500 m3	22 500 US Dollar	2 - Medium-term 2035	
G17 Number of riprap : 3 Volume : 150 m3	6 750 US Dollar	2 - Medium-term 2035	
Maintenance need	/		
Management monitoring	Visual inspection of riprap twice a year and removal of any waste or plant debris that may be present.		

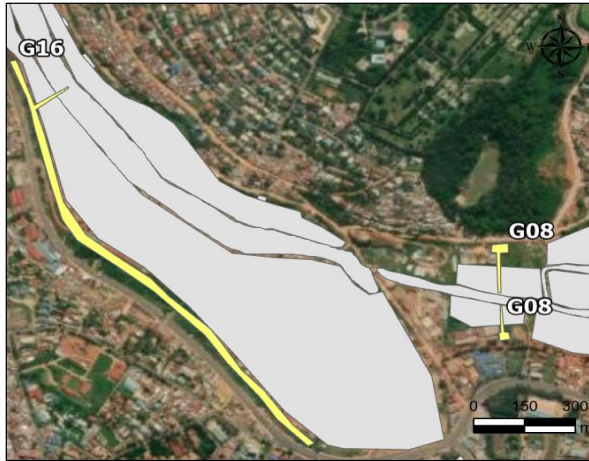
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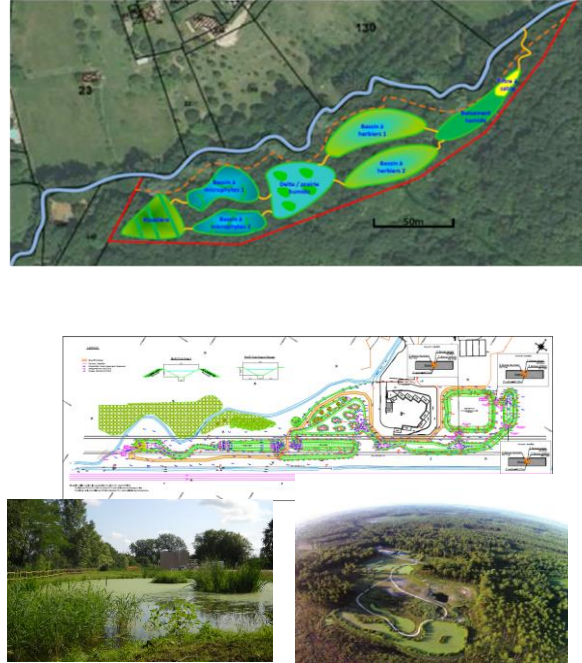
**Action
12.G**

Name	Creation of a constructed wetland - buffer zone
Action target	Biodiversity and Water Quality
Wetland	Gikondo

Location (map) G08 - G16



Photos / examples

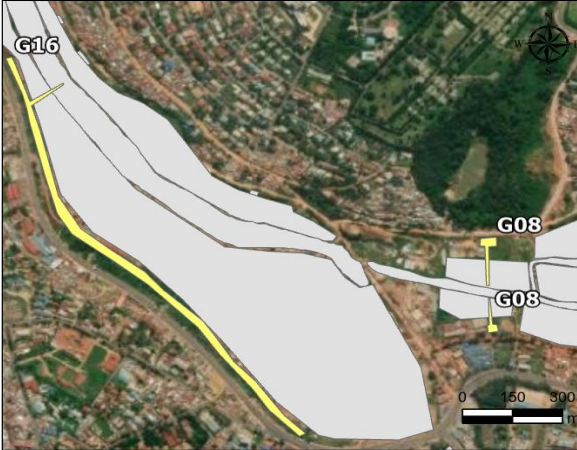
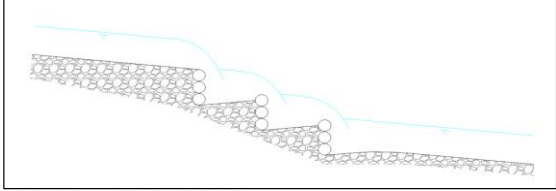




Characteristics	Rough cost estimate	Priority	Objectives
G08 Surface : 4 000 m ²	74 000 US Dollar	1 - Short-term 2025	The design approach of the buffer wetland leaves an important part to the study of the contributing watershed in order to know precisely the characteristics of the incoming effluents and of the contributing watershed (flow rate, surface of the watershed, quality, frequency of feeding...). This ecological engineering project is based on different components such as hydraulics, purification, wetlands ecology and plant engineering.
G16 Surface : 37 000 m ²	684 500 US Dollar	1 - Short-term 2025	<p>In summary, the creation of a wetland buffer zone is carried out in 3 stages</p> <ul style="list-style-type: none"> - Feasibility study to identify the environmental issues and take them into account in the design: topographic surveys, soil studies, hydraulic studies of the watershed... - Design study including: execution plans of the wetland buffer zone compartments, ecological engineering design, hydraulic sizing of the works and integration of educational supports... - Works and follow-up of the construction site requiring the intervention of qualified partners for the realization of the civil engineering (earthworks to create the various compartments, the overflows...), ecological engineering (choice of materials, planting of the vegetable species...) and a qualified site manager. <p>A safety margin of 0.30m (minimum difference between the highest water level and the top of the compartment crest) is provided for during periods of maximum compartment filling. To achieve this objective, overflows will be installed at the top of the compartment crest.</p>
Comments	<ul style="list-style-type: none"> - The wetland buffer cannot be effective if it collects untreated wastewater. - Maximum depth of the compartments fixed at 1,20m 		

Maintenance need	<p>Annual management by mowing in August, before the rainy season</p> <p>A wetland buffer reproduces, on a smaller scale, mechanisms that occur naturally in the natural environment. The evolution of the habitats and the sustainability of the objectives targeted by the wetland buffer (purification, biodiversity, education, etc.) are directly linked to the quality of its management from the moment it is put in water.</p> <p>The management of the buffer wetland leads to be vigilant on the following hydraulic phenomena</p> <ul style="list-style-type: none"> - Creation of hydraulic plugs at the level of the hydraulic structures that can lead to overflows (loading of the system) and a reduction in the residence time. - Reduction of the residence time and the treatment capacity of the system by short-circuits and filling of the volume of the basins. - Risk of invasive plants or plant dieback. <p>A management plan also has the following objectives</p> <ul style="list-style-type: none"> - Ensure the cutting of plants with export of green waste - Maintain a high level of biodiversity in the water compartments by applying a differentiated vegetation management method. - To perpetuate the landscape quality of the site and its potential to welcome the public.
Management monitoring	<p>Monitoring of the evolution of vegetation and hydraulics twice a year, during dry and rainy seasons, by an expert in ecological engineering, for 30 years (n+1, n+2, n+3, n+5, n+7, n+10, n+15, n+20, n+25, n+30)</p>

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet

Action 13.G	Name	Re-profiling of the hydraulic outlets from the discharge	
	Action target	Water filtration, Biodiversity	
	Wetland	Gikondo	
Location (map) G08 - G16		Photos / examples	
		  	
Characteristics	Rough cost estimate	Priority	Objectives
G08: Riprap at the outlet with creation of different river bed ground level over 230 m	6 000 USD	2 - Medium-term 2035	<ul style="list-style-type: none"> - limit erosion - enhance biodiversity with diversification of natural habitats
G16: Riprap at the outlet with creation of different river bed ground level over 112 m	2 900 USD	2 - Medium-term 2035	
Comments			
Maintenance need	<ul style="list-style-type: none"> - Maintenance of the outlets (prevent from solid waste accumulation): twice per year (including one before the rainy season) - Other needs to be defined according to the management monitoring report 		
Management monitoring	<p>The work will be the subject of a technical file of the works carried out with the plans of the built installations. A follow-up of the profile of the restored banks and the minor bed will be carried out 6 months after the end of the work and then the year that follows. The frequency will be adapted according to the possible disorders observed and the results of this follow-up.</p> <p>On the basis of the technical file, the following will be identified</p> <ul style="list-style-type: none"> - Possible movements, departures or contributions of blocks; - All possible traces of erosion, scouring on the resumed zones as well as on the transition zones and the zones peripheral to the development not impacted by the works. <p>All the elements of this follow-up will be recorded in a report. In conclusion, recommendations will be made on possible rework, the frequency of monitoring, and on future developments.</p>		

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

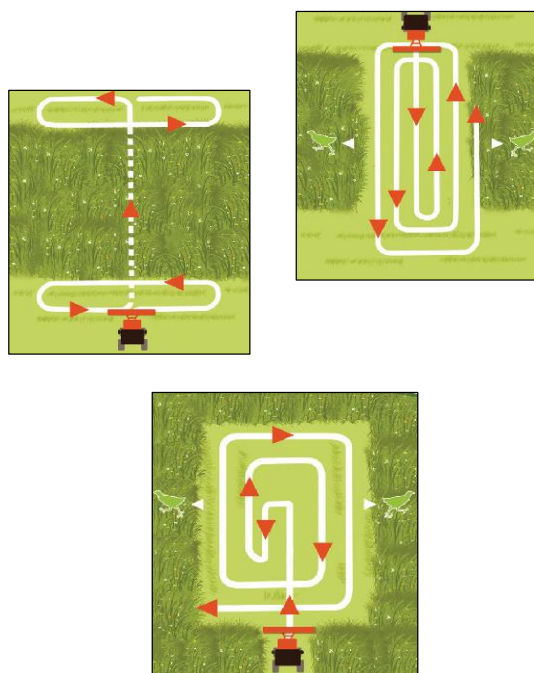
Action sheet

Action 14.G	Name	Differentiated management according to natural habitats
	Action target	Biodiversity
	Wetland	Gikondo

Location (map) G13 - G14





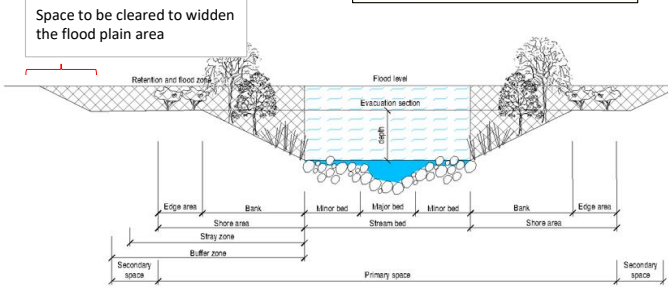
Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G13 Surface : 22 000 m ²	22 000 US Dollar	2 - Medium-term 2035	<p>Herbaceous habitats will be managed by annual mowing. Mowing will be mechanized or manual, in dry periods to facilitate access, promote reseeding and limit impacts on wildlife. They will be carried out at a minimum height of 10 cm, and centrifugal so as to push the fauna towards the refuge zones of the non mowed sectors (in accordance with the mowing principle illustrated in the diagrams above). The refuge zones, corresponding to the non mowed areas, will represent approximately 5% of the mowed surface. The speed of the self-propelled mowing machines will be moderate to allow time for insects and other fauna to move. Mowing residues will be systematically exported to limit soil eutrophication and the development of nitrophilic vegetation.</p>
G14 Surface : 16 000 m ²	16 000 US Dollar	2 - Medium-term 2035	<p>For low herbaceous formations, management by grazing as an alternative to differentiated mowing may be considered, if there is an opportunity for a territorial agricultural project in the medium to long term. The necessary conditions are: sufficiently dry soil, a grazing period limited to about 3 months and a stocking rate limited to 0.5 to 0.8 LU per hectare. Eco-grazing can be implemented after an initial period of management by mowing to establish the cover.</p> <p>Chemical weeding and the use of phytosanitary products is prohibited.</p> <p>As for the shrub and tree environments, management consists of selective clearing and removal of the shoots of any invasive species by manual or mechanical removal of the feet (with export).</p>
Comments			
Maintenance need	/		
Management monitoring	Annual botanical monitoring, during the dry seasons, by botanical expert, over 30 years (n+1, n+2, n+3, n+5, n+7, n+10, n+15, n+20, n+25, n+30) to identify the development and evolution of plant formations, in order to adapt the objectives and methods of maintenance, in particular the frequency of mowing, and to perpetuate the most suitable hygrophilous formations.		

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali



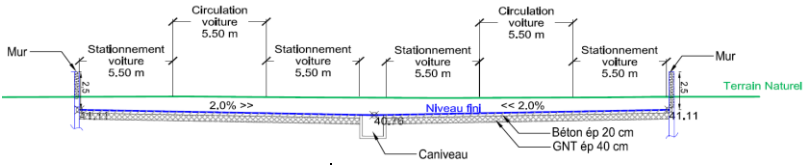
Action sheet

Action 15.G	Name	Clearance over a large width to facilitate the overflow		
	Action target	Flood mitigation, water storage		
	Wetland	Gikondo		
Location (map) G15		Photos / examples		
				
		<p>Space to be cleared to widen the flood plain area</p>		
Characteristics	Rough cost estimate	Priority	Objectives	
G15 : creation of a larger flooding plain along the extend of the river (meander and banks)	167 800 USD	1 - Short-term 2025		
Comments				
Maintenance need	Cleaning of waste			
Management monitoring	No needs			

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet



Action 16.G	Name	Groud levelling and vegetation to create an urban green space
	Action target	
	Wetland	Gikondo

<p style="text-align: center;">Location (map) G18 - G19 - G20 - G21</p> 	<p style="text-align: center;">Photos / examples</p> 
	

Characteristics	Rough cost estimate	Priority	Objectives
Package 1 - Pedestrian/cycling circuits 4m wide (5km linear, gravel paving)	92 000 USD	1 - Short-term 2025	- Landscaping - Planting vegetation
Package 2 : - Playgrounds (5x) - Food kiosks (5x) - Bike rental kiosk - Toilets - Crafts/souvenir kiosks (5x) - Visitor centre point with gift shop	11 400 USD	2 - Medium-term 2035	
Package 3 : - Outdoor gym areas (5 areas of 60m2) - Open air amphitheater for cultural events - Sports grounds - Bird watching decks (2x)	130 600 USD	3 - Long-term 2050	
Comments	See Action 10.G for details planned recreational activities		
Maintenance need	No needs		
Management monitoring	No needs		

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet

Action 20-G	Name	Stream protection zone with a vegetated riparian buffer	
	Action target	Biodiversity and Water Quality	
	Wetland	Gikondo	
Location (map) G06 - G09 - G15		Photos / examples	
			
Characteristics	Rough cost estimate	Priority	Objectives
G06 Vegetated buffer strip of approximately 12m wide on each side of the watercourse, i.e. an area of approximately : 7 800m ² for a total of 300m	31 200 US Dollar	2 - Medium-term 2035	<p>In order to limit the transfer of pollutants to the watercourse via runoff, vegetated buffer strips are positioned between agricultural plots and the watercourse network. In this action sheet, a vegetated buffer strip is defined as any vegetated surface that intercepts diffuse or concentrated surface runoff and therefore reduces the transfer of pollutants and/or sediments. These vegetated buffer strips are translated as grassy strips, permanent grasslands, fallow land, hedges, woods or copses.</p> <p>Their implementation requires :</p> <ul style="list-style-type: none"> - Tillage to level and decompact the land; - Revegetation, which is either seeding of grassland or planting of shrubs/trees; - A choice of local plant species. <p>This vegetated buffer strip, whose width will have to be refined according to the intercepted watershed, will also be a support for the migration of animal species.</p>
G09 Vegetated buffer strip of approximately 12m wide on each side of the watercourse, i.e. an area of approximately : 42 000m ² for a total of 1 700m	168 000 US Dollar	2 - Medium-term 2035	
G15 Vegetated buffer strip of approximately 25m wide on each side of the watercourse, i.e. an area of approximately : 100 000 m ² for a total of 2 000m	375 000 US Dollar	1 - Short-term 2025	
Comments	Developments must be carried out outside of rainy periods to avoid soil compaction and degradation caused by erosion (uprooting of plantations, seeds washed away by runoff...)		
Maintenance need	Annual management by mowing in August, before the rainy season		
Management monitoring	Monitoring the evolution of the vegetation twice a year, during the dry seasons, by botanical expert, over 30 years (n+1, n+2, n+3, n+5, n+7, n+10, n+15, n+20, n+25, n+30).		

Feasibility study, baseline studies and detailed designs for wetland rehabilitation in the city of Kigali

Action sheet

**Action
24.G**

Name	Protection and conservation of typical wetland habitats
Action target	Biodiversity
Wetland	Gikondo

Location (map) G13 - G14



Photos / examples



Characteristics	Rough cost estimate	Priority	Objectives
G13 Linear of fences : 600 ml	60 000 US Dollar	2 - Medium-term 2035	<p>This action aims to protect the wetlands of good plant quality and the most biologically sensitive (breeding grounds for heritage fauna, protected plant species, ...). For this, several solutions are proposed:</p> <ul style="list-style-type: none"> - the installation of fences or wooden barriers, positioned all around the area of interest, in order to prohibit any pedestrian or vehicle access (except for maintenance). These protective elements must be well integrated into the landscape, so wooden elements are recommended. Awareness signs may also be installed. - the classification of the zone of interest in a protection zoning (reserves, protected areas, ..), allowing to limit the uses to those favorable to the maintenance of the fauna and the present flora. The classification in protection zoning induces administrative procedures but proves to be a very relevant tool to guarantee the durability of the area and the actions carried out, and to maintain quality habitats. <p>In addition, thorough biological monitoring must be carried out on these areas by experts in ecology or environmental associations.</p> <p>The objective of this monitoring is to identify the fauna and flora issues in these areas, to follow the evolution of the habitats and to propose and adapt the management modalities in order to enhance the environment. This monitoring must be carried out at all times of the year, with more frequent visits during the period of activity of the fauna and development of the flora, and carried out according to a precise protocol repeated over several years.</p>
G14 Linear of fences : 500 ml	50 000 US Dollar	2 - Medium-term 2035	
Comments			
Maintenance need	/		
Management monitoring	Annual verification of the state of deterioration of the fences.		