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Bugesera Airport Company Limited

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NEW BUGESERA INTERNATIONAL AIRPORT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT- LANDSCAPE AND VISUAL

RAMBOLL ENVIRON

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15. LANDSCAPE AND VISUAL

15.1 Introduction

This chapter comprises an assessment the potential impacts on landscape and visual amenity of the Proposed Project Area, as well as adjacent landscape and visual receptors.

The Landscape and Visual Impact Assessment (LVIA) consists of a baseline assessment that describes the landscape and visual context; an analysis of the Proposed Project, its associated sources of potential landscape and visual impacts and potential effects; mitigation measures and an assessment of residual effects.

This chapter is accompanied by the following Technical Appendices:

- Technical Appendix 15.1: Figure - Topography
- Technical Appendix 15.2: Figure - Land use

15.2 Policy, Legal and Administrative Framework

15.2.1 Legal Framework

15.2.1.1 Organic Law No. 04/2005[1]

This identifies landscapes as part of the natural environment and defines it as *"a general outlook of an area made of mountains, forests, plainlands, valleys, swamps, lakes, rivers and streams," and lists the key landscape types of Rwanda as comprising:*

- Mountains: an elevated part of the earth higher than the plainlands and swamps;
- Plains: flat areas with little water and less biodiversity;
- Valleys: comprising areas between two mountains characterised by a source of water above the ground or underground;
- Swamp: flat areas between mountains with much stagnant water and biodiversity, with papyrus, cypress or other vegetation of the same family; and
- Wetland is a place made up of valleys, plains and swamps.

With the exception of requirements for EIA to adequately assesses impacts*, such as visual impacts and impacts on the landscape resource, much of the provision of the law are related to more general protection of the physical environment and natural resources. However, it does also contain specific reference in Article 14, section 3, to* "the obligation to rehabilitate in any possible way in order to restore the beauty of the landscape or the natural systems modified by human activity, in accordance with a pre-established rehabilitation plan approved by the competent authority." *This necessitates adequate reinstatement and enhancement of the Proposed Project Area in order to ensure the character and scenic quality of the area.*

15.2.2 International Standards

15.2.2.1 International Finance Corporation Performance Standards

The International Finance Corporation (IFC) Sustainability Framework comprises IFC's Performance Standard (PS) on Environmental and Social Sustainability. The standards of relevance to the LVIA include IFC PS1 and IFC PS6.

[1] Republic of Rwanda Organic Law No.04/2005 of 08/04/2005. Determining the Modalities of Protection, Conservation and Promotion of the Environment in Rwanda.

Under IFC PS1, the standards define environmental and social impacts as referring to *"any change, potential or actual, to (i) the physical, natural, or cultural environment, and (ii) impacts on surrounding community and workers, resulting from the business activity to be supported."*

IFC PS6 states that *"where paragraphs 13–19 are applicable, the client should consider project-related impacts across the potentially affected landscape or seascape."* This guidance, is therefore germane to the LVIA.

15.2.2.2 African Development Bank Group Integrated Safeguard System

Part III: Operational Safeguards of the African Development Bank Group's Integrated Safeguards System[2] outlines the key steps for completion of an ESIA, including identification of receptors that are anticipated to be subject to potential significant impacts (including prominent landscape and aesthetic features), the definition of baseline conditions, and mitigation design and impact assessment. It sets out the process for determining a suitable Study Area as well as assessing cumulative effects. This guidance s augmented by further guidance provided on page 19 of Integrated Safeguard System – Guidance Materials Volume 3: Sector Keysheets[3].

European Bank for Reconstruction and Development (EBRD) funded projects have to comply with the Bank's Environmental and Social Policy which expects that category A projects (as is the Proposed Project) meet good industry practice (GIP) related to environmental and social sustainability. For EBRD Performance Requirement (PR) 1 compliance the Environmental and Social Impact Assessment (ESIA) has to identify potential improvement opportunities and recommend any measures needed for the avoidance or, where avoidance is not possible, minimise and mitigate adverse impacts. Whilst EBRD does not make reference to LVIA specifically, the potential for mitigation of landscape and visual impacts is considered appropriate.

15.3 Assessment Methodology

15.3.1 The LVIA was prepared in accordance with the following guidance:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA)[4];
- Landscape Character Assessment[5];
- Techniques and Criteria for Judging Capacity and Sensitivity[6]; and
- Photography and photomontage in landscape and visual impact assessment, Advice Note 01/11[7].

15.3.2 Scope

The LVIA addresses potential effects of the Proposed Project on:

- The landscape fabric within the Proposed Project Area;
- The character of the landscape within the Proposed Project Area and wider Study area;
- The amenity of visual receptors within the Proposed visual study area, including:
  - Residential receptors and subsistence farmers;

[2] African Development Bank Group, 2013. Integrated Safeguards System – Policy and Operational Safeguards – Volume 1

[3] Available at https://www.afdb.org/en/news-and-events/bank-groups-new-guidance-on-environmental-and-social-impact-assessment-to-boost-sustainable-development-in-rmcs-15256/

[4] Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidance for Landscape and Visual Impact Assessment – Third Edition

[5] The Countryside Agency and Scottish Natural Heritage, 2002. Landscape Character Assessment.

[6] Scottish Natural Heritage and the Countryside Agency, 2002. Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity.

[7] The Landscape Institute, 2011. Photography and Photomontage in Landscape and Visual Impact Assessment – Advice Note 01/11.

- Residents and visitors to key settlements, including Kinazi, Kayumba, Mwogo, and Rilima; and
- Road users on existing roads in the Proposed Project Area, including tourists on main transportation routes (KK-15 Road).

For the purposes of the LVIA, a visual study area has been utilised that consists of the Proposed Project Area and an area equivalent to a 10 km radius from the Airport Area. The geographical extents of this area were selected in response to the potential extent of intervisibility across the gently undulating plateau on which the Proposed Project is located, and the scale of its constituent elements.

Consideration has been given to potential night time as well as daytime effects on landscape and visual receptors in the visual study area.

15.3.3 Baseline Characterisation

The landscape and visual context of the Proposed Project has been investigated by means of desktop evaluation and field verification, and has been summarised in Section 15.3. This baseline description was utilised as the basis against which the effects of the construction and operation phases of Proposed Project were judged.

The key sources of information utilised in the development of the landscape and visual baseline are listed below:

- Base mapping (utilised in all baseline figures): Open Street map data, sourced from Esri, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community;
- Terrain data (utilised in Technical Appendix 15.1): Derived from WGS 1984 UTM Zone 36S. Projection: Transverse Mercator. Datum: WGS 1984;
- Land use datum (utilised in Technical Appendix 15.2): Derived from the Food and Agriculture Organization of the United Nations. GEONETWORK. Aggregated land cover database for Rwanda (Africover) for tsetse habitat mapping (GeoLayer). (Latest update: 04 Jun 2015) Accessed (28 Jun 2017). URI: http://data.fao.org/ref/88ffbea0-1e49-11dc-abdf 000d939bc5d8.html?version=1.0; and
- Aerial photography: Sourced from: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

15.3.4 Construction Phase Method of Assessment

The effects of construction activities on the baseline context included the consideration of all site clearance, construction and reinstatement works.

The method adopted in determining the level of landscape and visual effects during this phase of the Proposed Project is set out in 15.3.6.

15.3.5 Operation Phase Method of Assessment

The effect of the operational Proposed Project and Expressway on the baseline context included consideration of all airport elements and ancillary infrastructure, as well as internal and external lighting, and the Expressway.

The method adopted in determining the level of landscape and visual effects during this phase of the Proposed Project is set out in 15.3.6.

15.3.6 Significance Criteria

The level of landscape and visual effect is a result of a combination of receptor sensitivity and magnitude of change arising from the Proposed Project, as summarised in Table 15-1. This matrix varies slightly in relation to the matrix presented in Chapter 3: Impact Assessment Methodology in that a magnitude of impact of 'none' has been added. For the purposes of this LVIA, **Major** and **Moderate** effects are considered significant.

Table 15-1: Landscape and Visual Effects

		Receptor Sensitivity		
		Low	**Medium**	**High**
Magnitude of Impact	**None**	None	None	None
	Very Low	Negligible	Negligible	Minor
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

15.3.6.1 Landscape Sensitivity

The sensitivity of the landscape to change is defined as high, medium or low based on professional interpretation of a combination of its susceptibility to change associated with the type of development proposed, and the value attributed to the landscape. The following parameters were therefore applied in determining the sensitivity of the landscapes within the visual study area:

- The demonstrable value placed on the landscape, such as protected areas;
- Landscape quality;
- Existing land use;
- The pattern and scale of the landscape;
- Visual enclosure/openness of views and distribution of visual receptors;
- The scope for mitigation, which would be in character with the existing landscape; and
- The degree to which the particular element or characteristic contribution to the landscape character and can be replaced or substituted.

15.3.6.2 Visual Receptor Sensitivity

Visual receptor sensitivity is also defined as high, medium, or low based on an interpretation of a combination of parameters, and also relates to the susceptibility and value ascribed to visual receptors or receptor locations. The following criteria were utilised in determining viewpoint sensitivity:

- The land use or main activity at the viewpoint/receptor location;
- The frequency and duration of use of receptor location; and
- The landscape character and quality of the intervening landscape.

In relation to land use at the viewpoint, visual sensitivity is defined Table 15-2.

Table 15-2: Definitions of Visual Sensitivity

High	Tourists and users of outdoor recreational facilities, including formal vantage points, strategic recreational footpaths, cycle routes or rights of way, whose attention may be focused on the landscape; important landscape features with physical, cultural or historic attributes; views

Table 15-2: Definitions of Visual Sensitivity	
	from residential buildings; beauty spots or picnic areas; or tourists utilising key routes to access the region.
Medium	Local or short range footpaths, local road users/people travelling through the landscape on roads, trains or other transport routes.
Low	People engaged in outdoor sports or recreation (other than appreciation of the landscape), commercial buildings, and other locations where people's attention may be focused on their work or activity.

15.3.6.3 Magnitude of Change

The magnitude of change arising from the Proposed Project is described as high, medium, low, very low or none based on the interpretation of a combination of largely quantifiable parameters, as follows:

- The receptors distance from the Proposed Project Area;
- The size and scale of the change to views or the landscape that is anticipated;
- The duration and frequency of impacts and whether they are reversible;
- The geographical extent of the Proposed Project Area, landscape, or route that would be affected;
- The angle of view in relation to main receptor activity;
- The degree of contrast between Proposed Project elements and the baseline context; and
- The extent and nature of other similar built development visible.

Magnitude is defined in Table 15-3.

Table 15-3: Definition of Magnitude	
High	Fundamental widespread change to the baseline landscape and/or views as a result of the loss of defining characteristics of the landscape or views.
Medium	Considerable change to the baseline landscape and/or views. The Proposed Project would represent a replacement or loss of numerous defining characteristics or elements.
Low	The Proposed Project would result in highly localised change to the baseline landscape and visual amenity of the visual study area. Baseline characteristics would remain pre-eminent.
Very Low	Barely discernible change. The defining characteristics of the baseline context would remain essentially unaltered.
None	No discernible change would occur.

15.3.6.4 Nature of Effects

Landscape and visual effects, due to their nature, are for the most part always considered to be probable, in terms of 'Likelihood'.

Effects may be:

- Direct (i.e. occurring through direct interaction of the Proposed Project or constituent element with environmental components, such as elements of the landscape fabric);
- Indirect (i.e. not a direct result of the project, or produced away from the Proposed project);

- Temporary (i.e. not permanent or reversible), or permanent (i.e. liable to occur in perpetuity and non-reversible);
- Adverse (resulting in loss or adverse change/deterioration to the landscape or visual baseline context);
- Beneficial (resulting in strengthening, enhancement or improvement of the landscape or visual baseline context); and
- Neutral (representing neither an adverse nor a beneficial effect overall and as such considered unlikely to represent a significant effect).

15.3.7 Assumptions and Limitation

Given that the previous inhabitants in the Airport Area have been resettled, this population will no longer be present and do not constitute visual receptors. They have, accordingly, been omitted from the LVIA.

The LVIA also does not assess effects on the visual amenity of individual properties as the LVIA is concerned with public, rather than private interest.

The LVIA was undertaken with reference to the Master Plan[8], section elevations and the description of the Proposed Project provided in Chapter 3.

Other limitations are associated with tolerances of commercially available baseline geographical and topographical data sets and geographical data utilised in the assessment, which are listed in 15.3.3. Such limitations are considered insufficient to prejudice the outcome or findings of the LVIA.

15.4 Baseline Conditions

15.4.1 Landscape Baseline

15.4.1.1 Landform and Hydrological Features

Technical Appendix 15.1 illustrates the elevations, key watercourses and lakes present within the Proposed Project Area and wider visual study area.

The Proposed Project Area is located on the central plateau of Rwanda, southeast of Kigali city. In the vicinity of the Proposed Project Area, elevations typically range between 1,300 and 1,500 metres above sea level (masl), the lowest occurring to the north and east, along the meandering alignment of the Nyabarongo watercourse and adjoining the western end of Lake Mugesera. Elsewhere, elevations increase to summits and ridges up to 1,675 masl to the west and northeast of the Proposed Project Area, as well as the Kigali and Bihembe ranges that climb to approximately 1,900 masl and enclose the visual study area to the north and northeast of the site, respectively.

The topography of the extended area undulates between 1,350 and 1,450 masl and is encircled by the incised landforms of Mwesa to the north, Kibilizig to the west, Lake Kidogo to the south, and Lake Gashanga to the east.

The Expressway extends northwest from Mwesa from the Airport Area before joining the existing road bridge across the Nyabarongo River and the KK-15, and then climbing to the Kigali range beyond.

15.4.1.2 Land Cover, Land use and Landscape Elements

Technical Appendix 15.2 shows the general land use and land cover within a 10 km radius of the Proposed Project Area.

[8] Bugesera District Development Plan (2013 – 2018)

The Proposed Project is located within an area dominated by an agrarian landscape with a prevalence of shrub crop production arranged in small to medium scale fields with occasional scrubby trees. The field pattern is generally rectilinear or slightly curved, following the contours of the underlying topography or running parallel to the network of minor local roads that cross the area. Shrub savannah is also present along the incised line of the Mwesa that links to Lake Mugesera, located to the north of the Proposed Project Area. The course of the Nyabarongo River is marked by extensive marsh and wet shrub vegetation, and nearby lakes are typified by open water and variable margins, which are abutted by rectilinear fields in the adjoining farmland.

The Airport Area covers an area of approximately 2,500 ha of land that, until recently, was utilised for subsistence farming. However, 9 ha of the Airport Area has been constructed and is now utilised as a Construction Camp, comprising site offices, laboratories, changing rooms, first aid station, vehicle parking and maintenance sheds, fuel tank area and water treatment plant.

15.4.1.3 Roads

There are currently no major dual carriageways or road corridors in the Proposed Project Area, with the majority of infrastructure comprising local rural roads between neighbouring settlements and scattered rural properties. However, the KK-15 Road is a key regional route that links the RN15 carriageway east of Nyamata to the RN3 Kigali road and Rukoli via Rilima. There are also a number of District roads present in the vicinity of the Airport Area, including:

- DR73 - Masaka-Nyakaliro-Juru-Nyamata, which, at its closest, abuts the northern boundary of the Airport Area; and
- DR74 - Rilima-Mwogo-Nyamata-Musenyi-Shyara, which encircles the Airport Area, and at its closest, immediately abuts the southeastern boundary of the Airport Area

The proposed Expressway would link to this route just south of the Nyabarongo River and provide a necessary link to the urban road network of Kigali city.

15.4.1.4 Settlement

Settlement is predominantly in the form of widespread scattered farmsteads and hamlets that are located up short tracks along the sides of the main road network. Such properties are single storey and generally associated with extensive shrub/crop cover that serves to filter views out into the wider landscape. Larger settlements and high concentrations of properties are present at:

- Kinazi and Kayumba, situated along the KK-15, between 6 and 8 km west of the Airport Area;
- Mwogo, a sprawling settlement approximately 5 km to the north of the Airport Area, and occupying elevated land to the east of the Expressway; and
- Rilima, which is situated between Lake Gashanga and Lake Kidogo, within 5 km of the eastern boundary of the Airport Proposed Project Area.
- Nyamata, situated approximately 3 km to the southwest of the Airport Area, and centred on the of the KK-15 Road corridor.

15.4.2 Landscape Designation and Classification

The visual study area contains no landscape designations or classifications. Consequently, these are not considered further in the LVIA.

15.4.2.1 Landscape Character

There is no published landscape character assessment for the area. Initial investigations and desktop evaluation suggests that the key characteristics of the visual study area may be summarised as follows:

- A gently undulating plateau cut through by a shallow, flat bottomed Nyabarongo River valley, a meandering watercourse and a network of incised channels linked to a network of irregular lakes fed from the elevated catchments in the Kigali and Bihembe ranges;
- A predominance of shrub farmland and occasional shrub savannah with marshland associated with the Nyabarongo River valley;
- A sparsely settled landscape, mainly of farmsteads positioned at the end of short tracks set back from numerous minor local roads that generally have a straight alignment;
- A large scale landscape with variable degrees of inter-visibility dependent upon elevation and the extent of tree and shrub cover;
- The most expansive views are bounded by distant ranges of hills which form an undulating horizon;
- Coarse textures associated with shrub and savannah vegetation; and
- An essentially quiet and still landscape where muted colours predominate and artificial light sources are minimal and associated with scattered properties.

15.4.2.2 Visual Receptors

The principal visual receptors within the visual study area include:

- Local residential receptors and farmers;
- Residents and visitors to nearby main settlements, including Kinazi, Kayumba, Mwogo, Rilima and Nyamata; and
- Road users on minor local roads, including tourists travelling through the area.

15.4.3 Baseline Summary and Conclusions

The visual study area comprises a large scale non-designated landscape largely valued for its agricultural productivity and rural character. Access through the landscape is almost exclusively by a network of minor local roads and tracks that connect communities and scattered single storey residential properties and farmsteads. Concentrations of receptors are centred on villages and small towns around the edges of the Proposed Project Area, many of which are located on slopes and low lying positions within valleys and incised landscapes associated with river corridors and catchments. The essentially quiet rural character, stillness and gently undulating form of the landscape provides a context that is susceptible to new large scale vertical elements, artificial lighting, movement and sources of loud noise. The mute colours present also make the landscape vulnerable to highly reflective objects and brightly coloured hues.

15.5 Potential Impacts

The Proposed Project includes the development, construction and operation of the following structures and infrastructure:

- Airport and associated structures and infrastructure;
- Temporary 5 km Water Pipeline for the construction phase;
- Upgrades to the quarry route; and
- 14.5 km Expressway to link the airport to the national KK-15 Road.

15.5.1 Construction Phase Impacts Prior to Mitigation

There are a number of potential impact generators associated with the construction phase of the Proposed Project, including:

- Site clearance and disposal of arisings;
- Establishment of Construction Camp and associated offices and welfare facilities at the Proposed Project Area;
- Creation of open excavated areas and trenches;
- Road widening, upgrading and maintenance and construction of temporary ditches, borrow pits, spoil heaps and other changes to ground surface conditions;
- Stockpiling and material storage;
- Increased vehicle movements, including construction vehicles, heavy goods vehicles and small light utility vehicles;
- Artificial light sources associated with security lighting, lighting of work areas and compounds, as well as site vehicles and plant;
- Construction of airport structures and infrastructure;
- Establishment of associated structures and infrastructure, including upgrades to the existing quarry road to facilitate use of the quarry as a source of aggregate, construction for the Proposed Project, and construction of the Expressway and installation of the Water Pipeline; and
- Landscape works associated with public realm and external spaces in and around the Airport Footprint.

The Proposed Project will make use of an existing quarry located approximately 10 km northeast of the Airport Area. An 18 km unsurfaced road is currently utilised by haulage vehicles that passes through Kabukuba Village. An existing alternative route has been identified to reduce effects on the village, this is to be widened and selectively improved, and when in use, will bypass part of Kabukuba Village and reduce the overall length of the haul between the quarry and the Proposed Project to 10 km.

The proposed Expressway will be approximately 14.5 km in length from the north-western section of the Airport Area and link to the existing KK-15 Road providing direct access to Kigali city. The Expressway will comprise a dual bitumen surfaced carriageway totalling approximately 9 m in width. The overall road reserve will be 44 m.

Initially, during the construction phase of the Proposed Project, a 5 km temporary Water Pipeline will be installed laid between a water treatment plant at the Construction Camp site and Lake Kidogo.

Construction of the Proposed Project will be undertaken in line with the Master Plan development phases set out in Chapter 3 which indicates a 25 year development period in total.

15.5.1.1 Design Controls

In addition to general good practice, and to mitigate potential construction effects on landscape and visual receptors, the following general measures will be adopted:

- Development of the Proposed Project in series of phases to enable the rapid establishment of NBIA and minimisation of landscape and visual effects at any given time;
- Positioning of the proposed Water Pipeline above ground, thereby avoiding the necessity of excavation of trenches along the pipeline route; and

- Use of suitable dust suppressant as part of standard environmental control systems to avoid generation of dust plume that could be intrusive and which could cause damage to neighbouring vegetation.

15.5.1.2 Impact Assessment – Landscape Effects – Prior to Mitigation

Landscape Fabric

The landscape within the Proposed Project Area is essentially flat and until recently was utilised for subsistence farming, but is now largely vacant. It is not of especially good quality in respect of landscape or visual amenity and is not especially rare. On this basis the landscape fabric is considered to have a moderate value and susceptibility and to therefore have a medium sensitivity to the type of development proposed.

Construction activities, whilst resulting in relatively minor changes to the form of the landscape, would result in considerable change to land cover and land use within the Airport Footprint and the alignment of the Expressway. Such changes would relate to activities such as site clearance, soil stripping and construction of site infrastructure and buildings. Whilst these operations are incremental, they will have a long duration and will affect an extensive geographical area. Consequently, they will represent impacts of a high magnitude and a pre-mitigation **Major Adverse** impact, which are considered significant.

Landscape Character

The landscape of the visual study area, and more particularly, the Proposed Project Area, is not subject to landscape designation or other formalised recognition of value in landscape terms. It is a large scale unremarkable landscape of moderate condition and which affords some potential for mitigation that is in keeping with the wider landscape. Consequently, it is considered to have a medium sensitivity to the type of development proposed.

The clearance of characteristic shrub farming vegetation, introduction of considerable additional vehicle movements, and the construction of uncharacteristic infrastructure and built structures associated with the airport and Expressway have potential to cause significant effects on landscape character. However, outside of the Airport Footprint and Expressway there would be no direct effects in the landscape and the Proposed Project would be partially obscured from by intervening vegetation and/or mitigated by distance. Similarly, the Expressway would be contained within a valley feature, thereby reducing its visibility and prominence. Consequently, the magnitude of perceived change to the character of the landscape would be high within, and immediately abutting the Airport Area and Expressway, and medium elsewhere within the Proposed Project Area, and the consequent impacts would range from **Major** to **Minor Adverse**. During the construction of the Proposed Project the landscape would retain its scale, form and underlying characteristics for all but the closest receptors to construction activities.

15.5.1.3 Impact Assessment – Visual Effects – Prior to Mitigation

The sensitivity of visual receptors is as follows:

- High in respect residential receptors and settlements;
- High in respect of tourists utilising national and regional roads;
- Medium in respect of general road users, including users of District Routes; and
- Low in respect of farmers/people farming.

Settlement

The Kinazi Village is situated within an incised landscape, occupying the sides of a valley that forms part of the catchment for Manyaru River. Consequently, no views of the Proposed Project

are anticipated from this settlement, and the impact significance would be **None** on the amenity of this settlement is predicted.

Kayumba is located on a southeast facing slope at approximately 1,400 masl, at a similar height to the Airport Footprint. Whilst construction works will be visible from this settlement, they will be partially obscured by intervening vegetation and will be seen distantly, and therefore will occupy a small proportion of the view from this settlement. On this basis, the magnitude of impact on the amenity of this settlement would be very low and the impact would be **Minor Adverse**, which is not considered significant. The most visible aspects of the construction works would be the elevated operations such as the construction of the Passenger and Presidential Terminals.

Given the highly scattered nature of Mwogo Sector, the impacts of construction works on this settlement are predicted to vary greatly, the greatest occurring on the western and southern extents of the settlement. The construction of the Expressway and operations within the Airport Footprint will be evident from these parts of the settlement, but intervening vegetation, including roadside vegetation will cause some reduction in views of the Proposed Project. Given the distance at which the construction works would be visible, the often restricted nature of such visibility, the magnitude of impact would be very low and the impact on the amenity of this settlement would be **Minor Adverse**, and not significant.

The Rilima Sector is situated north of Lake Kidogo on topography that slopes to the north, east and south; away from the Proposed Project and as a result would experience no discernible construction operations due to the screening effect of intervening topography and vegetation. Consequently, construction works would have an impact significance of **None** on the amenity of this settlement.

Nyamata is located on a gently southeast facing slope descending towards the Kibillzi at a similar height to the Airport Footprint. Whilst construction works will be visible from this settlement, they will be partially obscured by intervening vegetation and will be seen distantly, and therefore will occupy a small proportion of views from this settlement. Consequently, the magnitude of impact on the amenity of this settlement would be very low and the impact would be **Minor Adverse**, which is not considered significant. The most visible aspects of the construction works would be the elevated operations such as the construction of the Passenger and Presidential Terminals.

Road Users

A high proportion of the KK-15 Road within the visual study area is located within incised valley landscapes with the consequence that views of works in the Airport Area and Expressway will be rare and of short duration. Exceptions to this will occur at elevated locations west of Gakamba from where brief expansive views across the plateau are provided, and close to the Expressway junction east of Kayumba Village. Consequently, the KK-15 Road will generally be subject to an impact significance of **None**, but with highly localised **Minor Adverse** impacts for tourist and local road users, respectively. The greatest effects will occur west of east of Kayumba Village. Such effects are not considered significant.

The DR73 route will be subject to variable and intermittent visibility of construction works, the greatest visibility occurring at the northern extents of the Airport Area where this route is intersected by the proposed Expressway. Given its relatively restricted visibility and the short duration of potential views, the Proposed Project is considered to pose impacts on amenity of this route and therefore is predicted to range from none to very low, equating to a worst case, localised **Minor Adverse** impact on the amenity of this route, which is not considered significant.

Views of construction works from the DR74 would be highly variable and intermittent as a result of the screening effect of intervening topography and vegetation along this route. However, given this routes proximity to the Airport Area, it is considered inevitable that the amenity of this route will be affected. The principle causes of impact would relate to construction of Passenger and Presidential Terminals and the construction of the Expressway that will intersect it north of the Airport Area. Given the restricted visibility of construction operations the impact on amenity of this route is predicted to be very low, equating to a **Minor Adverse** impact, which is not significant.

15.5.2 Operation Phase Impacts Prior to Mitigation

Details of the key operational elements of the airport are set out in Chapter 6: Proposed Project Description, along with details of the Proposed Project phasing and the operational life of the airport.

15.5.2.1 Design Controls

The Proposed Project has adopted a number of locational and design approaches intended to minimise potential environmental and social effects. Those of relevance to the LVIA include:

- The airport Passenger Terminal and other buildings have been designed be low lying, which will help to mitigate against landscape and visual effects;
- The location of the tallest structures within the central part of the Airport Footprint thereby distancing them from neighbouring receptor locations; and
- The positioning of the Expressway within a low lying position below average elevations, thereby reducing its visibility from neighbouring receptor locations.

15.5.2.2 Impact Assessment – Landscape Effects - Prior to Mitigation

Landscape Fabric

The operation phase of the Proposed Project will result in no additional effects on the landscape fabric of the Proposed Project Area over and above those identified for construction activities. All disturbance and reinstatement works will occur during the construction phases.

Landscape Character

During the operation phase of the Proposed Project, the established airport will clearly contrast with the more rural settled context of the wider landscape, in respect of its form, scale, colour and texture, as well as in the extent of movement and noise associated with it. The Proposed Project will also introduce a number of potentially prominent light sources to what is otherwise a largely dark night setting, including those associated with interior and external lighting, vehicle lights on the Expressway and from aircraft flights into and out of the airport.

The perceived change to the baseline landscape character, as experienced by residential receptors and road users will be greatest in locations within 5 km of the Airport Area and at elevations in excess of 1,400 masl from where they will be most evident and will result in a magnitude of impact would vary greatly, between low and high, equating to **Minor** to **Major Adverse** impact significance. Significant adverse effects would be confined to locations within 2 km of the airport. Beyond 5 km impacts would range from none to low depending on elevation and distance from the Airport Area, and the effect on the character of the landscape would be none to medium and would not be significant. Effects on landscape character would concern the introduction of anomalous large scale structures, infrastructure and movement to a baseline landscape characterised by an essentially still rural landscape dominated by shrub cropping and scrubby vegetation. The inclusion of extensive artificial lighting will also be anomalous, extending effects into the night landscape.

15.5.2.3 Impact Assessment - Visual Effects – Prior to Mitigation

Settlements

The Kinazi Village is situated within an incised landscape, occupying the sides of a valley that forms part of the catchment for Manyaru River. Consequently, only views of incoming or outgoing aircraft will be evident. Aircraft will be seen for short duration, but relatively frequently, depending on flight paths. On this basis, the magnitude of impact will be very low and the impact on the amenity of the settlement is considered to be **Minor Adverse** and not significant.

Kayumba Village will be subject to views of the taller elements of the operational airport such as the Passenger and Presidential Terminals and the Tower, as well as incoming and outgoing flights. Internal and external lighting would increase the visibility of the Proposed Project. Given the distance this settlement is from the Airport Area, the magnitude of impact on the amenity of this settlement will be very low and the effect would be **Minor Adverse**, which is not considered significant.

Due to the somewhat dispersed nature of Mwogo Sector, the impact of the operational airport would vary greatly. The greatest impacts will be experienced on the western and southern extents of the settlement. The Expressway and taller elements of the operational airport such as the Passenger and Presidential Terminals and the Tower, as well as incoming and outgoing flights will be the most notable aspects of the Proposed Project. Internal and external lighting would increase the visibility of the Proposed Project. However; given the distance of the sector from the Airport Area, and the variability of visibility the magnitude of impact on the amenity of this settlement will be very low, and the overall impact would be **Minor Adverse**, which is not considered significant.

The operational airport would be substantially obscured from Rilma Sector by intervening topography and vegetation. However, flights into and out of the airport would be visible. However; given the short duration and distance of this flights, the magnitude of impact is predicted to very low and the impact on the visual amenity of residents will be **Minor Adverse** and not significant.

Nyamata would be subject to views of the taller elements of the operational airport such as the Passenger and Presidential Terminals and the Tower, as well as incoming and outgoing flights. Internal and external lighting would increase the visibility of the Proposed Project. Given the distance this settlement is from the Airport Area, the magnitude of impact on the amenity of this settlement will be very low and the impact would be **Minor Adverse**, which is not considered significant.

Road Users

The operational airport will be screened from the majority of the KK-15 Road due to its position within incised valley landscapes. However; inbound and outbound flights are likely to be visible to road users, but will constitute a very low impact and **Minor Adverse** effect, which is not considered significant. At elevated locations west of Gakamba Village, fleeting views of the main airport structures will be visible, and close to the proposed Expressway junction east of Kayumba Village. However, where such views occur, they would be highly localised and of short duration, thereby representing a **Minor Adverse** impact for tourist and local road users, respectively. Such effects are not considered significant.

The DR73 route will be subject to intermittent views of the operational airport, the greatest visibility occurring as the route climbs to a height of approximately 1,400 masl east of Kayumba Village and approaching the northern extents of the Airport Area where this route is intersected by the proposed Expressway. The most prominent aspects of the Proposed Project will be the

Expressway, the Passenger and Presidential Terminals and aircraft taking off and landing. Additionally, after dark light sources associated with these elements will be clearly evident. Given the intermittent and often fleeting visibility of the Proposed Project, the DR73 route will generally be subject to very low impacts and **Minor Adverse** impacts. Such effects are not considered significant.

Views of the operational airport from the DR74 route will be highly variable and intermittent as a result of the screening effect of intervening topography and vegetation along the route. However; given this route's proximity to the Airport Area, it is considered inevitable that the amenity of this route will be adversely affected. The principal causes of impact will relate to the prominence of Passenger and Presidential Terminals as well as the visibility of the Expressway that will intersect it north of the Airport Area. Given the variability of visibility the impact on amenity of this route is predicted to range from none to low, equating to a worst case **Minor Adverse** impacts, which is not considered significant.

15.6 Mitigation Measures

In order to mitigate construction effects on landscape and visual receptors the following general measures and operational controls will be adopted:

- Careful control of working areas/widths to minimise the extent of physical disturbance vegetation and other landscape elements as well as minimisation of visual intrusion in neighbouring visual receptors;
- Restriction on the size and duration of spoil heaps and stockpiles;
- Control of construction lighting through:
  - limiting the extent of elevated light sources;
  - Use of directable luminaires focusing light downwards to avoid incidence of glare and light spill; and
  - Using timers and proximity switches wherever possible and feasible to do so.
- Concurrent construction and re-instatement process to ensure rapid reversal of impacts wherever practicable and to minimise the extent of disturbance evident.

A series of design measures and operational controls will also be adopted in respect of the operational activities of the airport. These include:

- Incorporation of tree planting and suitable landscaping within the Airport Footprint and surrounds in order to soften the appearance of airport structures and reduce its apparent scale, whilst aiding its assimilation into the adjoining landscape; and
- Selective reinstatement of shrub species adjacent to the main Airport Footprint and along the side of the Expressway, as appropriate, to strengthen the enclosure of the airport.

In respect of lighting mitigation, the following is proposed.

- Wherever possible, use of short column high pressure sodium lighting or similar with suitable shields to focus lighting and avoid light spill;
- Use of non-reflective materials and surfaces (both within airport buildings, and externally to reduce the potential for the proposed development to add to potential sky glow;
- Minimisation of the illumination of building facades to lessen their prominence after dark; and
- Incorporation of blind or louvres to any roof lights and positioning/angling of interior lights away from openings to avoid light leakage.

15.7 Residual Impact Assessment Conclusions

The residual effect of the Proposed Project will be broadly consistent with potential impacts identified in Section 15.5 despite proposed incorporated and additional mitigation measures. However; there will be qualitative changes that would improve the aspects of the Proposed Project from the perspective of landscape and visual receptors.

15.7.1 Construction Phase Residual Impacts

15.7.1.1 Landscape Effects

Landscape Fabric

Residual effects on landscape fabric within the Airport Area and Expressway during construction of the Airport Area and Expressway will be **Minor to Moderate Adverse** as a result of the extent of the changes to land use/land cover which in turn result from the change of land use from rural to infrastructure use.

Landscape Character

Minor to Moderate Adverse impacts on landscape character within the Airport Area and Expressway corridor continue to be anticipated during construction following the mitigation measures adopted, as a result of alteration to baseline land cover and loss of landscape elements as a result of the change of use of the land from a rural-type usage to infrastructure. However, beyond the Airport Area and Expressway, effects would be indirect and the Proposed Project will be partially obscured from by intervening vegetation and topography. Consequently, the landscape outside of the Airport Area and Expressway will retain its essential scale, form and underlying characteristics for all but the closest receptors to the Airport Area and Expressway.

15.7.1.2 Visual Effects

Settlements

Post-mitigation, no significant construction phase effects are predicted on surrounding sectors and villages.

Road Users

No significant effects would be experienced on the KK-15 Road, which will generally be subject to **Minor Adverse** impacts. Similarly, whilst subject to some adverse effects due to their proximity, the amenity of the DR73 or DR74 routes are not considered to be liable to significant construction phase effects.

15.8 Operation Phase Residual Effects

15.8.1.1 Landscape Effects

Landscape Fabric

No additional significant effects are anticipated on the landscape fabric of the Proposed Project Area over and above those identified for construction operations.

Landscape Character

Residual effects on landscape character will be greatest in locations within 5 km of the Airport Area and at elevations in excess of 1,400 masl from where the Proposed Project would result in **None** to **Minor Adverse** impacts. Moderate adverse effects would be confined to locations within 2 km of the Airport Area. Beyond this impacts would range from none to low depending on elevation and distance from the Airport Area, and the impact on the character of the landscape would be **None** to **Minor Adverse** and would not be significant. Effects on landscape

character would concern the introduction of anomalous large scale structures, infrastructure and movement to a baseline landscape characterised by an essentially still rural landscape dominated by shrub cropping and scrubby vegetation. The inclusion of artificial lighting will extend effects into the night landscape, though these can be mitigated by minimising outward glare and cowling of lighting as specified and in accordance with Good International Industry Practice and site management.

15.8.1.2 Visual Effects

Settlements

No significant operational effects are anticipated within key surrounding sectors and villages.

Roads

No significant operational effects are anticipated on the KK-15 Road or on the DR73 and DR74 district routes.

15.9 Summary of Mitigation and Residual Effects

15.9.1 Summary of Findings

Table 15.4 contains a summary of mitigation measures and the landscape and visual effects arising from the Proposed Project. It is apparent from this analysis that significant residual effects would comprise the following effects:

- Construction effects on landscape fabric of the Airport Area and Expressway as a result of the extent of the changes to land use and land cover;
- Construction and operational effects on landscape character within the Airport Area and Expressway corridor, and in locations on close proximity to these construction sites; and
- Construction and operational effects on the amenity of scattered properties adjoining the Airport Area associated with terminals, incoming and outgoing aircraft and lighting.

Table 15-4: Summary of Findings

Impact	Receptor	Phase	Impact Magnitude	Receptor Sensitivity	Pre-Mitigation Impact Significance	Design, Enhancement or Mitigation Measures	Management Plan	Residual Significance
Impact on form and cover of landscape	Landscape Fabric	Construction	**Impact Magnitude:** High **Nature:** Adverse **Type:** Direct **Extent/Scale:** Regional **Duration:** Long term **Reversibility:** Irreversible	Medium	**Major Adverse** (Significant)	• Phased development; • Positioning of the proposed Water Pipeline above ground; • Use of dust suppressant; • Sympathetic, low rise terminal building designs; • Appropriate lighting management; • Control of working areas/widths; • Restriction on the size and duration of spoil heaps and stockpiles; • Concurrent construction and re-instatement process.	Construction Management Plan	**Minor to Moderate Adverse**
Impact upon baseline character/ characteristics of landscape	Landscape Character	Construction	**Impact Magnitude:** High (within the Airport Area) and medium in the surrounds **Nature:**	Medium	**Minor** to **Major Adverse** (Significant within the Airport Area	• Phased development; • Use of dust suppressant; • Use of existing tracks and roads; • Restriction on the size and duration of	Construction Management Plan	**Minor to Moderate Adverse** (Moderate within the Airport Area and Expressway

Table 15-4: Summary of Findings

			Negative **Type:** Direct and Indirect **Extent/Scale:** Regional **Duration:** Medium term **Reversibility:** Impacts associated with loss or alteration of key characteristics will be medium term		and Expressway and at locations within 2 km)	spoil heaps and stockpiles; • Control of construction lighting; and • Concurrent construction and re-instatement.		and at locations within 2 km)
Impact upon visual amenity of settlements	Surrounding Communities including: • Kinazi • Kayumba • Mwogo • Rilma • Nyamata	Construction	**Impact Magnitude:** None to very low **Nature:** Adverse **Type:** Indirect **Extent/Scale:** Regional **Duration:** Medium term **Reversibility:** Impacts would be long term or permanent	High	**None** to **Minor Adverse** (Not significant)	• Phased development; • Use of dust suppressant; • Use of existing tracks and roads; • Control of working areas/widths; • Restriction on the size and duration of spoil heaps and stockpiles; • Control of construction lighting; and • Concurrent construction and re-instatement.	Construction Management Plan	**None**

Table 15-4: Summary of Findings

Impact upon visual amenity of road users	Road users on: • KK-15 Road • DR73 route • DR74 route	Construction	**Impact Magnitude:** None to very low **Nature:** Adverse **Type:** Indirect **Extent/Scale:** Regional **Duration:** Rare/short and Medium term **Reversibility:** Impacts would be long term or permanent	Medium/ High	**None** to **Minor Adverse** (Not significant)	• Phased development; • Use of dust suppressant; • Use of existing tracks and roads; • Control of working areas/widths; • Restriction on the size and duration of spoil heaps and stockpiles; • Control of construction lighting; and • Concurrent construction and re-instatement.	Construction Management Plan	**None** to **Minor Adverse** (Not significant)
Impact upon baseline character/ characteristics of landscape	Landscape Character	Operation	**Impact Magnitude:** low to high **Nature:** Adverse **Type:** Direct and Indirect **Extent/Scale:** Regional **Duration:** Medium term **Reversibility:** Impacts associated	Medium	**Minor** to **Major Adverse** (Locally significant)	• Location of tallest structure from neighbouring receptors; • Low lying position of expressway; • Incorporation of tree planting and suitable landscaping within the Airport complex; • Selective reinstatement of shrub species adjacent to the main Airport Footprint and along the	A detailed landscape design and management plan and lighting specification	**Minor** to **Moderate Adverse** (Moderate within the Airport Area and Expressway) **None to Minor Adverse** (not significant at locations within 2 km)

Table 15-4: Summary of Findings

			with loss or alteration of key characteristics will be medium term			side of the Expressway; • Design of internal and external lighting that reduces potential glare, light spill and sky glow; • Use of non-reflective materials and surfaces (both within airport buildings, and externally to reduce the potential for the proposed development to add to potential sky glow; • Minimisation of the illumination of building facades to lessen their prominence after dark. • Incorporation of blind or louvres to any roof lights and positioning/angling of interior lights away from openings to avoid light leakage.		
Impact upon visual amenity of settlements	Surrounding Communities including:	Operation	**Impact Magnitude:** very low **Nature:**	High	**Minor Adverse** (Not significant)	• Location of tallest structure from neighbouring receptors; • Low lying position of	A detailed landscape design and management plan and	**None**

Table 15-4: Summary of Findings

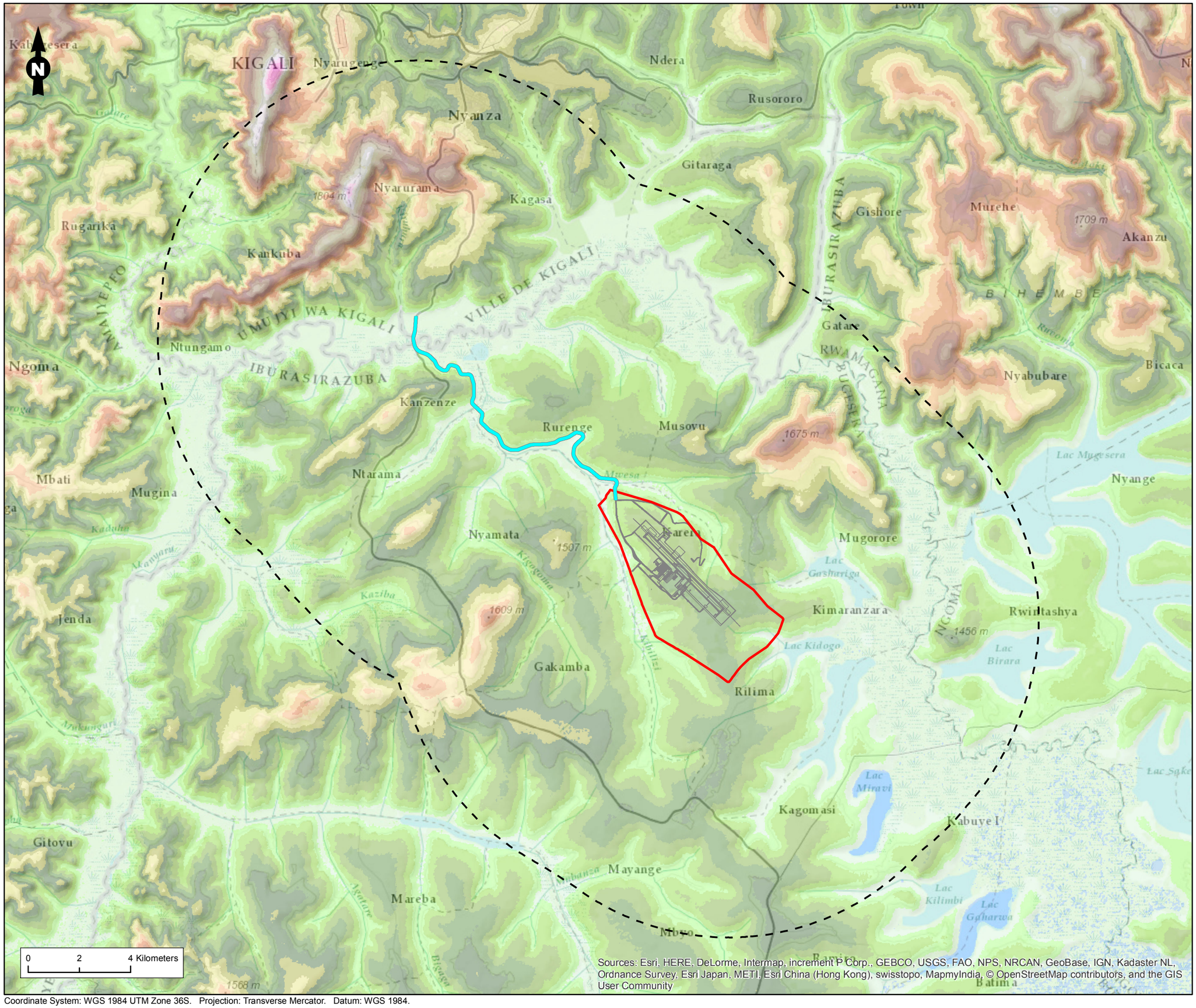
	• Kinazi • Kayumba • Mwogo • Rilma • Nyamata		Adverse **Type:** Indirect **Extent/Scale:** Regional **Duration:** Medium term **Reversibility:** Impacts would be long term or permanent			expressway; • Incorporation of tree planting and suitable landscaping within the Air-port complex; • Selective rein-statement of shrub species adjacent to the main Airport Footprint and along the side of the Expressway; • Design of internal and external lighting that reduces potential glare, light spill and sky glow; • Use of non-reflective materials and surfaces (both within air-port buildings, and externally to reduce the potential for the proposed development to add to potential sky glow; • Minimisation of the illumination of building facades to lessen their prominence after dark. • Incorporation of blind or louvres to any roof	lighting specification	

Table 15-4: Summary of Findings

						lights and positioning/angling of interior lights away from openings to avoid light leakage.		
Impact upon visual amenity of road users	Road users on: • KK-15 Road • DR73 route • DR74 route	Operation	**Impact Magnitude:** none to very low **Nature:** Adverse **Type:** Indirect **Extent/Scale:** Localised/Regional **Duration:** Medium term **Reversibility:** Impacts would be long term or permanent	High	**Minor Adverse** (Not significant)	• Location of tallest structure from neighbouring receptors; • Low lying position of expressway; • Incorporation of tree planting and suitable landscaping within the Air-port complex; • Selective rein-statement of shrub species adjacent to the main Airport Footprint and along the side of the Expressway; • Design of internal and external lighting that reduces potential glare, light spill and sky glow; • Use of non-reflective materials and surfaces (both within air-port buildings, and externally to reduce the potential for	Work scheme Construction Management Plan	**None**

Table 15-4: Summary of Findings

						the proposed development to add to potential sky glow; • Minimisation of the illumination of building facades to lessen their prominence after dark. • Incorporation of blind or louvres to any roof lights and positioning/angling of interior lights away from openings to avoid light leakage.		



Coordinate System: WGS 1984 UTM Zone 36S. Projection: Transverse Mercator. Datum: WGS 1984.

Legend

- Airport Site Boundary
- Expressway
- Site Boundary and Expressway 10km Buffer

Terrain Height (m)

< 1,325	1,626 - 1,650
1,326 - 1,350	1,651 - 1,675
1,351 - 1,375	1,676 - 1,700
1,376 - 1,400	1,701 - 1,725
1,401 - 1,425	1,726 - 1,750
1,426 - 1,450	1,751 - 1,775
1,451 - 1,475	1,776 - 1,800
1,476 - 1,500	1,801 - 1,825
1,501 - 1,525	1,826 - 1,850
1,526 - 1,550	1,851 - 1,875
1,551 - 1,575	1,876 - 1,900
1,576 - 1,600	> 1,901
1,601 - 1,625	

Figure Title
Fig 15.1: Topography

Project Name
New Bugesera International Airport ESIA

Project Number	Figure No.
UK11-24483	15.1
Date	Prepared By
September 2017	CO/AC
Scale	Issue
1:140,000 @A3	1

Client
Bugesera Airport Company Limited

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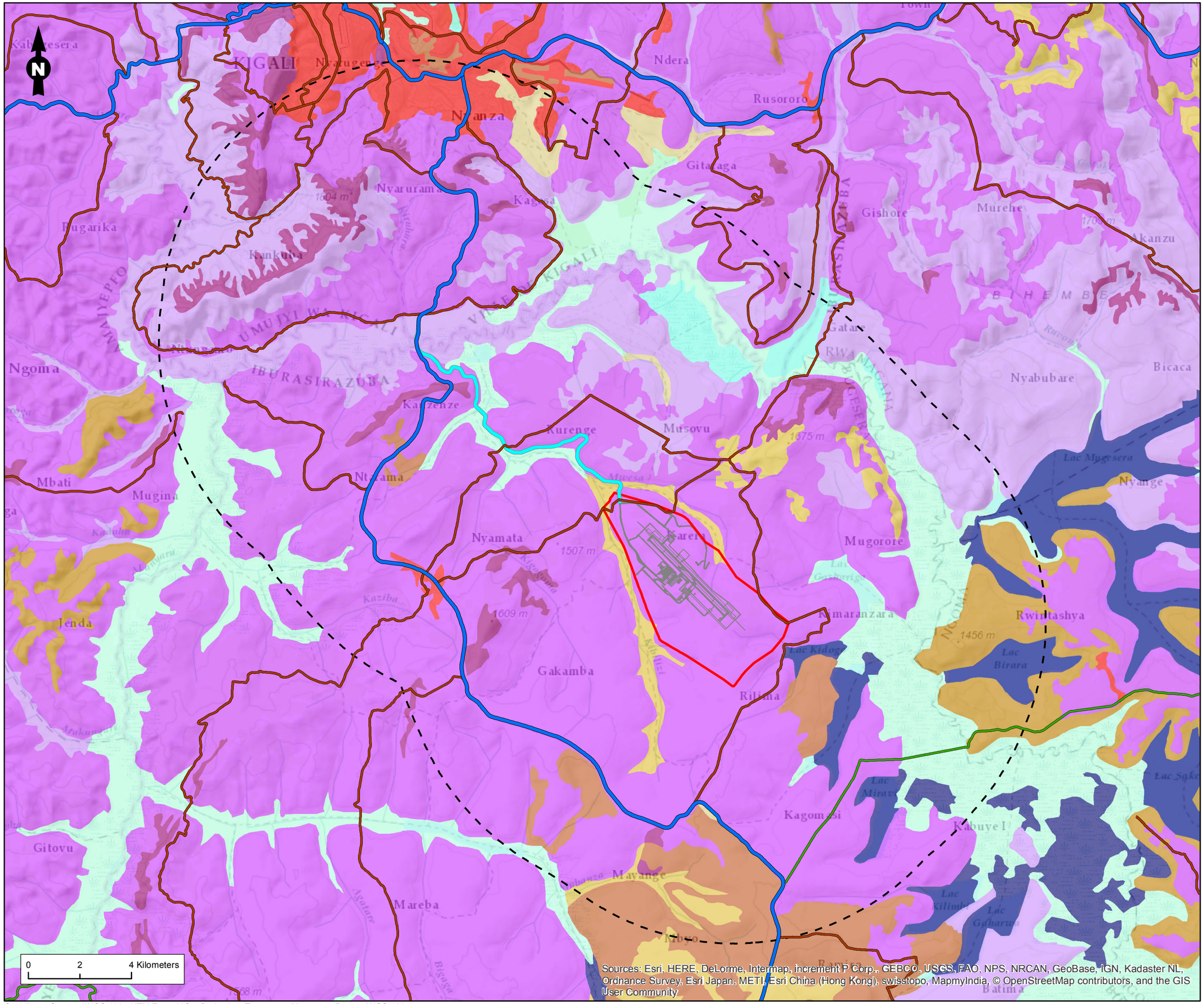

Coordinate System: WGS 1984 UTM Zone 36S. Projection: Transverse Mercator. Datum: WGS 1984.

Legend

- Airport Site Boundary
- Expressway
- Site Boundary and Expressway 10km Buffer
- National Road Paved
- National Road Unpaved
- District road class 1

Landcover

- Forest plantations and tree plantations
- Shrub crop
- Herbaceous crops
- Shrubland
- Tree savannah
- Shrub savannah
- Grassland
- Shrubs on flooded land
- Herbaceous vegetation on flooded land
- Artificial surfaces
- Water bodies

Food and Agriculture Organization of the United Nations. FAO GEONETWORK. Aggregated landcover database for Rwanda (Africover) for tsetse habitat mapping (GeoLayer). (Latest update: 04 Jun 2015) Accessed (28 Jun 2017). URI: http://data.fao.org/ref/88ffbea0-1e49-11dc-abdf-000d939bc5d8.html?version=1.0

Figure Title

Fig 15.2: Land Use

Project Name

New Bugesera International Airport ESIA

Project Number	Figure No.
UK11-24483	15.2
Date	**Prepared By**
September 2017	CO/AC
Scale	**Issue**
1:140,000 @A3	1

Client **Bugesera Airport Company Limited**

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