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NEW BUGESERA INTERNATIONAL AIRPORT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: ADDENDUM

NEW BUGESERA INTERNATIONAL AIRPORT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: ADDENDUM

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Made by **Brent Holme**
Checked by **Denise Wright**
Approved by **Denise Wright**

Made by: Brent Holme

Checked/Approved by: Denise Wright

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ABBREVIATIONS

Abbreviation	Definition
BAC	Bugesera Airport Company Limited
C-ESMP	Construction ESMP
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GHGs	Greenhouse Gas Emissions
GIIP	Good International Industry Practice
GOR	Government of Rwanda
HDPE	High-density Polyethylene
HGVs	Heavy Goods Vehicles
IFC	International Finance Corporation
INMR	Institute of National Museum of Rwanda
l	Litre/s
m	Metre/s
m ³	Cubic metre/s
Mota-Engil	Mota-Engil Engenharia e Construção
NO _x	Oxides of Nitrogen
PAPs	Project Affected Persons
PM ₁₀ and PM _{2.5}	Particulate Matter
PPE	Personal Protective Equipment
Ramboll	Ramboll Environment and Health UK Limited
SO ₂	Sulphur Dioxide
VOCs	Volatile Organic Compounds

1. INTRODUCTION TO ADDENDUM

1.1 Introduction

The Bugesera Airport Company Limited (BAC) is a joint venture between Mota-Engil Engenharia e Construção (Mota-Engil) and the Government of Rwanda (GOR). BAC intends to develop a new international airport within the Bugesera District, in the Eastern Province of Rwanda, referred to as New Bugesera International Airport (the 'Proposed Project').

The potential financial lenders for the Proposed Project include organisations that apply international financial institution standards. These include the International Finance Corporation (IFC) Performance Standards, the Equator Principles and the standards of specific banks, such as the African Development Bank Integrated Safeguards System. Therefore, an Environmental and Social Impact Assessment (ESIA) is required to demonstrate that the Proposed Project complies with the relevant Project Standards that are to be adopted. The ESIA has been prepared for BAC by Ramboll Environment and Health UK Limited (Ramboll). It presents the potential environmental, social and community health impacts associated with the Proposed Project.

1.2 Requirement for Addendum

Details associated with the Water Pipeline have been amended following the submission of the ESIA Report to the Rwanda Development Board (RDB) in November 2017. The Water Pipeline was previously planned to be installed aboveground; however, the Water Pipeline is currently being installed underground along a trench running the length of the pipeline, approximately 4,015 m in length.

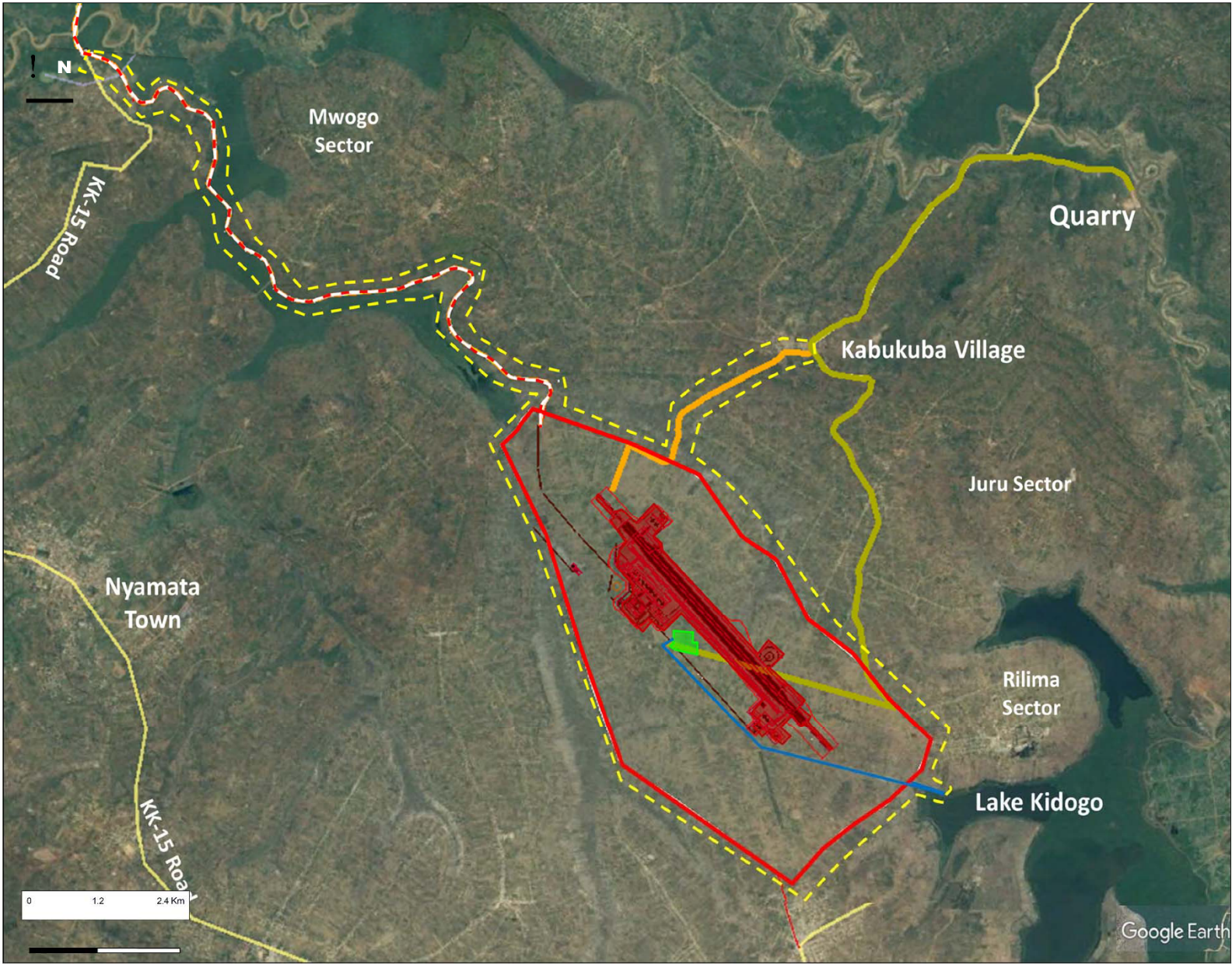
The Water Pipeline material is comprised of high-density polyethylene (HDPE) and ductile iron segments with an internal diameter of 160 mm. The pipeline is being installed to a depth of approximately 1 m in a trench of approximately 800 mm in width. The trench is being filled initially with well-graded granular sand, whereupon the pipe will be laid. Similar well-graded granular sand is being deposited over the pipe and covered with trench backfill. Hardstanding is overlaid on the surface at the manholes and on the surface at the Construction Camp. Air relief valves and washout valves are being installed inside concrete manholes, located every 1,000 m along the pipeline. Refer to Figure 1-1 for the location of key Project components.

The water obtained from Lake Kidogo is being lifted through pumps and stored in two separate 800 l water tanks inside the Construction Camp; one for process water and the other for potable water. Adjacent to each tank are independent booster sets to pressurise respective network needs; namely, the process water network (for concrete batching and prefabrication plants) and the potable water network. Potable water is being treated at the water treatment plant onsite.

According to BAC, an average of 20 m³ of water is required per day for potable use and 192 m³ is required for the processing plants (concrete batching and prefabrication plants). Daily water is being abstracted from Lake Kidogo over a period of 7 and 12 hours. Water is abstracted via a diesel generated pump. The abstraction pipe is equipped with a strainer to guarantee the filtration of solid materials. Additional filters include natural filters composed of crushed stone and aggregate.

1.3 Purpose of Impact Assessment

The purpose of the impact assessment process is to: determine a baseline environment; assess the significance of potential environment and social impacts; and identify mitigation measures that are designed to avoid, minimise or mitigate the identified significant impacts associated with the underground Water Pipeline.



Legend

- Proposed Project Area
- Airport Area
- Airport Footprint
- Expressway
- Construction Camp
- Existing Quarry Road
- New Quarry Road
- Water Pipeline

Figure Title
Key Project Components

Project Name
New Bugesera International Airport ESIA

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Client
Bugesera Airport Company Limited

RAMBOLL

Figure 1-1: Key Project Components

The impact assessment has been conducted according to Rwandan environmental legislation to ensure a comprehensive, transparent and independent process. In addition, the impact assessment must comply with IFC Performance Standards 2012. The impact assessment associated with the underground Water Pipeline has been conducted retrospectively as construction of the Proposed Project, including pipeline installation, has already commenced.

Assessment methodologies and baseline conditions for each impact have been previously reported in specific chapters of the ESIA Report (i.e. chapters 8 to 19) and are not be repeated in this addendum. Cumulative impacts associated with the Water Pipeline will be similar to those identified in Chapter 19: Cumulative Impact Assessment.

1.4 Structure of this Chapter

As stated previously, this report forms an addendum to the ESIA Report submitted in November 2017 and includes anticipated impacts associated with the replacement of the Water Pipeline below ground. The chapter has been structured to include impacts, mitigation measures and residual impacts for all environmental, cultural and socio-economic topics. Note that operation impacts and decommissioning activities have not been considered as these will be considered in the operation phase risk assessment.

2. TRANSPORT

2.1 Impact Assessment Prior to Mitigation

The Institute of Environmental Assessment guidance suggests a list of topics against which the significance criteria can be applied across the relevant receptors. For this addendum, the topics of severance, driver delay, safety of transport users and amenity for transport users have been selected as relevant for this assessment. Receptors include surrounding communities and construction phase employees. A full definition of each selected topic and how impact significance is measured is described in Section 8.3.6 of Chapter 8: Transport.

Two Heavy Goods Vehicles (HGVs) will be used during trench development and installation of the Water Pipeline, and therefore, will be of **Negligible** significance to the change in severance, driver delay, safety of transport users and amenity for transport users, based on a low receptor sensitivity and low magnitude of impact.

2.2 Mitigation Measures

Similar mitigation measures as contained in Section 8.6 of Chapter 8: Transport will be applicable during the installation of the Water Pipeline; namely by ensuring all vehicles are maintained regularly and are road worthy. Furthermore, the route to be used by the HGV must be limited to a pre-defined track.

2.3 Residual Impacts

When taking account of incorporated and recommended mitigation measures, the overall residual impact significance remains **Negligible**. Table 13-1 provides a summary of the impacts and mitigation measures associated with traffic and transport during the installation of the underground Water Pipeline.

3. AIR QUALITY

3.1 Impact Assessment Prior to Mitigation

Activities associated with the installation of the Water Pipeline have the potential to result in air emissions of fugitive particles, particularly during trench development, pipeline installation and re-filling of the trench. This will result in the emissions of carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM₁₀ and PM_{2.5}), sulphur dioxide and volatile organic compounds (VOCs). Receptors include surrounding communities, construction phase employees and surrounding ecosystems/habitats. A full definition of the assessment methodology is contained in Section 9.3 of Chapter 9: Air Quality. It must be noted that this impact assessment has been conducted via a desktop approach, taking cognisance of anticipated impacts contained in Chapter 9 (Air Quality).

Prior to mitigation, the activities associated with the Water Pipeline installation will contribute to limited emissions of fugitive particles resulting in a **Minor Adverse** impact to surrounding communities, employees and the ecosystem/habitat, based on a medium receptor sensitivity and low magnitude of impact.

3.2 Mitigation Measures

Similar mitigation measures, as contained in Chapter 9.6 (Air Quality), will be applicable during the installation of the Water Pipeline. These include:

- Minimising dust emissions from open soil storage piles, by using control measures such as covering storage piles with sheeting, and increasing the moisture content therein;
- Dust suppression techniques, such as applying water or non-toxic chemicals to minimise dust from vehicle movements; and
- Management of emissions from mobile sources, including adequate maintenance of vehicle and equipment.

3.3 Residual Impacts

When taking account of incorporated and applicable mitigation measures, the overall residual impact significance will be **Negligible**. Table 13-1 provides a summary of the impacts and mitigation measures associated with air emissions during the installation of the underground Water Pipeline.

4. NOISE AND VIBRATION

4.1 Impact Assessment Prior to Mitigation

Activities associated with the installation of the Water Pipeline have the potential to result in noise emissions from the earthworks during trench development, pipe laying and backfill activities. This is limited to two HGVs (excavator and heavy goods delivery vehicle) that will be operated intermittently. The noise emissions from all significant noise sources have been estimated based on experience from other similar construction activities. Calculations referenced in Chapter 10 (Noise and Vibration) have been used for this assessment.

Receptors include construction phase employees, local communities and surrounding wildlife. Additional descriptions of the methodology utilised is contained in Section 10.4 of Chapter 10: Noise and Vibration. Critical noise distances summarised in Table 10-10 have also been used as part of this impact assessment.

Based on the distance from sensitive receptors (more than 25 m), and the limited operation of the vehicles, noise emissions associated with the installation of the pipeline is considered to be **Negligible** to the local community and surrounding wildlife based on an impact magnitude of low. Employees in close proximity to the operating vehicles will be subjected to an impact of **Minor Adverse** significance.

4.2 Mitigation Measures

Similar mitigation measures as contained in Section 10.7 of Chapter 10: Noise and Vibration will be applicable during the installation of the Water Pipeline. This includes ensuring that vehicles are of good working condition and submitted to routine maintenance and repair. Additional engineering controls include the provision of employees with adequate Personal Protective Equipment (PPE) for construction activities.

4.3 Residual Impacts

When taking account of incorporated and recommended mitigation measures, the overall residual impact significance will be **Negligible**. Table 13-1 provides a summary of the impacts and mitigation measures associated with noise and vibration during the installation of the underground Water Pipeline.

5. BIODIVERSITY

5.1 Impact Assessment Prior to Mitigation

Baseline conditions identified along the Water Pipeline route will not require updating as the route alignment has not been amended. All baseline findings of flora, herptiles (amphibians and reptiles), birds and mammals are detailed in Chapter 11.3 and 11.4 (Biodiversity).

Potential impacts associated with the installation of the Water Pipeline relate to vegetation clearance along the route which can result in the following:

- Habitat loss;
- Mortality of plants and animals;
- Fragmentation; and
- Introduction and spread of invasive species.

Additional impacts on the biophysical environment include impacts to air quality, impacts to surface and groundwater due to runoff, and the disturbances from noise and human activity, which are discussed in relevant sections in this addendum.

As the pipeline route has been previously disturbed (anthropic landscapes and bush fallow), and no important biophysical environmental (i.e. Important Bird Areas or wetlands) will be impacted as a result of the installation activity, the impact on the biophysical environment is considered to have a **Moderate Adverse** significance. This is based on highly sensitive receptors but a medium impact magnitude and a temporary period that the pipeline will be in operation.

5.2 Mitigation Measures

Mitigation measures contained in Chapter 11.7 (Biodiversity) are applicable in minimising the resultant impact from the installation activity. Furthermore, a Construction ESMP will be developed with a supporting Biodiversity Management Plan and additional commitments contained in the Biodiversity Action Plan can be implemented to manage the impacts.

5.3 Residual Impacts

The significance of the impact, following implementation of mitigation measures, will be considered as **Minor Adverse**. Table 13-1 provides a summary of the impacts and mitigation measures associated with biodiversity during the installation of the underground Water Pipeline.

6. WATER RESOURCES

6.1 Impact Assessment Prior to Mitigation

The potential impacts related to the construction of the Water Pipeline is limited to an increase in sediment load to Lake Kidogo and mismanagement of wastewater resulting from the installation activity. Receptors and the magnitude of the potential impact have been described in Section 12.3 of Chapter 12: Water Resources. Impacts associated with the abstraction of water from Lake Kidogo have been considered and quantified in Chapter 12: Water Resources and therefore will not be considered in this addendum.

Lake Kidogo is considered sensitive because of its important role as part of the ecologically sensitive adjacent wetland habitats and the aquatic fauna it supports (notably the IUCN endangered Ningu fish species), as well as its importance to local communities for water supply, fishing and other important ecosystem provisioning services. It also supports areas of papyrus swamp wetland, which are an important functional part of the local Nyabarongo wetlands habitat and Important Bird Area.

Approximately 5,750 m³ of soil will be excavated during the development of the trench along the pipeline route, which is not considered substantive. Furthermore, the excavated soil will be stockpiled for a limited time period before being re-filled. The average slope along the pipeline route is between 1.1 % and -3.7 %. Resultant pollution to surface water from sedimentation, contaminated runoff (hydrocarbon spillages from vehicles, etc.) is not considered likely, and therefore the impact significance is considered to be **Minor Adverse** based on the sensitivity of the water body.

6.2 Mitigation Measures

Design measures and engineering controls contained in Section 12.7 in Chapter 12: Water Resources, will be applicable during the installation of the Water Pipeline. If implemented correctly, the measures will be sufficient to reduce the anticipated potential impacts to a level which requires no further direct mitigation measures for surface water protection of Lake Kidogo. Specific mitigation measures include to prohibit contractor vehicles from accessing the lake, store stockpiles in accordance with international best practice and to ensure that no discharge to the lake occurs during installation activities.

6.3 Residual Impacts

On the basis that the construction phase ESMP and the Pollution Prevention Plan are implemented in line with the requirements detailed under the construction phase design controls, the impact significance relating to the pipeline on Lake Kidogo is anticipated to be **Negligible** and no further residual impacts are anticipated. Table 13-1 provides a summary of the impacts and mitigation measures associated with water resources during the installation of the underground Water Pipeline.

7. SOIL AND GEOLOGY

7.1 Impact Assessment Prior to Mitigation

The potential impact from the installation of the Water Pipeline relates to soil as a resource. Indirect receptors that use soil, groundwater and surface water have also been considered (such as ecological and human receptors). Pathways that could link the sources and receptors have been identified. Only where the complete linkage of source, pathway and receptor are present can impacts potentially occur.

Detailed methodology for calculating the significance and magnitude of impact of the activities to receptors is detailed in Section 13.3.4 of Chapter 13: Soil and Geology, which has been used as the basis of this impact assessment.

The pipeline route is situated within an area that has historically been used predominantly for subsistence cattle and crop farming. The general structure and lithological type of the soils do not support intensive agriculture nor have a high natural level of fertility and so are not a highly sensitive receptor to potential impacts in this respect. Additionally, the potential for historic contamination to be present along the pipeline is considered low, and the resultant impact is considered to be of **Negligible** significance.

Earthworks and soil stockpiling can lead to the mixing of different soil types, and also the changing of the soil structure, which may influence overall fertility with implications for agricultural use and or habitat degradation. Similarly, mixing of excavated soil types can result in the contamination of previously clean soils by contaminated soils impacted from hydrocarbon spillages from vehicles. Unplanned releases of contaminants during installation are possible prior to implementation of mitigation measures. Therefore, the resultant impact is considered to be of **Minor Adverse** significance during installation prior to mitigation.

Vegetation clearance and earthworks can lead to the exposure of surface soils to erosion and compaction resulting in potential changes to ecosystem habitats and interactions between stormwater and surface water receptors. The limited area which will be disturbed for the pipeline installation will result in a potential mobilisation of sedimentation to surrounding surface water receptors. In relation to soil disturbance and loss of topsoil resource along the pipeline route, potential impact to the ecological receptors is considered to be of **Minor Adverse** significance, due to the sensitivity of the receptors prior to mitigation.

Installation activities may also mobilise soil particles that could present fallout onto surrounding ecosystems and into surface water bodies, resulting in a change in ecological receptors under certain exposure scenarios. Furthermore, contaminated dust particles may also be mobilised presenting a potential health risk to construction workers and other human health receptors surrounding the pipeline route. Impacts associated with human health resulting from the mobilisation of soil particles is considered to be of **Minor Adverse** significance, due to the sensitivity of the receptors prior to mitigation.

7.2 Mitigation Measures

Design measures and engineering controls contained in Sections 13.5.2.1 and 13.6 of Chapter 13: Soil and Geology will be applicable during the installation of the Water Pipeline. These measures include the adoption of Good International Industry Practice (GIIP) for the managing of hydrocarbons (fuels, etc.) and the adaption of the various environmental and social management plans (Pollution Prevention Plan, Soil Management Plan, etc.).

7.3 Residual Impacts

On the basis that the mitigation measures contained in Chapter 13.5.2.1 and Chapter 13.6 (Soil and Geology) are implemented during the installation of the pipeline, impact significance resulting to and from soils is anticipated to be **Negligible** and no further residual impacts are anticipated. Table 13-1 provides a summary of the impacts and mitigation measures associated with soil and geology during the installation of the underground Water Pipeline.

8. ARCHAEOLOGY AND CULTURAL HERITAGE

8.1 Impact Assessment Prior to Mitigation

The potential impacts to archaeology and cultural heritage are limited to the development of the trench associated with the installation of the Water Pipeline. Sensitive receptors include, but are not limited to, family graves in close proximity to rural dwellings, larger graves, vegetation that may have medicinal properties, and undiscovered/unknown archaeological artefacts or areas of cultural heritage. Details of the impacts from the Proposed Project are detailed in Chapter 14: Archaeology and Cultural Heritage.

Undiscovered cultural heritage, archaeological or palaeontological objects or features may potentially be disturbed as a result of ground intervention activities associated with the installation of the pipeline. Objects of spiritual value or that relate to worship or community gathering may also be disturbed if they are present along the pipeline route.

Installation activities have the potential to directly damage pottery sites, which are indicators of the beginnings of trade and production in the early years. Installation activities may also disturb human remains outside gazetted burial grounds/cemeteries. No known gazetted burial grounds exist along the pipeline route.

The removal of vegetation, top soil stripping and earthworks have the potential to lead to the exposure and possible damage or destruction of archaeological artefacts. The extent of the impact would be local, covering the pipeline route and the duration would be short term. The magnitude of this impact is therefore low and the receptor sensitivity is considered low. Impact significance before mitigation is **Negligible**.

The extent of impacts in the event that a burial site is discovered would be local and will be limited to a short duration. The magnitude of this impact is assessed as medium and receptor sensitivity high. Impact significance before mitigation is therefore considered **Minor Adverse** as the likelihood of potential discoveries is considered low.

8.2 Mitigation Measures

A Chance Finds Procedure has been developed and is being implemented to salvage sites where archaeological or cultural heritage finds are encountered, and all chance finds will be reported to the Institute of National Museum of Rwanda (INMR).

8.3 Residual Impacts

With implementation of mitigation measures mentioned herein, the significance level of the impacts identified will be reduced to **Negligible**. Table 13-1 provides a summary of the impacts and mitigation measures associated with archaeology and cultural heritage during the installation of the underground Water Pipeline.

9. LANDSCAPE

9.1 Impact Assessment Prior to Mitigation

The installation of the Water Pipeline on the landscape, and ultimately on visual influences, can potentially impact on the landscape fabric, character of the landscape and the amenity of visual receptors surrounding the pipeline route. Definitions and details on assessment methodology is included in Section 15.3 in Chapter 15: Landscape.

Potential impacts associated with the installation activity is limited to site clearance, development of the trench and stockpiling of soils, which is likely to effect the local communities from Rilima Village. Furthermore, the potential impact on the landscape fabric, character of the landscape and amenity of visual receptors will be minimised as the pipeline will be installed underground as opposed to aboveground.

Impacts on the landscape fabric and landscape character, which are considered to have a moderate value and susceptibility for change, will be considered to have a **Negligible** significance due to the short timeframe of trench development, soil stockpiling and refill activities. Furthermore, potential visual impacts to the local communities in Rilima Village will also be considered to be **Negligible** as the pipeline will no longer be located aboveground. Short term visual impacts will occur from trench development and stockpile activities on the amenity to Rilima Village.

9.2 Mitigation Measures

Mitigation measures detailed in Chapter 15.6 (Landscape) will be implemented during the installation activities. These measures include, but are not limited to minimising the extent of physical disturbance during trench development, restricting the size and duration of stockpiles, and ensuring refilling activities are conducted in a timeous manner.

9.3 Residual Impacts

Considering the adequate implementation of the mitigation measures, the residual impact on the landscape fabric, landscape characteristic and amenity to the community in Rilima Village is considered to have an impact of **Negligible** significance. Table 13-1 provides a summary of the impacts and mitigation measures associated with landscape and associated visual impacts during the installation of the underground Water Pipeline.

10. WASTE MANAGEMENT

10.1 Impact Assessment Prior to Mitigation

Potential impacts are limited to the generation of waste during clearing, earthworks, trench development and refill activities from the installation of the Water Pipeline.

Earthworks during trench development can result in contamination from unplanned releases of hydrocarbons from construction vehicles on soil resources. The resultant contaminated soils would need to be managed as hazardous waste and removed for disposal offsite. Potential impacts to sensitive receptors such as surface and groundwater users, as well as the surrounding ecology and risk to local communities are considered in relevant sections within this addendum document.

The Nduba landfill will be used and arrangements will be made to use two other facilities. Details of the additional facilities have not yet been provided and available capacity cannot be confirmed. Potential contamination of soils from unplanned releases of hydrocarbon from vehicles is possible prior to mitigation and, should the release occur, contamination will be contained to a limited area along the pipeline route. If a small volume of contaminated soil is generated it has the potential to have a **Minor Adverse** impact if uncontrolled waste disposal occurs.

10.2 Mitigation Measures

A Waste Management Plan will be developed and will set out measures to ensure that hazardous wastes arising from uncontrolled hydrocarbon releases from vehicles during pipeline installation will be managed in a safe and acceptable manner and in accordance with accepted Good International Industry Practice.

10.3 Residual Impacts

Management of hazardous wastes generated from uncontrolled releases from vehicles can be adequately controlled with the implementation of the Waste Management Plan resulting in a residual impact significance of **Negligible**. Table 13-1 provides a summary of the impacts and mitigation measures associated with waste management during the installation of the underground Water Pipeline.

11. RESOURCE EFFICIENCY

11.1 Impact Assessment Prior to Mitigation

The methodology utilised for the impact assessment is defined in Section 17.3 in Chapter 17: Resource Efficiency and includes the quantification of resource use with respect to energy/fuel, water and materials during the construction and operation phases of the Proposed Project. Water use, efficiency of energy and materials to be used has been discussed in Chapter 17: Resource Efficiency. This addendum will consider impacts of resource efficiency for earthworks during the installation of the Water Pipeline.

The usage of non-renewable resources can have a direct impact on the receiving biophysical and social environment as a result of resource minimisation, generation of carbon dioxide, Volatile Organic Compounds (VOCs), etc., and potential impacts associated with the mismanagement of dangerous goods, fuels and chemicals. Sensitive receptors include local communities, ecological receptors and surface and groundwater.

Fuel demand construction vehicles will have impacts in terms of increased traffic flow and Greenhouse Gas Emissions (GHG) emissions if high levels of resource efficiency are not maintained. Traffic flow will not be impacted as available vehicles will be used which have already been quantified in the ESIA Report. The effect of GHG emissions will be very small in both a local and national context. Air quality and other impacts are dealt with in other chapters. Overall the magnitude of impact is considered to be low and the receptor sensitivity is low. As a result, the significance of impact is considered to be **Negligible**.

11.2 Mitigation Measures

In line with GIIP, an energy management programme will be adopted within the relevant topic specific Environmental and Social Management Plans and Procedures, which will:

- Ensure that equipment and machinery is in good running condition and perform regular maintenance;
- Ensure that machinery is not kept running while it is not in use;
- Identify, regularly measure and monitor the principal energy uses associated with construction vehicles; and
- Regularly compare energy use with performance targets to identify where action should be taken to reduce energy use.

11.3 Residual Impacts

Residual fuel and energy demand associated with construction vehicles during the installation of the Water Pipeline will result in an impact significance of **Negligible** based on very low magnitude and receptor sensitivity. Table 13-1 provides a summary of the impacts and mitigation measures associated with resource efficiency during the installation of the underground Water Pipeline.

12. SOCIO-ECONOMIC

12.1 Impact Assessment Prior to Mitigation

Impacts on socio-economy resulting from the Proposed Project have been detailed in Chapter 18: Socio-Economics. Resultant impacts will be similar as a result of the installation of the underground pipeline as opposed to an aboveground feature. This addendum does not include positive impacts related with skills development, employment, availability of potable water to communities, etc. which have been discussed in Chapter 18: Socio-Economics.

The installation of the Water Pipeline will require land acquisition as the pipeline is required for the construction phase only. The Water Pipeline route is located outside the nearest community and does not cross any areas of human habitation nor is it close to any structures. Physical displacement will not occur; however, limited temporary economic displacement may occur as people were seen working in a small plot in close proximity to the abstraction point of the pipeline.

The significance of this impact prior to mitigation is **Moderate Adverse** as the impact magnitude is low (a small number of Project Affected Persons (PAPs), limited land take and the infrastructure is temporary) and the sensitivity of the receptors is considered high. Those economically displaced by the Water Pipeline are similar in terms of receptor sensitivity to those displaced for the Airport Area as they are primarily subsistence farmers with a similar livelihood status and income levels.

12.2 Mitigation Measures

Numerous specific mitigation measures have been developed and are included in Section 18.6 of Chapter 18: Socio-Economics, which include operational controls and financial measures, and lists key management plans and policy/procedure documents that will be developed in order to mitigate identified impacts. A Supplemental Resettlement Plan may be required following the conclusion of the Resettlement Outcomes Audit, which is being discussed with the Ministry of Infrastructure. Should the supplementary plan be required, it will include measures for livelihood restoration along the pipeline route which will comply with the IFC Performance Standard 5, dealing with Land Acquisition and Involuntary Resettlement.

12.3 Residual Impacts

The residual impact is quantified as being of **Negligible** significance (medium receptor sensitivity and very low impact magnitude) when the mitigation measures contained in Chapter 18 (Socio-economic) are implemented. Table 13-1 provides a summary of the impacts and mitigation measures associated with socio-economic aspects during the installation of the underground Water Pipeline.

13. SUMMARY OF IMPACT ASSESSMENT, MITIGATION AND RESIDUAL SIGNIFICANCE

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

Topic	Impact	Impact Magnitude	Receptor and Sensitivity	Pre-mitigation Impact Significance	Mitigation Measure	Management Plan	Residual Significance
Traffic	Severance, driver delay, transport user safety and transport user amenity.	Impact Magnitude: Low Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Local community, employees Low sensitivity	Negligible	<ul style="list-style-type: none"> Ensure all vehicles are maintained regularly and are road worthy Ensure the HGV is limited to a pre-defined route 	Construction Traffic Management Plan	Negligible
Air quality	Emissions of fugitive particles	Impact Magnitude: Low Nature: Adverse Type: Direct Extent/Scale: Local Duration:	Local community, employees and ecosystem/habitats Medium sensitivity	Minor Adverse	<ul style="list-style-type: none"> Minimising dust emissions from open soil storage piles, by using control measures such as covering storage piles with sheeting, and increasing 	Pollution Prevention Plan	Negligible

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

		Short Term Frequency: Week days Reversibility: Reversible			the moisture content therein <ul style="list-style-type: none"> Dust suppression techniques, such as applying water or non-toxic chemicals to minimise dust from vehicle movements Management of emissions from mobile sources, including adequate maintenance of vehicle and equipment 		
Noise and vibration	Generation of noise	Impact Magnitude: Low Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency:	Local community and surrounding wildlife Low sensitivity	Negligible	<ul style="list-style-type: none"> Vehicles, machinery and equipment will be of good working condition and submitted to routine maintenance and repair 	Construction ESMP	Negligible
			Construction employees Medium sensitivity	Minor Adverse			

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

		Week days Reversibility: Reversible					
Biodiversity	Biophysical environment	Impact Magnitude: Medium Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Ecosystem and habitats High sensitivity	Moderate Adverse	<ul style="list-style-type: none"> Development of Construction ESMP and supporting Biodiversity Management Plan Development of Biodiversity Action Plan 	C-ESMP Biodiversity Management Plan Biodiversity Action Plan	Minor Adverse
Water resources	Contamination of surface and groundwater sources	Impact Magnitude: Low Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term	Lake Kidogo High sensitivity	Minor Adverse	<ul style="list-style-type: none"> Development of Construction ESMP Development of Pollution Prevention Plan 	C-ESMP Pollution Prevention Plan	Negligible

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

		Frequency: Week days Reversibility: Reversible					
Soil and geology	Identification of previously unidentified soil contamination	Impact Magnitude: Low Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Soil resources and human health Low significance	Negligible	<ul style="list-style-type: none"> Develop unexpected find protocol and education of staff implementing reactive control measures 	Occupational Health and Safety Management Plan Environmental Induction and Training Plan	Negligible
	Contamination of soil resources due to unplanned release event	Impact Magnitude: Medium Nature: Adverse Type: Direct Extent/Scale: Local Duration:	Soil resources and human health Medium significance	Minor Adverse	<ul style="list-style-type: none"> Adopt Good International Industry Practice (GIIP) for the managing of hydrocarbons (fuels, etc.) Construction ESMP 	GIIP management C-ESMP Emergency Response Plan Emergency Spills and Abatement Management Plan Soil Management Plan	Negligible

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

		Short Term Frequency: Week days Reversibility: Reversible					
	Mobilisation of sedimentation to surrounding surface water receptors	Impact Magnitude: Medium Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Soil resources and surface water receptors Medium significance	Minor Adverse	<ul style="list-style-type: none"> Construction ESMP 	C-ESMP Emergency Response Plan Emergency Spills and Abatement Management Plan Soil Management Plan	Negligible
	Mobilisation of soil particles	Impact Magnitude: Medium Nature: Adverse Type: Direct Extent/Scale:	Ecology and human receptors Medium significance	Minor Adverse	<ul style="list-style-type: none"> Construction ESMP 	C-ESMP Emergency Response Plan Emergency Spills and Abatement Management Plan Soil Management Plan	Negligible

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

		Local Duration: Short Term Frequency: Week days Reversibility: Reversible				Occupational Health and Safety Management Plan Site Clearance, Excavations and Earthworks Management Plan Environmental Induction and Training Plan	
Archaeology and cultural heritage	Cultural heritage	Impact Magnitude: Low Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Local communities Low sensitivity	Negligible	<ul style="list-style-type: none"> Development and implementation of a Chance Finds Procedure 	Chance Finds Procedure Construction ESMP	Negligible
	Archaeological and exposure of human remains	Impact Magnitude: Medium	Local communities	Minor Adverse	<ul style="list-style-type: none"> Development and implementation 	Chance Finds Procedure	Negligible

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

		Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Medium sensitivity		of a Chance Finds Procedure	Construction ESMP	
Waste management	Management of hazardous wastes	Impact Magnitude: Low (small volume) Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Local community, ecosystem, surface water and groundwater surrounding the landfill disposal sites Medium sensitivity	Minor Adverse	<ul style="list-style-type: none"> Development of a Waste Management Plan 	Waste Management Plan	Negligible

Table 13-1: Summary of Impacts, Mitigation Measures and Residual Significance

Resource efficiency	Utilisation of fuels	Impact Magnitude: Low Nature: Adverse Type: Direct Extent/Scale: Local Duration: Short Term Frequency: Week days Reversibility: Reversible	Local community, ecosystem, surface water and groundwater Low sensitivity due to installation activities being localised	Negligible	<ul style="list-style-type: none"> Development of an Energy Management Plan 	Energy Management Plan	Negligible
Socio-economic	Economical displacement	Impact Magnitude: Low Nature: Adverse Type: Direct Scale: Local Duration: Temporary Frequency: Once off Reversibility: Reversible	Property owners and land occupiers/users with assets or access to assets in located in the land to be acquired High sensitivity	Moderate Adverse	<ul style="list-style-type: none"> Construction ESMP Supplemental Resettlement Plan (ONLY if required) 	Construction ESMP Supplemental Resettlement Plan (ONLY if required)	Negligible