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NEW BUGESERA INTERNATIONAL AIRPORT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT- WASTE MANAGEMENT

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16. WASTE MANAGEMENT

16.1 Introduction

This chapter of the ESIA Report considers the potential impacts of the Proposed Project on waste management. The assessment predicts and evaluates the potential impacts of the Proposed Project and the likely impacts associated with waste management, arising from the construction works, and operation of the Proposed Project.

16.2 Policy, Legal and Administrative Framework

This section provides an overview of Rwandan and international waste management requirements, processes and practices that apply to this assessment.

16.2.1 Rwandan Policy

16.2.1.1 *National Policy and Strategy for Water Supply and Sanitation, February, 2010¹*

This policy includes the objective to implement integrated solid waste management within Rwanda. The policy outlines a commitment to adhere to the principles of the waste hierarchy, focusing specifically on the minimisation of wastes generated and reducing toxicity of certain waste streams. The policy specifies the future implementation of waste accountability measures, promotes waste segregation at business level and specifies a household, public and business organic waste composting target of 70% by 2020.

16.2.1.2 *National e-Waste Management Policy for Rwanda, September 2015²*

Built upon five guiding principles relating to circular economy thinking and sustainable development, this document sets the overarching objectives for the management of electronic waste (e-waste). The objectives seek to ensure the sustainable management of e-waste and minimize any adverse effects on the environment and human health. A requirement to develop an appropriate legal and regulatory framework is therefore communicated.

16.2.2 Legal Framework

16.2.2.1 *Organic Law Determining the Modalities of Protection, Conservation and Promotion of Environment in Rwanda, April 8 2005 No: 04/2005³*

This law describes the manner in which waste should be handled, treated or otherwise disposed so as to prevent or limit degradation of the natural environment, flora and fauna, human health, industry, or the economic potential of the affected environment. Such controls commonly specify waste management actions to be prohibited within named environments, including wetlands and waterways. Controls over the handling, collection and treatment of dangerous (including medical waste) or toxic wastes are also established. Legislation prohibits the importation of waste without appropriate authorisation.

¹ Republic of Rwanda Ministry of Infrastructure, (2010). National Policy & Strategy for Water Supply and Sanitation Services - http://www.rura.rw/fileadmin/docs/Board_Decisions/WATSAN_Policy_Strategy.pdf - Accessed 30.06.2017.

² Ministry of Natural Resources, 2015. National e-Waste Policy for Rwanda - http://www.minirena.gov.rw/fileadmin/Environment_Subsector/Laws_Policies_and_Programmes/Laws/E-waste_policy_-_FINAL.pdf - Accessed 30.06.2017.

³ Government of Rwanda, 2005. Organic Law Determining the Modalities of Protection, Conservation and Promotion of Environment in Rwanda, April 8 2005 No: 04/2005 - http://www.kigalicity.gov.rw/fileadmin/Template/Documents/laws/Organic_Law_determining_the_modalities_of_protection__conservation_and_promotion_of_the_environment_in_Rwanda__No_042005_OF_08042005.pdf - Accessed on 30.06.2017

16.2.2.2 *Regulations Governing of Solid Wastes Recycling in Rwanda, April, 2015⁴*

These regulations provide a framework for the design, installation, operation and licensing for facilities that recycle, compost or convert solid wastes in Rwanda. The objectives of these regulations are to protect public health and the environment, and encourage recycling. Recyclable fractions are defined as plastic, metal, glass, paper, cardboard, organic wastes and other solid wastes. The regulation requires operators to apply for a licence if operating over a certain capacity. Requirements for monitoring, reporting and enforcement are also laid out. Regulatory sanctions include fines, suspension of activities and/or licence suspension or revocation.

16.2.2.3 *Governing Liquid Waste Collection and Transportation, November 10 2016 No: 005/R/SAN-EWS/RURA/2016⁵*

These regulations establish a framework for liquid waste collection and transportation in Rwanda. These regulations apply to any company, cooperative or individual providing services of liquid waste collection and transportation including collection and transportation of municipal liquid waste, septic waste and any other effluent specified by the Regulatory Authority. A licence is required from the regulatory authority by any person providing collection or transportation services. These regulations also lay out the conditions that the licence holder must fulfil, and operational conditions. These regulations also carry requirements for reporting and monitoring. Non-compliance may lead to regulatory sanctions.

16.2.2.4 *Law Relating to the Prohibition of Manufacturing, Importation, Use and Sale of Polythene Bags in Rwanda, October 9 2008 No: 57/2008⁶*

This law specifies the requirement to obtain written authorisation for the above named activities relating to polythene bags. An application letter is required to indicate reasons for the request and the manner through which polythene waste shall be managed.

16.2.2.5 *Ministerial Order Establishing Special Regulations Relating to Burying Toxic Wastes, July 1 2010 No: 006/16.01*

This order forbids the burying of toxic wastes without proper authorisation and in accordance with the processes outlined in this Order. The associated annex communicates those materials to which this order applies. An application letter must be sent to the Rwanda Environment Management Authority (REMA), the prescribed content of which is detailed in the Order itself. Key information should be provided with the application including an accurate record of the waste itself, the receiving environment, methods to be employed and any parties associated with the waste.

16.2.2.6 *Draft Regulations Governing e-waste Management in Rwanda, Republic of Rwanda, Rwanda Utilities Regulatory Authority, 2016 (RURA)⁷*

These regulations establish a framework for the management of electrical and electronic waste. They apply to every producer, retailer, importer, collector, dismantler, recycler, refurbisher, consumer or bulk consumer involved in manufacture, assembly, sale and purchase and

⁴ Regulations for the Governing of Solid Wastes Recycling in Rwanda, April 24 2015. No: 002/ESWASTAN/SW/RURA/2015 - http://www.rura.rw/uploads/media/CLEANED_FINAL_SOLID_WASTES_RECYCLING_REGULATIONS.pdf - Accessed on 13.09.2017.

⁵ Government of Rwanda, 2016. Governing Liquid Waste Collection and Transportation, November 10 2016 No: 005/R/SAN-EWS/RURA/2016 - http://www.rura.rw/uploads/media/Regulations_Governing_liquid_waste_collection_and_transportation.pdf - Accessed on 13.09.2017.

⁶ Ministry of Natural Resources, 2008. Law Relating to the Prohibition of Manufacturing, Importation, Use and Sale of Polythene Bags in Rwanda, October 9 2008 No: 57/2008 - <http://www.minirena.gov.rw/index.php?id=206> - Accessed on 30.06.2017.

⁷ RURA, 2016. Draft Regulations Governing E-waste Management in Rwanda - http://www.rura.rw/fileadmin/laws/E-waste_regulations_Rwanda_with_technical_requirements_.pdf - 30.06.2017.

processing of waste electronic and electronic equipment (WEEE) or e-waste. The aim of these regulations is to protect environmental and human health through the prevention/reduction of negative impacts from the generation and management e-waste and encouraging the recovery of resources. The regulations require all persons collecting, transporting, retailing, importing, dismantling, recycling or refurbishing e-waste to obtain an operator's licence from the regulatory authority. Technical requirements and responsibilities are also laid out for the collection, transportation, refurbishment, disposal, consumption and storage of e-waste under the licence.

16.2.2.7 *Draft Regulations Governing Hazardous Waste Management, 2016,⁸ⁱ*

These regulations aim to protect public health and the environment by regulating hazardous waste management and shall apply to any person engaged in the generation, storage, collection, transportation, treatment or disposal of hazardous waste. Persons carrying out any of these activities require a licence issued by the Regulatory Authority. These regulations lay out a variety of characteristics defining hazardous wastes. Regulation prohibits persons from generating hazardous waste without a valid Environmental Impact Assessment Certificate, and requires the segregation of hazardous waste. Open and unlabelled storage of hazardous waste is prohibited. This regulation requires generators of hazardous waste to ensure suitable packing for safe handling, storage and transport and ensure that hazardous waste characteristics are correctly labelled.

16.2.3 International Standards

16.2.3.1 *International Finance Corporation Performance Standard 3 Resource Efficiency and Pollution Prevention (IFC PS3):*

With regard to waste management, IFC PS3 (Ref. 7.7.2) states that:

"... the client will avoid the generation of hazardous and non-hazardous waste materials. Where waste generation cannot be avoided, the client will reduce the generation of waste, and recover and reuse waste in a manner that is safe for human health and the environment. Where waste cannot be recovered or reused, the client will treat, destroy, or dispose of it in an environmentally sound manner that includes the appropriate control of emissions and residues resulting from the handling and processing of the waste material. If the generated waste is considered hazardous, the client will adopt Good International Industry Practice (GIIP) alternatives for its environmentally sound disposal while adhering to the limitations applicable to its trans-boundary movement. When hazardous waste disposal is conducted by third parties, the client will use contractors that are reputable and legitimate enterprises licensed by the relevant government regulatory agencies and obtain chain of custody documentation to the final destination. The client should ascertain whether licensed disposal sites are being operated to acceptable standards and where they are, the client will use these sites. Where this is not the case, clients should reduce waste sent to such sites and consider alternative disposal options, including the possibility of developing their own recovery or disposal facilities at the project site."

With regard to hazardous waste, IFC PS3 recognises that *"hazardous materials are sometimes used as raw material or produced as product by the project. The client will avoid or, when avoidance is not possible, minimise and control the release of hazardous materials. In this context, the production, transportation, handling, storage, and use of hazardous materials for project activities should be assessed. The client will consider less hazardous substitutes where hazardous materials are intended to be used in manufacturing processes or other operations."*

⁸ Government of Rwanda, 2016. Draft Regulations Governing Hazardous Waste Management, No: .../RURA/2016 - http://www.rura.rw/fileadmin/docs/Draft_regulations_on_hazardous_waste_management.pdf - Accessed on 13.09.2017.

The client will avoid the manufacture, trade, and use of chemicals and hazardous materials subject to international bans or phase-outs due to their high toxicity to living organisms, environmental persistence, potential for bioaccumulation, or potential for depletion of the ozone layer."

16.2.3.2 Mota-Engil, Sustainability Report, 2016⁹

Mota-Engil has included a number of commitments within its Sustainability Report associated with their operations in Rwanda. No specific commitments are included in this document in terms of waste management; however, commitments are made to promote an environmentally responsible culture, ensuring appropriate measures are taken to ensure successful, sustainable outcomes are achieved.

16.3 Assessment Methodology

16.3.1 Scope

The scope of this assessment includes the consideration of waste generation during earthworks, construction and operation and waste management infrastructure associated with the Proposed Project, including the Expressway, upgraded quarry road and Water Pipeline. The potential effect of waste generated and its on-going management on sensitive receptors has been considered, taking into account mitigation measures that are proposed to minimise any adverse effects that may arise.

16.3.2 Baseline Characterisation

Baseline information was obtained through the acquisition and review of reports, documents, policies and general information relevant to waste management for the Proposed Project during construction and operation.

Consideration of the following was made to characterise the baseline for the Proposed Project:

- Proposed Project information for construction and operation phases provided by BAC;
- Review of construction waste management practices associated with international infrastructure projects;
- International airport waste management practices, including review of waste arisings from commercial operations and passengers and how these are managed;
- Local waste management facilities and practices within the Bugesera District; and
- Waste management facilities and practices within Rwanda.

The Area of Influence considered for waste management will include the Bugesera District and any other areas where wastes arising from the Proposed Project are proposed to be transported for processing.

16.3.3 Construction Phase Method of Assessment

The method of assessment for waste management during the construction phase followed the anticipated flow of waste materials at each stage of the waste management process. This comprised the following:

- Identification of relevant construction phase waste streams;

⁹ Mota-Engil, 2016. Corporate Sustainability Report - <http://en.mota-engil.pt/Sustainability/Reports-of-Sustainability> - Accessed 22.09.2017.

- Qualitative review of waste streams using a traffic light system to highlight the anticipated quantities of key waste streams;
- Identification of the proposed management techniques for waste streams; and
- Determination of the potential impacts associated with the management of each waste stream, assessing the significance of each impact on sensitive receptors.

The information gathered was based on the Project information provided by BAC and assessed using professional judgement.

16.3.4 Operation Phase Method of Assessment

The method of assessment for waste management during the operation phase followed the anticipated flow of waste materials at each stage of the waste management process. This comprised the following:

- Identification of relevant operation phase waste streams using information from BAC and comparisons with airports of a similar size;
- Estimation of the anticipated volumes or quantities of each waste stream based on the proposed maximum annual passenger capacity and waste composition of comparable airports;
- Identification of the proposed management technique for each waste stream during operation; and
- Determine the potential impacts associated with the management of each waste stream and assess the significance of each impact on sensitive receptors.

The information gathered was based on the project information provided by BAC and assessed using professional judgement.

16.3.5 Significance Criteria

Within this ESIA Report, impact significance was evaluated through the determination of impact magnitude and receptor sensitivity in line with the methodology set out in Chapter 3: Impact Assessment Methodology. Impact significance was assessed with and without mitigation measures in place (in both cases it is assumed that the design controls are in place) i.e. with the Proposed Project and incorporated mitigation/design controls and then with additional mitigation if relevant to understand the residual impact.

A residual impact is the impact that remains following the application of additional mitigation measures, and is thus the final 'level' of impact. Residual impacts are the focus of management and monitoring activities during Project implementation.

Where it was not possible to quantify impacts and effects, qualitative assessments were carried out, based on expert knowledge, GIIP and professional judgement. In this regard, impacts were first identified and classified as adverse (negative) or beneficial (advantageous/positive). Then impacts were predicted where possible quantitatively or qualitatively, or, in certain instances, both.

Quantitative methods predicted measurable changes as a result of the Proposed Project and relied on accurately measuring baseline conditions to make predictions/estimations regarding the potential impacts. Qualitative assessment methods relied on professional judgement and experience.

16.3.6 Assumptions and Limitations

Where limited baseline information was available during the assessment, the following assumptions were made:

- Initial estimates of construction waste arisings were made available, as detailed estimations of waste arisings associated with construction of the Proposed Project, including the Expressway, upgraded quarry road and Water Pipeline were not available. Therefore, a predominantly qualitative approach was taken, which looked at comparable international infrastructure projects.
- Annual waste estimations have been based on international airports of a comparable size in terms of passenger capacity. A qualitative approach was adopted for the waste streams anticipated to arise from the airport, based on generalised waste arisings data from other international airports with comparable passenger capacity.

Waste will be appropriately managed during construction and operation, meeting any local legal and lender requirements.

16.4 Baseline Conditions

The Proposed Project Area has not generated large quantities of waste in the past as there are limited developments in the vicinity of the Proposed Project.

There is limited evidence of formal waste management facilities within Bugesera, or in wider Rwanda. Nduba landfill is located approximately 30 km from the Proposed Project Area and is identified as being the only facility in Kigali city where solid waste can be disposed of, receiving 140,000 tonnes per year. The landfill has been identified as having insufficient protection in place to protect the surrounding environment as there is a lack of an engineered lining system, gas collection or leachate management systems¹⁰.

REMA in their State of Environment and Outlook Report¹¹ acknowledged that Rwanda in general has a lack of sufficient waste management facilities. Most waste is sent to landfill, with the remainder being informally disposed into pits, watercourses, or burned in an uncontrolled manner. Industrial waste has also been identified to have been disposed of in such a manner. Rwanda also continues to experience problems with solid waste management, including lack of waste segregation, poor handling of waste and management of dumpsites. A limited amount of waste material is thought to be recycled¹².

Very little waste in Rwanda and in Bugesera District was found to have been disposed of in an authorised manner (Table 16.1). Due to high biodegradable waste composition, most household waste is composted; however, waste is generally dumped informally rather than being collected and treated appropriately, or it is recycled informally at the point of user generation by the user or others, as is common in local resource-deficient developing nations.

¹⁰ Isugi, J. and Niu, D., 2016. Research on Landfill and Composting Guidelines in Kigali City, Rwanda Based on China's Experience, International Proceedings of Chemical, Biological and Environmental Engineering. http://www.ipcbee.com/vol94/rp0012_ICEST2016-C0043.pdf - Accessed on 13.09.2017.

¹¹ Rwanda State of Environment and Outlook Report Chapter 2. Population, Health and Human Settlements, 2009. <http://www.rema.gov.rw/soe/chap2.php> - Accessed on 13.09.2017.

¹² Rwanda Environment Management Authority (REMA) 20/08/2014 Press Release - http://www.rema.gov.rw/index.php?id=10&tx_ttnews%5Btt_news%5D=153&cHash=8677aa01a29999a5da278d6b304f5f70 - Accessed on 13.09.2017.

Table 16.1: Methods of Household Disposal Nationally in Rwanda and in Bugesera District¹³							
	Methods of Household Waste Disposal (%)						
	Comp ost heap	Thrown in bushes/ fields	Rubbish collection service	Dumped in river/ lake	Publicly managed refuse area	Burnt	Other
All Rwanda	51.6	40.2	6.2	0.1	1.5	0.1	0.2
Bugesera District	34.0	64.1	0.4	0.0	0.7	0.4	0.4

The Bugesera District Development Plan 2013 – 2018¹⁴ highlighted a lack of a waste management and treatment plans. The district was aiming to construct landfill and solid waste dumping sites and ensure all rural households have rubbish pits by 2016.

Sensitive receptors include groundwater and surface water resources that have the potential to be impacted by inappropriate management of waste streams. In addition, the health and amenity of occupants in the Area of Influence could be impacted by inappropriate management practices. More specifically, the following sensitive receptors may be impacted by waste management practices associated with the construction and operation of the Proposed Project:

- Regional groundwater aquifer systems and surface water bodies;
- Local communities;
- Local waste management facilities;
- Employees of the Proposed Project who work onsite during excavation and construction or operation;
- Airport passengers and/or visitors; and
- Local flora and fauna and migrating fauna.

16.5 Potential Impacts

The impacts associated with each phase of the Proposed Project will be specific to the environmental and socio-economic context, spatial and temporal aspects of the airport and required international objectives. The potential impacts associated with waste will primarily be associated with poor management practices, which could result in waste materials and substances escaping into the surrounding environment, impacting upon soil, groundwater, surface water, air quality, flora and fauna and people. The following sections provide further information regarding the potential waste management effects, which could impact upon the identified sensitive receptors within the Area of Influence of the Proposed Project.

16.5.1 Construction Phase Impacts Prior to Mitigation

Construction phase impacts for the Proposed Project will be associated with the construction of the Proposed Project, including the Expressway, upgraded quarry road and Water Pipeline. Initial quantitative waste arising estimates have been provided by BAC, more detailed estimates

¹³ Table adapted from EICV4 Thematic report on Utilities and Amenities by the National Institute of Statistics of Rwanda, 2016.

¹⁴ Republic of Rwanda, Eastern Province, Bugesera District, District Development Plan (2013 – 2018) -

http://www.bugesera.gov.rw/fileadmin/user_upload/Bugesera_District_DDP_2012-17_Final.pdf - Accessed on 13.09.2017.

for each waste stream will be included within the detailed Waste Management Plan (WMP) (NBIA-MEECARW-EM-PLN-0001). The WMP for construction provides an overview of waste streams anticipated to arise; through the utilisation of previous project experience, a qualitative identification of these waste streams was undertaken. A traffic light system has been applied to each waste stream to provide an estimation of waste quantities (a key is provided in Table 16.2). These colours are based on the anticipated quantities of waste arising during construction (Table 16.3). It should be highlighted that waste streams of low quantity are relative to those waste streams, which are anticipated to be produced in high quantity.

Table 16.2: Qualitative Waste Key for Anticipated Quantities of Waste Arisings for the Proposed Project

Anticipated Quantities of Waste Arisings	
Low	A limited amount of this waste stream is anticipated to be produced during this phase
Medium	A medium amount of this waste stream is anticipated to be produced during this phase
High	Substantial amounts of this waste stream are anticipated to be produced during this phase.

Waste streams for which high quantities of waste are anticipated to be produced comprise excavated soil and organic material during excavation and site clearance; this is predominantly due to the extensive amount of earthworks, which are required for the Proposed Project. High quantities of packaging waste predominantly comprising plastic packaging and films (not plastic bags), paper and cardboard are also anticipated during the construction phase.

Approximately 1,800 workers (at peak) are anticipated to work from the Construction Camp associated with the Proposed Project; therefore high levels of putrescible and packaging waste are anticipated to be produced due to the high number of workers.

Table 16.3: Waste Streams Anticipated to Arise during the Construction Phase of the Proposed Project

Waste Type	Form	Source									
		Excavation	Site clearance	Offices	Vehicle maintenance and depot	Camp	Kitchens	Medical facility	Construction	Batching plants	Laboratory
Inert Waste											
Broken concrete	Solid	X	X						X	X	
Broken masonry	Solid		X			X			X		
Non-Hazardous Waste											
Excavated soil	Solid	X	X								
Scrap metal	Solid		X		X						

Table 16.3: Waste Streams Anticipated to Arise during the Construction Phase of the Proposed Project											
Organic material e.g. tree branches and roots	Solid	X	X						X		
Putrescible waste including food waste	Solid			X		X	X				
Wooden pallets	Solid	X	X		X	X	X		X	X	
Vehicle Tyres	Solid				X						
Plastic	Solid		X	X	X	X	X		X	X	
Paper/card board	Solid		X	X	X	X	X	X	X	X	
Municipal waste	Solid		X	X		X	X				
Glass	Solid		X	X	X	X	X	X			X
Hazardous Material											
Sewage	Liquid			X		X	X			X	X
Historical landfill site waste not suitable for fill material	Solid	X	X								
Waste oil	Liquid				X		X				
Waste oil filters and oily rags	Solid				X			X	X		
Chemicals	Liquid							X			X
Contaminated soil (from areas of historical contamination or localised spillage)	Solid	X	X		X				X		
Cables containing substances	Solid		X	X	X	X			X	X	X
Asbestos containing materials	Solid	X	X								

Effective management of excavated soil and organic material is key to minimising any impacts associated with its disposal. Five borrow pits are proposed to obtain fill material and six spoil areas have been demarcated in the Airport Area. Approximately 9,000,000 m³ of cut will be excavated and 7,000,000 m³ will be required in order to level the Airport Area. At this stage it has not been confirmed how much of this cut material is suitable for reuse as fill. Cut material suitable for reuse will be used for landscaping around the Airport Area and filling of the borrow pits. It is estimated that there will be a net excess of approximately 2,000,000 m³ of cut material, which will be used for landscaping and the reinstatement of borrow pits accordance with Borrow Pits Management Plan. This will not require off-site disposal.

On average approximately 30 m³ per month of waste is anticipated to be generated from the construction phase, collected by a licensed waste contractor and disposed of at a licensed landfill site. It is assumed that this estimate does not include the generation of the excavated soil and organic material, which is considered separately due to the large quantities of material involved.

Due to the scale of the Proposed Project, it is also anticipated that other waste streams which are not expected to be produced in high quantities could still cause a significant impact on Rwandan waste management facilities. In particular the processing of hazardous waste could potentially have a significant impact. BAC has identified suitable hazardous waste facilities within Rwanda, which will be capable of receiving hazardous waste. According to BAC, limited hazardous waste will be generated during the construction period which will be disposed of at a licensed facility (Nduba Landfill).

16.5.1.1 Construction Phase Design Controls

Waste Management Plan

In accordance with GIIP, a Waste Management Plan¹⁵ (WMP) has been prepared by Bugesera Airport Company Limited (BAC)¹⁶ and outlines the key processes and procedures which are to be implemented during the construction phase, to ensure that the impacts of waste generated are minimised.

The WMP will be implemented across all activities associated with the construction phase where all employees will be responsible for the control and verification of this plan on site. Sub-contractors and other service providers will also be required to adhere to all commitments within the WMP. Any non-compliances with requirements will be recorded where BAC will develop, update and keep records at the jobsite of such non-compliances. A monthly summary indicating progress to date of all recycled waste will also take place.

The WMP also describes measures where all contractors will be required to comply with the project mandatory recycling requirements. The WMP will be implemented and executed as follows:

- Salvageable materials will be diverted from disposal where possible;
- There will be a designated area reserved for bins, each specifically labelled for respective materials to be received;
- Before proceeding with any removal of construction materials from the construction site, Health, Safety and Environment (HSE) officers will inspect containers for compliance with requirements;

¹⁵ Mota Engil Engenharia e Construção Africa, 2017. New Bugesera International Airport – Project Waste Management Plan – (NBIA-MEECARW-EM-PLN-0001).

¹⁶ BAC is a joint venture between Mota-Engil and the Government of Rwanda. Additional information is contained in Chapter 1 of the ESIA.

- Wood cutting will occur in centralised locations to maximise reuse and make collection easier; and
- Hazardous waste will be managed by a licensed waste vendor and will be stored separately from other waste types in a clearly demarcated hard surfaced area for the purpose and within lockable steel containers or transport containers designed for the purpose.

The WMP Plan will outline the key measures which employees, contractors and sub-contractors will be expected to adhere to, including:

- Engineering, Procurement, and Construction (EPC) contractor will conduct onsite pre-construction meetings with sub-contractors. Attendance will be required for the sub-contractor's key field personnel, to reinforce to subcontractors the commitments made by their companies with regard to the Project goals and requirements;
- Waste prevention and recycling activities will be discussed at each sub-contractor co-ordination meeting to reinforce Project goals and communicate progress to date;
- As each new sub-contractor comes on site, the HSE officers will present him/her with a copy of the Waste Management Plan and provide a tour of the recycling areas;
- The sub-contractor will be expected to make sure all their crews comply with the Waste Management Plan;
- The sub-contractors will have contractual obligations to comply on a back-to-back basis with obligations from the EPC contract with regard to HSE matters;
- All recycling containers will be clearly labelled. Containers shall be located in close proximity to the building(s) under construction in which recyclables/salvageable materials will be placed;
- All sub-contractors will be informed about the importance of non-contamination with other materials or waste; and
- HSE officers will inspect the containers on a regular basis to insure that no contamination is occurring and precautions shall also be taken to deter any contamination by the public.

All contractors responsible for waste disposal will be listed and have the necessary licences and government authorisations required. Information regarding the locations of final disposal of non-recyclable waste will also be listed as well as quantities sent and estimated for disposal recorded in appropriate form.

The Nduba landfill has already been identified within the WMP as an authorised location where solid waste can be disposed of by a licensed company. Currently, BAC is identifying two additional locations for final disposal and treatment of hazardous and biodegradable waste. Tenders have been circulated for the contract; however, will only be finalised in the fourth quarter of 2018.

The identification of licensed waste management facilities suitable for the receipt of construction waste means that impacts are anticipated to be minimised during the construction phase. Periodic audits will take place to ensure that the waste management facilities proposed to be used by the Proposed Project contain the necessary precautions, to prevent impacts, such as the release of hazardous leachate and methane gas.

16.5.1.2 Impact Assessment Prior to Mitigation

Impacts on the sensitive receptors during construction prior to mitigation, but including design controls, have been identified and outlined in Table 16.4.

Table 16.4: Construction Phase Impacts	
Identified Receptors	Summary
Regional groundwater aquifer systems and surface water bodies (High Sensitivity)	Design controls will ensure that waste is stored and disposed of appropriately. This will minimise impacts on ground and surface water. Impacts are considered to be Minor Adverse .
Local communities (High Sensitivity)	Design controls will ensure that waste is stored and disposed of appropriately, without impacts on local communities. However, the transport of waste to points of disposal will result in a Moderate Adverse impact on the communities through which waste is transported as a result of the hazardous nature of some of the waste streams and volumes being transported.
Local waste management facilities (Medium Sensitivity)	The WMP outlines the requirements of contractors to ensure that they use licensed facilities for disposal, therefore it is anticipated that suitable facilities will be identified within Rwanda or in neighbouring countries. However, whilst 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. Therefore, at this stage it is assumed that the limited volume of construction waste being generated from the Proposed Project will lead to a burden on these facilities and could result in some uncontrolled disposal of waste. Consequently a Moderate Adverse impact is considered to result.
Employees of the Proposed Project who work onsite during the construction phase (High Sensitivity)	Impact from improper handling of waste streams by employees during the construction phase (i.e. improper manual handling of waste or contact with hazardous waste) will be minimised following the implementation of the WMP and associated on-site training. Although the employees are highly sensitive, the WMP will minimise the magnitude of the impact resulting in a Negligible significance.
Local flora and fauna and migrating fauna (High Sensitivity)	The WMP requires that waste can only be disposed of at licensed waste management facilities which contain necessary protection measures. The local flora and fauna is considered highly sensitive; however, through the correct implementation of the WMP, the impact is considered to be Minor Adverse .

16.5.2 Operation Phase Impacts Prior to Mitigation

Operation phase impacts for the Proposed Project will predominantly be associated with the operation of the airport, as no waste is envisaged to be generated for the Expressway once operational.

Limited published information could be identified which outlined operational airport waste arisings within Rwanda or other similar countries. According to BAC, monthly operational waste generated at the existing Kigali International Airport is approximately 30 m³.

Aberdeen Airport, in the UK, was identified as operating at a comparable capacity to the Proposed Project's maximum capacity for 2045. Aberdeen handled approximately 2 million passengers in 2001, where 0.26 kg of waste per passenger was produced¹⁷. It should be highlighted that there is significant variation in waste generated across airports for which information could be obtained. Edinburgh Airport in the UK reported the lowest quantity of waste produced per passenger at 0.21 kg per passenger, while London Gatwick also in the UK reported the highest quantity per passenger at 0.50 kg per passenger. Recycling rates were also found to vary significantly across airports, a rate of 13% was found at Istanbul Atatürk, while Frankfurt achieved a rate of 83%¹⁸. This is anticipated to relate to the provision of suitable waste management facilities available in each country.

Based on this information, a broad estimate of the anticipated waste arisings for the operation of the Proposed Project can be made. The assessment assumes the scenario of the airport operating at maximum forecasted capacity in 2045, which equates to an estimated 2.25 million passengers, this is based on the forecast from Volume 6 of the Bugesera Master Plan – Technical Concept.

Based on the studies reviewed, a range of 0.21 to 0.5 kg per passenger is considered appropriate for the Proposed Project. Therefore it is estimated that annual waste arisings at the Proposed Project at the maximum 2045 capacity will be between 470 to 1,130 tonnes per annum. Limited recycling infrastructure is understood to exist within Rwanda. Therefore, it is not possible to estimate a likely recycling rate for the Proposed Project. Annual cargo capacity in 2045 is estimated to be 56,400 tonnes, which will also lead to additional waste being generated.

Waste arisings for each waste stream were based on a qualitative assessment, applying the same approach as the construction phase (Table 16.5). A traffic light system was utilised for each waste stream to provide an estimation of waste quantities (see Table 16.2 for key).

Waste streams for which high quantities of waste are anticipated to be produced are associated with activities within the airport terminal buildings. High quantities of putrescible waste including food waste and packaging waste predominantly comprising plastic packaging and films (not plastic bags), paper and cardboard, due to the number of airport passengers, employees and visitors coming to the airport are considered likely. High quantities of putrescible waste including food waste are expected from catering services and high quantities of packaging waste comprising plastic packaging and films (not plastic bags), paper and cardboard are also anticipated within the cargo facility.

Table 16.5: Anticipated Waste Streams that will be generated during the Operation Phase									
Waste Type	Form								
		Terminals	Aeroplanes	Offices	Vehicle/ plane Maintenance	Airport maintenance	Catering	Medical facility	Cargo Facility

¹⁷ Pitt and Smith, 2003. Waste management efficiency at UK airports, Journal of Air Transport Management vol. 9 pg 103 – 111.

¹⁸ Kilkiş, S. and Kilkiş, S.,2015. Benchmarking airports based on a sustainability ranking index, Journal of Cleaner Production.

Table 16.5: Anticipated Waste Streams that will be generated during the Operation Phase									
Non-hazardous Material									
Scrap metal	Solid				X	X			
Putrescible waste including food waste	Solid	X	X	X			X	X	X
Wooden pallets	Solid	X			X		X	X	X
Vehicle tyres	Solid				X				
Plastic	Solid	X	X	X	X	X	X	X	X
Paper/cardboard	Solid	X	X	X			X	X	X
Municipal waste	Solid	X	X	X			X		X
Glass	Solid	X		X	X	X	X	X	X
Hazardous Waste									
Sewage	Liquid	X	X	X			X	X	X
Waste electrical equipment	Solid	X	X	X	X	X	X	X	X
Waste oil including plane fuel and lubricants	Liquid				X	X			
Waste oil filters and oily rags	Solid				X	X			
Grease and cooking oil	Liquid						X		
Batteries	Solid	X	X	X	X	X		X	X
Medical waste	Solid							X	
Chemicals	Liquid	X	X		X	X		X	X
Cables containing substances	Solid				X	X			
Waste sludge from runway oil/water interceptors and wastewater treatment facilities	Liquid					X			
Runway sludge following runway marking maintenance	Liquid					X			

The effective management of operational waste from the Proposed Project is key to minimising the potential impacts associated with the operation phase of the airport. A solid waste management storage area has been specified within the airport design which will provide the

means with which to segregate specific waste streams that may arise during operation, for example separate storage of putrescible, hazardous and mixed general wastes.

The Nduba landfill has already been identified as an authorised location where solid waste disposal can be taken by the licensed waste contractor during operation. Based on the waste estimations for the Proposed Project, where an annual estimate of 1,130 tonnes of waste is anticipated to be produced once operational, the Nduba landfill with an annual capacity of 140,000 tonnes, it is thought to be of sufficient capacity to receive operational waste from the Proposed Project. Currently, Kigali International Airport (KGL) operational waste is disposed of at the Nduba landfill. Additionally, an agreement will also be made with two other locations for final disposal and treatment of waste (as discussed in Section 16.4.1). Furthermore, it is understood that the operation of the Proposed Project will result in an increase in waste generation within Rwanda; however, waste streams from KGL will decrease. This will result in an increase in the volume of waste generated; however, will be minimised from the cessation of waste at KGL.

16.5.2.1 Operation Phase Design Controls

A solid waste management storage area has been incorporated within the Proposed Project design (NBIA-430-B-820-001-SOLIDWASTE-REV02). This area has been designed to allow for the effective storage of segregated waste streams prior to removal for reuse, recycling or disposal. Hazardous waste storage areas have also been identified, which will incorporate the necessary safeguards and protection measures to ensure waste can be stored safely without risk of such materials entering the surrounding environment.

The Nduba landfill has already been identified as a viable solid waste disposal facility (see above). An agreement will also be made with two other locations for final disposal and treatment of hazardous and biodegradable waste.

The identification of nominated, appropriately licensed waste management facilities suitable for the receipt of operation waste assumes that impacts are anticipated to be minimised during the operation phase. Periodic audits will take place to ensure that the waste management facilities proposed to be used by the Proposed Project contain the necessary precautions, to prevent impacts, such as the release of hazardous leachate and methane gas.

16.5.2.2 Impact Assessment Prior to Mitigation

Impacts on the identified sensitive receptors during operation have been identified in Table 16.6.

Table 16.6: Operation Phase Impacts	
Identified Receptors	Summary of Impacts Affecting Receptors
Regional groundwater aquifer systems and surface water bodies (High Sensitivity)	Design controls will ensure that waste is stored and disposed of appropriately. This will minimise impacts on ground and surface water. Impacts are considered to be Minor Adverse .
Local communities (High Sensitivity)	Design controls and appropriate management, storage and handling of wastes in line with accepted good international industry practice (GIIP) will ensure that waste is stored, managed and disposed of appropriately, eliminating foreseen impacts on local communities. The transport of waste to final management location (i.e. recycling facilities or landfill sites) will result in an impact on the communities through which waste is transported. However, with the implementation of the WMP and additional measures such as appropriate receptacle usage and covering of these receptacles, the impact will be Minor Adverse .
Local waste management facilities (High Sensitivity)	Design controls include the commitment to use licensed facilities for disposal, therefore it is anticipated that suitable facilities will be identified within Rwanda or in neighbouring countries. However, whilst 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. Therefore, at this stage it is assumed that operational waste from the Proposed Project will lead to a burden on these facilities and could result in some uncontrolled disposal of waste. Consequently a Moderate Adverse impact is considered as a result.
Employees of NBIA during operation (Medium Sensitivity)	Impact from improper handling of waste streams by employees during the operation phase (i.e. improper manual handling of waste or contact with hazardous waste) will be minimised following the implementation of the WMP and associated on-site training. The operation phase WMP has yet to be developed and therefore, as employees are considered highly sensitive, the impact of improper handling and management of waste is considered to be Moderate Adverse .
Local flora and fauna and migrating fauna (High Sensitivity)	The WMP requires that waste can only be disposed of at licensed waste management facilities which contain necessary protection measures. The operation phase WMP has yet to be developed and therefore, as fauna and flora are considered highly sensitive, the impact of improper management of waste is considered to be Moderate Adverse .

16.6 Mitigation Measures

The mitigation measures outlined below address the impacts which are suggested to arise in Section 16.4 and minimise any residual impacts as far as possible.

16.6.1 Construction Mitigation Measures

The Waste Management Plan will set out measures to ensure that wastes arising will be managed in a safe and acceptable manner and in accordance with accepted good international industry practice. This will minimise impacts associated with waste management during construction. The key features of the plan in this respect include:

- Confirmation of waste streams anticipated to be produced and a detailed breakdown of quantities that will be produced for each waste stream in a quantified waste inventory;
- Finalisation of the list of licensed waste management contractors and facilities and auditing of all waste facilities proposed to be used, to ensure that legal compliance is met and that sufficient capacity is available;
- Detailed plans of suitable storage areas during construction for each waste stream, including hazardous waste, ensuring effective segregation takes place and the necessary safeguards are in place to minimise any risk of adverse impacts arising;
- Detailed plans for routing of traffic transporting waste, in order to minimise impacts on communities;
- Details of the training and protection measures to be implemented, which will protect any Proposed Project employees from the hazards associated with managing construction waste; and
- Audits by the BAC Environment Officer to ensure that the detailed construction phase WMP is being adhered to and all requirements are being met.

16.6.2 Operation Phase Mitigation Measures

An operation phase WMP will be developed and implemented, this will define effective and appropriate techniques and systems for the management and disposal of wastes during the operation phase of the Proposed Project to ensure that impacts associated with this phase in relation to waste management are minimised. The operation phase waste management techniques and systems applied will include the following:

- Confirmation of waste streams anticipated to be produced and detailed estimation of quantities for each waste stream from each part of the airport, once operational via a detailed waste inventory;
- Finalisation of licensed waste management contractors and facilities, and auditing of all waste facilities proposed to be used, to ensure that legal compliance is met, and that sufficient capacity is available, will all take place prior to the commencement of operation for the Proposed Project;
- Detailed plans for routing of traffic transporting waste, in order to minimise impacts on communities;
- Finalised detailed plans of the solid waste management storage area during operation for each waste stream including hazardous waste, ensuring effective segregation takes place and the necessary safeguards are in place to minimise any risk of adverse impacts arising;
- Detailed training and protection measures to be implemented, which will protect any airport employees from the hazards associated with managing operation waste; and
- Undertaking of regular audits by the airport Environment Officer to ensure that the detailed construction phase WMP is being adhered to and all requirements are being met.

16.7 Residual Impact Assessment Conclusions

16.7.1 Construction Phase Residual Impacts

Following implementation of mitigation measures detailed in Section 16.5, all residential impact will be **Negligible** or **Minor Adverse**.

16.7.2 Operation Phase Residual Impacts

Following implementation of mitigation measures detailed in Section 16.5, all residential impact will be **Negligible** or **Minor Adverse**.

16.7.3 Summary of Findings

Mitigation measures, in addition to design controls, will be implemented. These measures will lead to more specific and detailed measures than those included within design controls, and will result in all residual impacts being **Negligible** or **Minor Adverse**.

A summary of the assessment findings can be found in Table 16.7.

Table 16.7: Summary of Findings

Impact	Receptor	Phase	Impact Magnitude	Receptor Sensitivity	Pre-mitigation Impact Significance	Design, Enhancement or Mitigation Measures	Management Plan	Residual Significance
Deterioration of water quality resulting from the improper disposal of waste in unlicensed facilities or using inappropriate disposal methods	Regional groundwater aquifer systems and surface water bodies	Construction	Impact Magnitude: Low Nature: Negative Type: Direct Extent/Scale: Regional Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible	High	Minor Adverse	<ul style="list-style-type: none"> Salvageable materials will be diverted from disposal where possible; Designated area reserved for bins will be provided; HSE officers will inspect containers for compliance with requirements; Wood cutting will occur in centralised locations to maximise reuse and make collection easier; Hazardous waste will be managed by a 	<ul style="list-style-type: none"> C-ESMP Construction Phase Waste Management Plan 	Negligible
Impacts on local communities including loss of land, nuisance, disturbance through increased vehicle	Local communities within the Proposed Project Area of Influence	Construction	Nature: Negative Type: Direct Extent/Scale: Local/Regional/National Duration:	High	Moderate Adverse	<ul style="list-style-type: none"> Hazardous waste will be managed by a 	<ul style="list-style-type: none"> C-ESMP Construction Phase Waste Management Plan 	Minor Adverse

Table 16.7: Summary of Findings

movements, indirect impacts as a result of negative impacts on the surrounding environment			Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible			licensed waste vendor and will be stored separately; <ul style="list-style-type: none"> Quantified waste inventory will be prepared; Legal compliance will be met and sufficient capacity available for contractors and facilities will be provided; Effective segregation and safeguarding will take place for waste; Detailed plans for routing of traffic transporting waste, in order to minimise impacts on communities 		
Improper disposal of waste due to existing waste management facilities being unable to process high volumes of waste arising from the Proposed Project	Local waste management facilities within the Proposed Project Area of Influence	Construction	Nature: Negative Type: Direct Extent/ Scale: Local/Regional/National Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible	Medium	Moderate Adverse		<ul style="list-style-type: none"> C-ESMP Construction Phase Waste Management Plan 	Minor Adverse
Health-related impacts on employees of the Proposed Project as a	Proposed Project employees	Construction	Nature: Negative Type: Direct Extent/Scale:	High	Negligible		<ul style="list-style-type: none"> C-ESMP Construction Phase Waste Management Plan 	Negligible

Table 16.7: Summary of Findings

result of improper handling, storage and disposal of waste			Local/Regional Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible			will be provided; <ul style="list-style-type: none"> • Training and protection measures to be implemented; and • Audits by the BAC Environment Officer will be undertaken. 		
Improper disposal of waste leading to the release of substances which may be harmful to the environment impacting upon local flora and fauna and migrating fauna	Local flora and fauna and migrating fauna	Construction	Nature: Negative Type: Direct Extent/Scale: Local/Regional Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible	High	Minor Adverse		<ul style="list-style-type: none"> • C-ESMP • Construction Phase Waste Management Plan 	Negligible
Deterioration of water quality resulting from the improper	Regional groundwater aquifer systems and surface	Operation	Impact Magnitude: Low Nature: Negative	High	Minor Adverse	<ul style="list-style-type: none"> • Allocated waste storage areas will be provided; 	<ul style="list-style-type: none"> • O-ESMP • Operation Phase Project Waste 	Negligible

Table 16.7: Summary of Findings

disposal of waste in unlicensed facilities or using inappropriate disposal methods	water bodies		Type: Direct Extent/Scale: Regional Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible			<ul style="list-style-type: none"> Disposal will be to licensed and audited facilities; A Waste Management Plan will be developed and implemented; Confirmation of waste streams detailed estimation of quantities for each waste stream; 	Management Plan	
Impacts on local communities including loss of land, nuisance, disturbance through increased vehicle movements, indirect impacts as a result of negative impacts on the surrounding environment	Local communities within the Proposed Project Area of Influence	Operation	Nature: Negative Type: Direct Extent/Scale: Regional/National Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible	High	Minor Adverse	<ul style="list-style-type: none"> Finalisation of licensed waste management contractors and facilities, and auditing of all waste facilities Detailed plans for routing of traffic transporting waste will be provided; 	<ul style="list-style-type: none"> O-ESMP Operation Phase Waste Management Plan 	Minor Adverse

Table 16.7: Summary of Findings

Improper disposal of waste due to existing waste management facilities being unable to process high volumes of waste arising from the Proposed Project	Local waste management facilities within the Proposed Project Area of Influence	Operation	Nature: Negative Type: Direct Extent/Scale: Regional/National Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible	High	Moderate Adverse	<ul style="list-style-type: none"> • Solid waste management storage areas during operation for each waste stream including hazardous waste will be provided; • Detailed training will be undertaken and protection measures to be implemented; and 	<ul style="list-style-type: none"> • O-ESMP • Operation Phase Waste Management Plan 	Minor Adverse
Health-related impacts on employees of the Proposed Project as a result of improper handling, storage and disposal of waste	Proposed Project employees	Operation	Nature: Negative Type: Direct Extent/Scale: Local/Regional Duration: Medium/Long Term Frequency: Potentially continuous Reversibility:	Medium	Moderate Adverse	<ul style="list-style-type: none"> • Regular audits by the airport Environment Officer will be undertaken. 	<ul style="list-style-type: none"> • O-ESMP • Operation Phase Waste Management Plan 	Minor Adverse

Table 16.7: Summary of Findings								
			Reversible					
Improper disposal of waste leading to release of substances which may be harmful to the environment impacting upon local flora and fauna and migrating fauna	Local flora and fauna and migrating fauna	Operation	Nature: Negative Type: Direct Extent/Scale: Local/Regional Duration: Medium/Long Term Frequency: Potentially continuous Reversibility: Reversible	High	Moderate Adverse		<ul style="list-style-type: none">• O-ESMP• Operation Phase Waste Management Plan	Minor Adverse