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CNOOC UGANDA LIMITED

Visual Impact Assessment Report for the Proposed Kingfisher Development

Submitted to:
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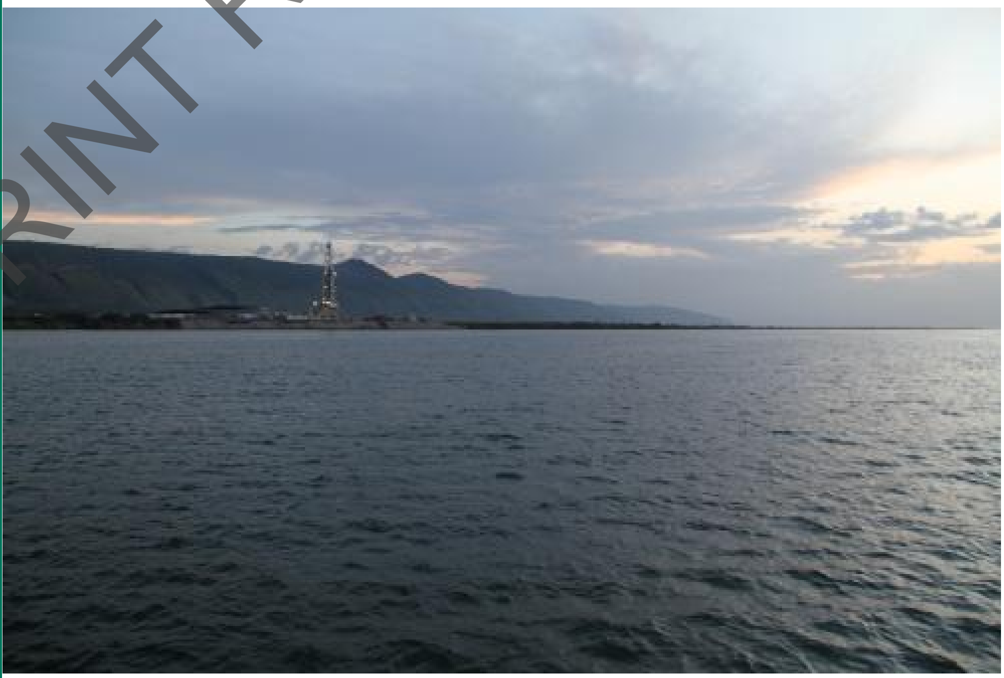

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List of Acronyms

Acronym	Explanation
CNOOC	China National Offshore Oil Corporation
CPF	Central Processing Facility
DRC	Democratic Republic of the Congo
ESIA	Environmental and Social Impact Assessment
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment

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1.0 INTRODUCTION

CNOOC Uganda Limited ("CNOOC") is developing the Kingfisher field Development on the eastern shore of Lake Albert, in the Hoima District of Uganda. In accordance with Ugandan law, it is necessary for CNOOC to determine the potential environmental and social impacts of the project and to demonstrate how these will be mitigated and managed. Golder Associates (Golder) was appointed to conduct the required Environmental and Social Impact Assessment (ESIA) for the proposed CNOOC Kingfisher project for this purpose. This report presents the aesthetics baseline and visual impact assessment ("VIA") for the proposed project.

This VIA report separately assesses the main components of the project, namely:

- Production facility, which will be located on the Buhuka Flats along the eastern escarpment of Lake Albert. The facility will consist of the central processing facility (CPF) and four well pads which will be drilled consecutively, as well as a permanent worker camp and other supporting infrastructure; and
- Feeder pipeline, which will connect the production facility with a proposed refinery to be located at Kabaale, 46.2 km to the north east.

This report is structured in the following main sections:

<u>Section 1 – Project context:</u>

- Introduction;
- Terms of reference;
- Project summary;
- Visual baseline assessment methodology; and
- Assumptions and limitations

<u>Section 2 – Main production facility:</u>

- Study area;
- Baseline visual resource value assessment; and
- Visual impact assessment.

<u>Section 3 – Pipeline corridor:</u>

- Study area;
- Baseline visual resource value assessment; and
- Visual impact assessment.

<u>Section 4 – Conclusion:</u>

- Summary;
- Recommendations and way forward; and
- References.

2.0 TERMS OF REFERENCE

The terms of reference for this VIA are listed below:

- Assess the baseline conditions and perceived aesthetic resource value of the visual context within which the CNOOC project will be located;
- Establish what visual impacts may potentially arise as a result of the project, should it proceed;

- Determine what visual receptor groups may potentially be affected by the project, and the likely perceived significance of the visual impacts caused; and;
- Investigate possible methods by which the potential impacts may be mitigated or reversed, where feasible.

3.0 PROJECT SUMMARY

3.1 CPF, wells flowlines and associated infrastructure

Wells, The Kingfisher development is an upstream project comprising wells, flow lines, central processing facility (CPF) and associated infrastructure and an oil product line, the feeder pipeline, to distribute oil to the tie in point with the export pipeline at Kabaale. This infrastructure is summarised in more detail below.

The wells, flowlines, central processing facility (CPF) and supporting infrastructure are situated on the Buhuka Flats in the Kingfisher Development Area (KFDA), on the south-eastern shores of Lake Albert. The project entails the drilling of wells from four onshore well pads, namely Pad 1, Pad 2, and Pad 3 (where exploration wells have already been drilled) together with Pad 4A (where no drilling has yet taken place). A total of 31 wells are planned to be drilled and commissioned as part of the development, 20 of which will be production wells and 11 to be used as water reinjection wells.

The produced well fluids will be conveyed to the CPF through buried infield flow lines connecting each well pad to the CPF. Well fluids will be separated at the CPF to yield produced water, sand, salts and associated gas (together with small quantities of other material) and crude oil of a quality that will meet the crude oil export standard. At the CPF the associated gas will be utilised for production of power or LPG for local market. Power will serve the requirements of the Kingfisher development but in later years is likely to be in excess of project requirements and will be exported to the national grid. No gas flaring is contemplated except in cases of emergency.

Supporting infrastructure associated with the production facility will include in-field access roads and flowlines, a jetty, and a water abstraction station on Lake Albert, a permanent camp, a material yard (or 'supply base'), and a safety check station at the top of the escarpment. (Figure 1).

3.2 Feeder pipeline

A feeder pipeline exits from the CPF and extends to the north running from the CPF storage tanks to a delivery point near Kabaale. The feeder pipeline exits the CPF on the east side, running almost due north to the base of the escarpment, where the alignment turns to the East climbing the escarpment. The average gradient in this section of the route is 1:3 (Vertical: Horizontal), rising from roughly 650 to 1040 mamsl. within a horizontal distance of 740 m. From the point at which the feeder pipeline crests the escarpment, the pipeline route runs to the north-east through gently undulating terrain that is extensively cultivated. This landscape includes a number of rural settlements. The route passes south-east of Hohwa and Kaseeta villages and passes immediately north of the planned Kabaale Airport, turning eastward to the terminal point at the proposed Kabaale Refinery. The total length of the pipeline is 46.2 km.

At Kabaale, the Government of Uganda is planning an industrial park which, among other facilities, will include a refinery, associated petrochemical processing plants, an international airport and related supporting infrastructure.

At the delivery point, there will be metering of the crude oil, which will be piped either to the industrial park to feed the refinery and associated petrochemical industry or exported through the East African Crude Oil Pipeline (EACOP), planned from Kabaale to the Tanga sea port in Tanzania. The EACOP will be a public - private partnership between the governments of Uganda, Tanzania and oil company(s).

The Feeder Pipeline ends at the delivery point in Kabaale. The industrial park and the EACOP are independent projects that do not feature further in the FD-ESMP (Figure 2).

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Figure 1: Project infrastructure to be developed on the Buhuka Flats

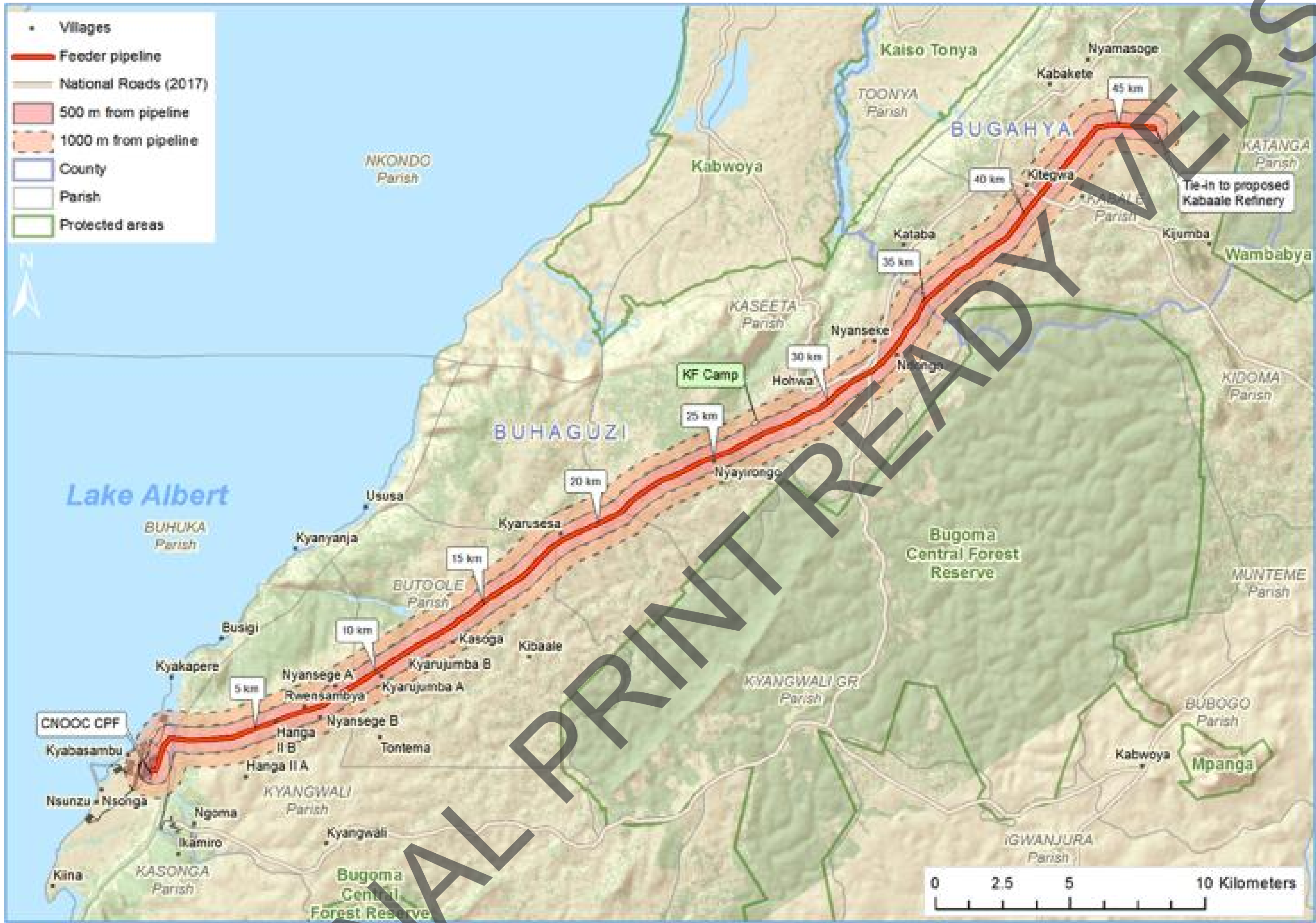


Figure 2: Project site location and feeder pipeline route

4.0 VISUAL BASELINE ASSESSMENT METHODOLOGY

4.1 Assessment methodology

- This VIA specialist study was conducted following a series of consecutive steps discussed below and illustrated by Figure 3:
- **Step one:** determining the intensity of the impact, which is a function of the visual resource value of the study area and a number of industry-standard visual assessment criteria, i.e. visibility, visual intrusion and visual exposure. This was done as follows:
  - Describing the baseline landscape visual character of the project study area based on the findings of the scoping phase site visit conducted on the 3rd and 4th of December 2014, as well as a review of available aerial photography and topographical maps, in terms of:
    - Overall topographical character and specific landform features;
    - Water bodies and features as well as drainage lines and patterns;
    - Overall vegetation cover and specific vegetation communities;
    - Visual absorption capacity of the landscape; and
    - Sense of place of the landscape, as a function of the relationship between the afore-mentioned aspects and human activity in the study area.
  - Determining the visual resource value of the landscape, based on the above visual characteristics;
  - Conducting an assessment of the likely visual impacts of the project, using recognised visual assessment criteria namely:
    - Theoretical visibility;
    - Visual intrusion; and
    - Visual exposure.
  - Determining the impact intensity, by considering the results of the above visual impact assessment in terms of the landscape visual resource value;
- **Step two:** evaluating the impact magnitude, in terms of the following standard impact assessment criteria:
  - Direction of the impact (whether the impact is positive or negative);
  - Geographic extent of the impact (over how large an area will the impact likely be experienced by receptors, which in the context of visual assessment comprises different people groups);
  - Duration of the impact (how long will it last for); and
  - Reversibility (whether there will be any lasting effect on receptors once the sources of visual impact is removed).
- **Step three:** determining the perceived significance of the visual impact, by assessing the degree of sensitivity of the receptors together with the magnitude of the impact caused; and
- **Step four:** Identifying potential mitigation measures to reduce or the magnitude of the visual impacts, where feasible.

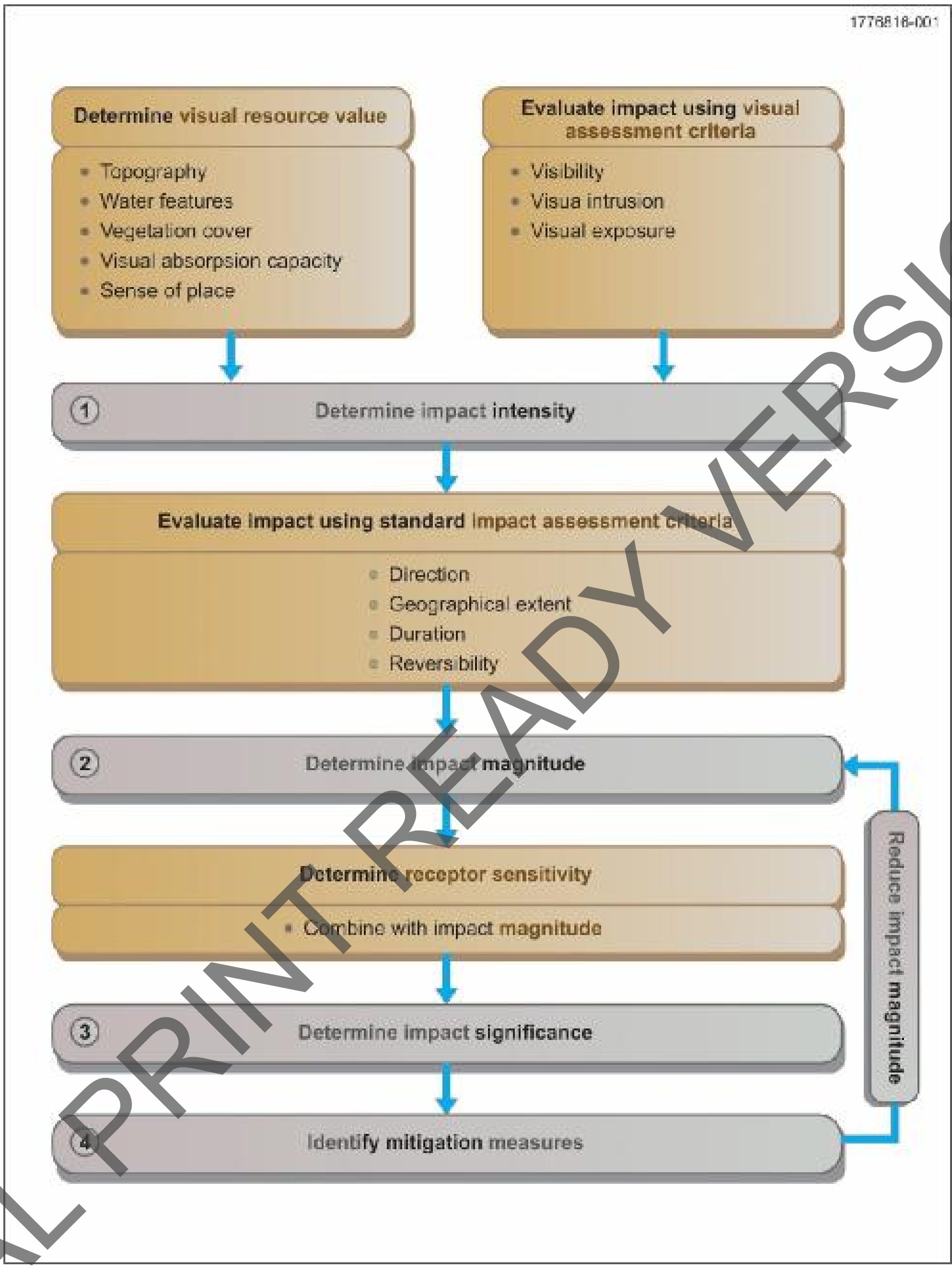


Figure 3: Visual impact assessment methodology

4.2 Assumptions and qualifications

The following assumptions and qualifications are relevant to the process followed, as well as findings of this VIA:

- Determining the value, quality and significance of a visual resource, or the significance of the impact that an activity may have on it, in absolute terms, is not achievable. The value of a visual resource is partly determined by the receptor or viewer, and therefore influenced by a person's personal preferences as well as fluctuating factors such as emotional mood. Changes in conditions such as weather patterns, time of day and the season during which the landscape is viewed can also dramatically alter its appearance, and perceived resultant appeal;

- It is furthermore acknowledged that different cultures attach diverse values to the landscape, and that different aesthetic considerations may therefore also apply to different people groups. Individual or constituent elements of the landscape may be of specific importance to certain people groups, which may not be obvious to others;
- For these reasons, visual impact cannot be measured by empirical standards only, as is for instance the case with water, noise or air pollution. It is therefore impossible to conduct a visual assessment without also relying on the expert professional opinion of a qualified consultant, who is by nature biased and therefore to some extent subjective. However, a large body of scientific knowledge exists on the field of visual assessment, which were applied in conducting this study. The opinion of the visual consultant is unlikely to materially influence the findings and recommendations of the study, and is therefore not expected to marginalise specific socio-cultural or religious value systems;
- This VIA assessed the visual resource value of the study area as a single entity, even though discreet attributes of the landscape character were considered. This was done because of the very strong "sense of place" that this particular landscape possesses, which is as much a function of the relationship between the various landscape character elements, as it is of the individual constituent attributes themselves. This is an important point, as the implication is that changes to any one landscape character attribute will have an impact on the entire visual study area. Visual impacts in such a context can therefore not easily be "isolated", in order to mitigate them;
- The potential visual impacts of the proposed project has been assessed from an anthropocentric point of view only, as evaluating the potential impact on other biota was not part of the scope of work for this VIA. However, it is expected that the ecological impact of specifically light pollution at night will be significant, as aquatic animals in Lake Albert as well as insects that use moonlight for navigation will be negatively impacted by the development;
- The viewshed analysis was conducted using the latest available project development layout plans, as well as heights for the various project components as provided by the client. However three-dimensional models for the various infrastructure components were not available, and were therefore conceptually generated by Golder for graphic representations purposes;
- The following CPF infrastructure heights as provided by client were used when generating the various viewshed analyses and graphic representations:
  - Flare stack – 28 m;
  - Production treatment towers – 20 m;
  - Oil tank storage – 18 and 15 m respectively;
  - Respective other buildings and structures ranging from 8 m to 15 m in height; and
  - The existing drill rig, of which the height was estimated at approximately 60 m, using photos taken during the site visit.
- Certain photographs have been digitally "stitched" together or alternatively cropped to illustrate certain concepts, and may not represent a "natural" view or perspective as viewed by the human eye;
- The findings of this report are considered to be indicative of the nature and magnitude of the potential project visual impacts only, due to the preliminary nature of the available layout and design drawings. Certain findings of this VIA including proposed mitigation measures may therefore need to be reviewed and updated, when final site layout drawings have been produced and/or actual project implementation commences; and
- The quality of especially the night-time photos and graphic simulations are significantly reduced when printed, or during low-resolution conversion of the original MS Office Word file to .pdf or other formats. It is therefore recommended that the report be viewed in its original Word format, or that the photos and graphic simulations be printed at a high resolution on photo quality paper.

5.0 CPF, WELLS AND ASSOCIATED INFRASTRUCTURE

5.1 Study area

The proposed development has the potential result in visual impact through introduction of project infrastructure in largely undeveloped areas, causing the existing landscape to be altered. In addition. For the purposes of this VIA, the project study area is therefore defined as the spatial footprint of the infrastructure and related landscape alterations, as well as an associated zone of influence from which these elements and changes may be visible. Two project study areas were identified, namely that of the main production facility area which is described below, and that of the feeder pipeline which is described in Section 3 of the report.

The minimum study area for the production plant area was defined as a 10 km radius around the physical footprint of the Kingfisher production site infrastructure illustrated on Figure 1. The distance of 10 km was selected based on the assumption that most daytime visual impacts regardless of their nature or extent, will be relatively inconspicuous beyond this range as the human eye can no longer distinguish significant detail over this distance. Exceptions in this regard are only where very large structures such as power stations or large wind turbines, are erected in rural or undeveloped areas. Furthermore, visual impacts may also extend well beyond this distance in certain landscapes, such as in very flat areas or where viewed from elevated locations.

Light pollution is particularly significant at night and can extend over significant distances, as most of the visual detail that may camouflage a visual impact by day is not present/visible at night. A cursory overview of various online sources dealing with astronomy and star gazing indicate that relatively small towns may cause light pollution beyond a range of 20 miles / 30 km. The visual impact is caused both as a result of direct glare and indirect sky glow caused by the lights. Given the fact that there are almost no bright lights within the existing study area aside from the existing project pilot infrastructure, it is expected that the CPF and well rig will likely be visible from the opposite (western) shore of Lake Albert, in the Democratic Republic of the Congo (DRC).

5.2 Baseline visual resource assessment

5.2.1 Landscape visual character

It is necessary to first determine the visual resource value of a landscape, in order to assess what the actual perceived visual impact of a proposed project on that landscape may be. Visual resource value refers to the perceived aesthetic quality of individual aspects of an environment, as well as the relationships between these elements and how they appeal to our senses. The visual resource value of the landscape is therefore assessed by considering both the natural (physical and biological) and human-made (land use) attributes within a given study area.

Studies in perceptual psychology have shown that in a broad sense, humans have an affinity for landscapes with a higher visual complexity, than for homogeneous ones (NLA, 2004). Furthermore, based on research in human visual preference (Crawford, 1994), landscape visual quality is a function of the following landscape attributes, which were assigned score values for the purposes of this VIA:

- The general topographical character of the study area including prominent landforms, and the spatial orientation of these in terms of the project site. Landscapes with prominent and varied topography and/or interesting geological landmarks and features are considered to have high visual resource value (rated 3), whereas landscapes with rolling and relatively featureless topography have lower visual resource values (rated 1 to 2, depending on the context);

- The nature, physical extent and appearance of water bodies such as lakes, dams, rivers, pans or wetlands within the study area. Large expanses of open water, prominent watercourses or interesting features such as waterfalls typically have a high visual resource value (rated 3), whereas less prominent hydrological features such as wetlands, ephemeral pans or smaller streams have a moderate visual resource value (rated 2). In landscapes where few to no hydrological features are present, this aspect is rated as low (1);

- The nature of the vegetation cover within the study area in terms of its density, height, visual diversity and level of disturbance. Landscapes characterised by prominent natural vegetation with relatively high levels of visual diversity such as forests, woodlands and expansive blooming fields are rated as having high visual resource value (3). Vegetation cover that is not particularly prominent or visually diverse such as grasslands, artificial woodlots or croplands are rated as moderate (2). In landscapes where the natural vegetation cover has been largely displaced by invaders or removed, this aspect is rated as being of low visual resource value (1). It is however important to realise that context also plays a significant and somewhat subjective role in this regard, as a lack of vegetation cover can in some instances still result in visually appealing conditions, such as desert landscapes;
- The level of visual absorption capacity (VAC) of the existing landscape, which is the ability of the landscape to accommodate alterations without a significant negative impact or reduction in the visual resource value of the landscape. Landscapes that are characterised by very low VAC are rated as sensitive or high (3) in this regard, as they will be most severely impacted by any new development. Landscapes that will likely be only moderately impacted due to some pre-existing development and/or visual complexity, are rated as moderate (2). Conversely, landscapes that are unlikely to be materially impacted by new or further development are rated as low (1); and
- The perceived sense of place of the landscape, or the degree of visual uniqueness or distinctiveness of the landscape and the cultural and spiritual significance that different people groups attach to it. Landscapes that have a very strongly defined visual character, or with high levels of cultural or spiritual significance attached to them by certain population groups, are rated as high (3). Similarly, national or international landmarks are also considered as having a strongly defined sense of place, as they are usually unique and highly recognisable, and therefore irreplaceable. Conversely, landscapes in which the pre-existing natural attributes have been largely displaced by visually incoherent and intrusive elements and that are not associated with any specific group of people would be considered to have little, or alternatively a negative sense of place, and would be rated low (1). This aspect is obviously subject to a significant degree of personal interpretation and may be highly context-specific, as significantly transformed or built-up landscapes may still have a strongly defined positive sense of place, as would for instance be the case with cultural-historic monuments, or highly scenic towns and cities.

When assessing the value of a landscape as a visual resource, it is also necessary to consider the landscape in terms of the broader context in which it is located. Although a specific landscape may objectively be considered to be less scenically appealing than other similar but far-off landscapes, it may still be considered significant in terms of the local visual context within which it is located. In this way, what may be commonplace when placed in another visual context, may be special or exceptional when viewed within its present setting.

The baseline assessment and resultant resource determination was conducted based on a dedicated photographic assessment of the study area carried out by the Golder VIA specialist on 3 and 4 December 2014, as well as using photographs that were taken by other specialists during 2014. Available Google Earth satellite imagery from 2013 and 2016 as well as recent high-resolution aerial imagery dated were also used as reference. The existing visual baseline is summarised in terms of the individual attributes listed above, followed by an assessment of the resultant visual resource value.

5.2.1.1 Topography

The main production facility area is characterised by two distinct topographical zones, namely:

- The high escarpment which encircles most of Lake Albert, which is vertically prominent; and
- The narrow peninsula on which the production facility site is located and the adjacent Lake Albert, which are both horizontally dominant.

The stark juxtaposition between the prominent, linear relief of the escarpment and the vast, near-flat surface formed by the peninsula and adjacent water body is largely responsible for the strongly unique visual character of the study area. The visual contrast and sense of enclosure is also emphasised by the encircling escarpment mountains on the other side of Lake Albert in the DRC, which are visible from the site under clear conditions.

These unique attributes together form one inseparable visual context, with the result that altering either landscape attribute fundamentally impacts on the visual landscape as a whole. This effect is illustrated by the third photograph in Figure 4 below, which shows the profound impact of the access road excavations and single drilling rig on the visual landscape as a whole.

Vertically dominant escarpment cliffs and hills encircling Lake Albert

Horizontally dominant peninsula on which the main project site is located

The strong juxtaposition between the linear escarpment mountains and flat peninsula forms the most prominent visual attribute of the study area

Figure 4: Topographical character of the main project study area

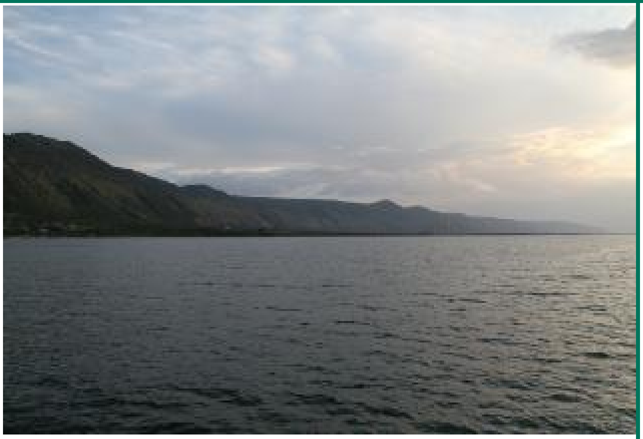
Based on the above summary, the contribution of the study area topography in terms of its overall visual resource value is rated as **high (3)**.

5.2.1.2 Water bodies

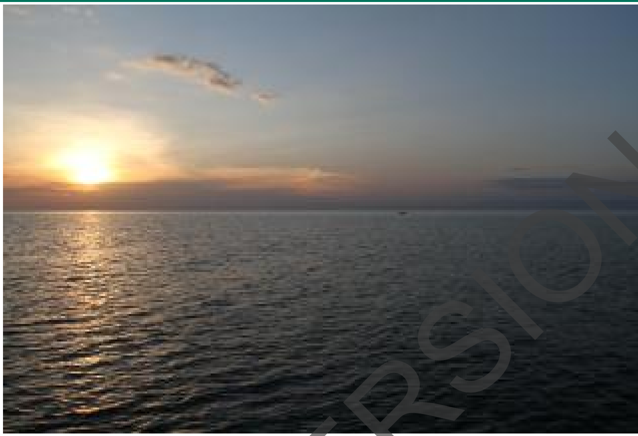
Lake Albert constitutes the entire eastern half of the project study area, whilst the visual range of the western half of the study area is largely truncated by the high escarpment. For this reason, the lake is considered the single-most prominent visual element in terms of this VIA. In addition to being responsible for what would universally be considered as beautiful scenery, the lake is also central to the regional biological diversity and forms an integral component of the livelihoods of the local villagers. Lake Albert as one of the East African Rift Valley lakes is also bisected by the national border between Uganda and the DRC; and as such is an internationally recognised landmark.

Aside from Lake Albert itself, a small reed-lined estuary pool is located on the lake's edge in the northern part of the peninsula, and a shallow watercourse fringed by wetlands bisects the southern half of the peninsula. However, these features are only prominent when viewed from elevated vantage points or from close up. Furthermore, the escarpment face is deeply grooved by many non-perineal drainage lines characterised by denser vegetation cover, and that only convey runoff after rainfall events.

These aspects are illustrated by Figure 5 below.



Lake Albert constitutes the entire eastern half of the project study area



The lake is central to the visual character of the study area and responsible for highly appealing scenery

The lake is a determining factor in terms of regional biodiversity

The majority of the local residents are dependent on the lake for their livelihood

Small reed-lined estuary pool located on the lake's edge in the northern part of the peninsula

Grooved escarpment face, with non-perineal drainage lines characterised by denser vegetation cover

Lake Albert is an internationally recognised landmark, and has a strongly identifiable visual character and sense of visual appeal

Figure 5: Hydrological characteristics of the main project study area

Based on the above summary, the contribution of water bodies and specifically Lake Albert to the visual resource value of the overall project study area, is rated as **high (3)**.

5.2.1.3 Vegetation cover

The region is characterised by a variety of vegetation types, however the majority of the narrow peninsula is dominated by low grasses and scrubland, allowing for uninterrupted long range views. The result is that the attention of viewers is rather focussed on the various other visual attributes of the study area. The escarpment and plateau are typically characterised by more dense vegetation with a far greater percentage of shrubs and small trees, especially within the drainage lines. However, this vegetation is not considered to be a dominant visual aspect of the study area itself, as it effectively becomes the colour and texture of the far more prominent escarpment. The visual appeal of the vegetation therefore lies mostly in the detail of individual plants or groups, rather than as a distinct characteristic attribute of the study area.

In this regard, the escarpment access road excavations and earthworks are considered to be highly intrusive, due to the contrasting spoil rock heaps and its strongly diagonal alignment across the face of the escarpment. On a local scale, the natural vegetation cover is also being threatened by the presence of a number of invasive alien plant species. These infestations are more common in the vicinity of the various villages, as well as areas where prolonged grazing takes place. In these areas, the otherwise visually coherent appearance of the natural vegetation cover has been clearly disrupted by the intruding plant species.

The vegetation cover of the main study area is illustrated by Figure 6 below.

Although the local flora contributes to the overall scenic quality of the area, the vegetation cover is not visually dominant and much of the appeal therefore rather lies in specific details. Based on the above summary, the contribution of the vegetation cover to the visual resource value of the overall project study area is rated as **moderate (2)**.

The dominant grassland conditions found on the peninsula generally allow for long range views

Invasive alien plant species threaten the visual character of the study area, especially near the villages

The appeal of the local flora mainly lies in detail aspects, rather than as a distinct visual attribute of the study area

The loss of vegetation cover, as well as contrasting colours and textures of the access road excavations along the escarpment is visually intrusive

Figure 6: Vegetation cover attributes of the production site study area

5.2.1.4 Visual absorption capacity

The perceived significance of a visual impact is at least partly dependent on the degree to which the existing landscape can accommodate alterations, without resulting in a significant alteration in the overall visual appearance and character of the landscape. This aspect is referred to as its visual absorption capacity

(VAC), and can be defined as an "*estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality*" (Oberholzer, 2005).

The ability of a landscape to absorb development or additional human intervention is therefore primarily a function of the topography, dominant vegetation cover, and nature and prevalence of pre-existing human structures in that landscape. A further major factor is the degree of visual contrast between a proposed new project, and that of the existing elements in the landscape. If, for example, a visually prominent industrial complex already exists in an area, the capacity of that landscape to visually "absorb" additional industrial development is higher than that of a landscape dominated for instance by low density rural development.

The northern, southern and especially western quadrants of the study area are characterised by very long range views, as a result of the lack of prominent screening topography, tall and dense vegetation or existing development. The notable exception in this regard is the tall escarpment, which significantly truncates the range of views to the east. The overall colour palette of the landscape is relatively narrow if highly diversified, ranging from various greens, tans and ochres to darker browns and greys. Especially the surface of the lake forms a very uniform visual backdrop, ranging from greyish to greenish blues and other hues, depending on the time of day and atmospheric conditions. These visual attributes all result in a landscape that has a low overall VAC, as any horizontally expansive, tall or more brightly coloured infrastructure will be very prominent and therefore visually intrusive.

The night-time landscape is characterised by a lack of almost any artificial illumination, save for small pinpricks of lights associated with the villages and those of isolated telecommunications towers situated on the highest hills on the escarpment. The frequent cloud cover means that the night-sky is often also partially or completely obscured, further reducing the light levels at night. These factors result in a night-time landscape with a very low VAC, as illustrated by the last two photographs of Figure 7.

Based on the above summary, the visual absorption capacity of the overall project study area is rated as being **low (3)**.

5.2.1.5 Sense of place

According to Lynch (1992), in the built or anthropocentric landscape sense of place is "*the extent to which a person can recognise or recall a place as being distinct from other places, as having a vivid or unique, or at least particular character of its own*". From an anthropology perspective, Low (1992) defines sense of place (or "place attachment") as "*the symbolic relationship formed by people giving culturally shared emotional/affective meanings to a particular space of piece of land that provides the basis for the individual's and group's understanding of and relation to the environment.... Thus, place attachment is more than an emotional and cognitive experience, and includes cultural beliefs and practices that link people to place.*"

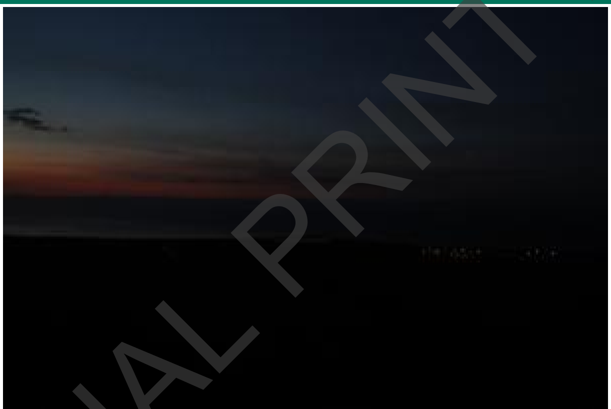
Thus, sense of place means that a site has a uniqueness or distinctiveness, which distinguishes it from other places. The primary informant of these qualities is the spatial form and character of the natural landscape, together with any cultural transformation associated with historic use and habitation. A landscape can therefore be said to have a strong sense of place, regardless of whether it is predominantly natural or manmade.

Furthermore, in certain instances it is possible for a manmade landscape to have a distinct and definable negative sense of place, such as very large industrial operations or desolated development sites. This criteria is arguably the most ambiguous in the field of visual assessment, as it is largely open to the interpretation of the individual and may vary widely based on any number of factors. However generally speaking, in instances where high landscape visual quality and strong sense of place coincides, the visual resource value is considered to be high.

Prior to the establishment of the pilot project infrastructure the peninsula was therefore exclusively characterised by low intensity rural land uses, with the local population being intrinsically tied with the natural landscape.


The study area is mostly characterised by long range views, and a relatively narrow range of natural colours. Expansive landscape alterations (left) or the inclusion of more brightly coloured objects such as building roofs are therefore very visible, even over considerable distances (right)


The low horizon line of much of the study area (left) means that any vertically prominent structures that protrude above it such as the existing drill rig, are highly prominent (right)




The existing landscape is characterised by very low levels of development and almost no artificial night-time illumination (left). The very low ability of this landscape to absorb impact at night is illustrated by the existing contractor camp and especially drill rig (right), which are clearly visible over a distance of more than 3 km.

Figure 7: The study area is characterised by low levels of visual absorption capacity

The peninsula is sparsely inhabited, with the local inhabitants living in a number of small villages spaced along the lake shoreline. The livelihoods of the local population is sustained by fishing, as well as subsistence and small-scale commercial cattle ranching, with craft-based trades also being significant. These elements all form part of the visual identity and character of the study area, and result in a distinctly rural aesthetic. The study area is also characterised by numerous sites and features of strong cultural and spiritual significance, several of these to the extent that their locations are being kept confidential in terms of the ESIA process (Golder, 2017).

By contrast, the tall well pad 2 pilot drill rig forms a prominent vertical and visually contrasting landmark in the landscape. Other components of the pilot infrastructure are less prominent, but still form strongly linear visual pathways through the landscape, especially the airfield and access road excavations.

The pre-development study area possesses a sense of timelessness, largely owing to the centuries-old, subsistence-based rural lifestyle of the local people. This attribute is heightened by the dramatic and unique visual context within which the site is located. By contrast, the existing well pad 2 infrastructure, site camp and access road excavations are considered to be visually intrusive, and in visual conflict with the pre-existing sense of place. A number of land use examples within the study area are illustrated by Figure 8.

The pre-existing land uses within the study area are mainly subsistence fishing (left) and small-scale agriculture including cattle ranching (right)

The visual character of the pre-existing manmade elements in the study area retain a distinctly rural aesthetic

The existing well pad 2 rig forms a prominent vertical landmark that contrasts with the study area sense of place

Linear infrastructure form disruptive visual pathways through the landscape

Figure 8: Land use within the main project study area

A further aspect of the visual baseline that needs to be considered is that of atmospheric conditions, as this factor can greatly influence how a landscape is perceived by viewers, as well as the distance over which views are possible. Low cloud and high atmospheric humidity frequently reduces visibility in the region and limits views to medium range distances. Dense fog makes longer range views impossible even from elevated locations, while clear conditions enable views over great distances from the same elevated positions. Partially cloudy conditions often also result in dramatic sunsets that greatly contribute to the appeal and resource value of the landscape.

These aspects are demonstrated in Figure 9 below.

Atmospheric humidity results in hazy conditions which may partially obscure objects over greater distances

Conversely clear conditions enable longer range views

Partial cloud cover may give rise to highly appealing visual conditions

Figure 9: Atmospheric conditions can greatly influence the visual appearance of the landscape and contribute to visual appeal and sense of place

Based on the above summary, the uniqueness and sense of place of the pre-development visual landscape as a whole is considered to be irreplaceable, and is therefore rated as **high (3)**.

5.2.2 Visual resource value assessment

The visual resource value ratings assigned to each of the visual attributes determined in Section 5.2.1 are summarised in Table 1 below.

Table 1: Production facility study area visual resource summary

Visual baseline attribute	Topography	Water bodies	Vegetation	VAC	Sense of place
Visual resource value score	3 (high)	3 (high)	2 (moderate)	3 (low VAC, thus high susceptibility to change)	3 (high)
Total visual resource value score					**14**

The total score was subsequently applied to the criteria summarised in Table 2, in order to determine the visual resource value of the study area.

Table 2: Study area visual resource value determination

Visual resource value score	Criteria
13 – 15 = High visual resource value	Pristine or near-pristine condition / natural areas with little to no visible human intervention visible / characterised by highly scenic or attractive natural features, or cultural heritage sites with high historical or social value and visual appeal / Areas that exhibit a strong positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive to change.
9 – 12 = Moderate visual resource value	Partially transformed or disturbed landscape / human intervention visible but does not dominate view / scenic appeal of landscape partially compromised / noticeable presence of incongruous elements / Areas that exhibit positive character but which may have evidence of degradation / erosion of some features resulting in areas of more mixed character. These landscapes are less important to conserve, but may include certain areas or features worthy of conservation.
5 – 8 = Low visual resource value	Extensively transformed or disturbed landscape / human intervention dominates available views / scenic appeal of landscape greatly compromised / visual prominence of widely disparate or incongruous land uses and activities / Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

From the assessment performed in Section 5.2 and the score ranges presented in the table above, it is concluded that the visual resource value of the production facility study area as a whole is **high.** This assessment is based on the appeal of its respective biophysical and land use characteristics individually, as well as the innate and strongly defined sense of place of the study area as a single entity.

An assessment of the expected visual impacts that would arise as a consequence of the proposed project development was subsequently conducted as described in Section 5.3.

5.3 Visual impact assessment

5.3.1 Project phases and potential visual impacts

For the purposes of this VIA, the project can be divided into four phases, namely:

- Construction Phase - the construction period is deemed to be a secondary impact period that is comparatively short in relation to the operational phase. A number of the expected impacts, such as dust propagation and vehicular movement, will be associated with temporary construction-related activities. However, during this phase the degree of visual impact caused by the project is also expected to steadily increase as construction of the project infrastructure progresses;

- Operational Phase - This phase is deemed to cause the primary visual impact, as the climax of the project activities will take place then. The operational phase will also continue for the longest period of time, which is expected to be approximately 25 years;
- Decommissioning Phase - is deemed as part of mitigation for this project, as these activities will progressively assist in lessening the visual impact. Activities associated with the demolition and subsequent rehabilitation of disturbed areas will have a temporary negative impact, but will assist in returning the site to a condition that more closely resembles the pre-development visual baseline; and
- Long-term Phase – the VIA considers any residual visual impacts that may still be present when all rehabilitation measures have been implemented.

During each of these phases the proposed project will cause a number of physical changes to the visual landscape, all of which are expected to directly impact on the visual resource value of the study area. The key potential visual impacts associated with the project and the respective phases during which they are expected to occur were therefore identified, as indicated in Table 3:

Table 3: Anticipated visual impacts associated with the various project phases

Anticipated visual impact	Project phase			
	Construction	**Operation**	**Decommissioning**	**Long-term**
1) Dust pollution (temporary impact)	yes	no	yes	no
2) Increased activity on site from construction equipment/plant, vehicles, and materials handling (temporary impact)	yes	No/ sporadic	yes	no
3) Alteration of site topography and loss of vegetation cover	yes	yes	yes	likely
4) Introduction of visually intrusive infrastructure/industrial land use – CPF, Drill rig moving to four separate well pads, permanent support infrastructure and escarpment access road	yes	yes	No/ progressively decreases	no
5) Light pollution at night	yes	yes	yes	no
6) Loss of sense of place (resultant impact)	yes	yes	yes	likely

The level of visibility, visual intrusion, and proximity of the production facility to identified receptors was evaluated in Sections 5.3.2.1 to 5.3.2.3 respectively. The levels of visibility and visual exposure was semi-quantitatively determined from a series of viewsheds that were modelled using the site topography and project layout drawings. The visual intrusion of the primary impacts (impacts 3 to 5 in Table 3) was subjectively estimated based on the anticipated appearance of the various project infrastructure components. Loss of sense of place (impact 6) is a consequence of these impacts, and was dealt with as a separate impact during the impact magnitude and significance determination stages.

Furthermore, the short-term or sporadic impacts associated with the construction and decommissioning phases, namely dust propagation and increased vehicular activity (impacts 1 and 2), are secondary impacts of the above primary impacts and were therefore not assessed further. However, mitigation measures to address these impacts were proposed in Section 5.3.6.

5.3.2 Visual impact criteria

5.3.2.1 Level of visibility

The expected level visibility is defined as the sections of the study area from which the proposed project or its constituent elements may be visible. This area was determined by conducting a viewshed analysis and using Geographic Information System (GIS) software with three-dimensional topographical modelling capabilities, including viewshed and line-of-sight analyses (cross-sections).

The basis for the viewshed analysis was a digital elevation model (DEM) and the viewsheds were modelled on the above-mentioned DEM using Global Mapper 15® software. The receptor height was set to 1.5 m and the various infrastructure elements associated with the production facility given heights indicated by the client. In this fashion, the level of visibility based on the results of the viewshed analysis was then rated as shown in Table 4, as a function of how much of the study area is indicated as being visually exposed to the project infrastructure:

Table 4: Level of visibility rating

Level of theoretical visibility of project element	Visibility rating
Less than a quarter of the total project study area	Low
Between a quarter and half of the study area	Moderate
More than half of the study area	High

5.3.2.2 Visual exposure

The visual impact of a development diminishes at an exponential rate as the distance between the observer and the object increases – refer to Figure 10. Relative humidity and fog in the area directly influence the effect. Increased humidity causes the air to appear greyer, diminishing detail. Thus, the impact at 1 000 m would be 25% of the impact as viewed from 500 m. At 2 000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (Hull, R.B and Bishop, I.E, 1998) (Hull, R.B and Bishop, I.E, 1998) and was used as important criteria for this study.

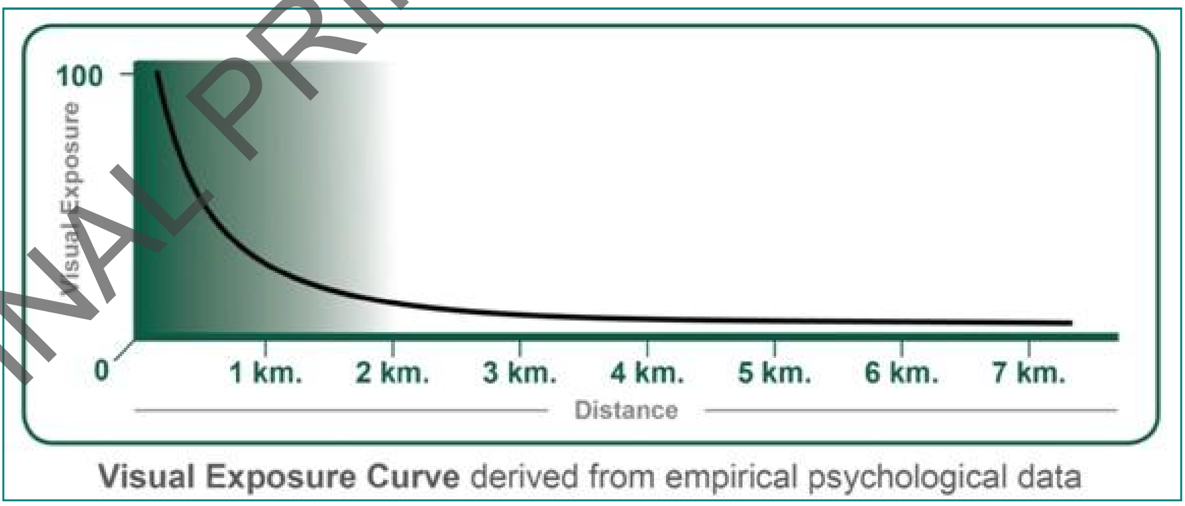


Figure 10: Visual impact vs. visual exposure distance

Thus, visual exposure is an expression of how close receptors are expected to get to the proposed interventions on a regular basis. For the purposes of this assessment, visual exposure is defined as summarised in Table 5:

Table 5: Level of visual exposure

View range/receptor distance from visual impact source	Visual exposure rating
Close-range views / views over a distance of 500 m or less	Low
Medium-range views / views of 500 m to 2 km	Moderate
Long-range views / views over distances greater than 2 km	High

Two sets of viewsheds were generated, namely receptor- and impactor-based. The first set considers the project infrastructure from the perspective or vantage point of potential visual receptors (such as local villages or roads within the study area). Representative locations within the study area were identified for this purpose, to develop an understanding of how exposed these receptors may be to the impact.

The second set is generated from the source of the visual impact itself, in this case the production facility infrastructure, to develop an understanding of the spatial extent and distribution of the visual impact within the study area. The impactor-based viewsheds can also be used to develop an understanding of the potential extent of exposure to light at night. However as previously mentioned, the visible impact of brightly lit structures at night may extend much further than the level of visibility of same infrastructure during the day, due to the heightened contrast between the light source and black background.

Together these viewsheds form a picture of the expected level of visibility and therefore spatial extent of the visual impact associated with the project, as well as how identified receptors may be impacted by it. Furthermore, this information is used later on to identify appropriate visual mitigation measures to the visual impacts, where possible. The results of the above viewsheds are briefly summarised below.

5.3.2.2.1 Receptor-based viewsheds

- Kyakapere, located in the northern part of the study area (Figure 11): From this position the majority of the project infrastructure will likely be obscured or only partially visible, however exposure to well pad 4 will be high as it is located within 500 m of this location. The level of visibility of the project site as a whole from this position will therefore be low, however the degree of visual exposure will be high.
- Kyabasambu, located near the centre of the study area (Figure 12): From here almost the entire production complex will be visible, as well as well pads 1, 2 and 4. Well pad 2, a section of the CPF as well as some of the support infrastructure will also be within 500 m of this location. The level of visibility and degree of visual exposure from this position will therefore be high.
- Nsonga north, located just south of the study area centre (Figure 13): Parts of the CPF and also supporting infrastructure will be visible from this location, as well as well pad 1. However all of the project infrastructure is located further than 500 m but nearer than 2 km from this location. The level of visibility and degree of visual exposure from this position will therefore be moderate.
- Nsonga south, located in the southern part of the study area (Figure 14): The majority of the production complex infrastructure is hidden from view from this location due to the gently sloping topography in the foreground. However this location is situated directly adjacent to well pad 3. The level of visibility of the project site as a whole from this position will therefore be low, however the degree of visual exposure will be high.

5.3.2.2.2 Impactor-based viewsheds

The range to which the project infrastructure will potentially be visible is significantly restricted to eastward, due to the presence of the high escarpment, which effectively screens the peninsula from view from most of the adjacent, higher-lying plateau. The visual range is at its shortest directly to the east at roughly 1.5 km, and around 4 km to the north and 6 km to the south respectively, with the areas of potential visibility covering the majority of the study area in between.

However, the visibility of the project infrastructure will be totally unobstructed towards the west over Lake Albert, and constitutes an international impact as especially the rig will be visible from the DRC section of the lake, from all 4 well pad locations. As already mentioned, the effect will be significantly more pronounced at night as the bright lights of the CPF and rig will be starkly visible against the near-black backdrop. These viewsheds are illustrated by Figure 15 to Figure 18. From an impactor-based perspective, the level of visibility of the project is therefore considered to be high, as most receptors within the study area will be exposed to aspects of the project to varying extents regardless of where they are located.

Based on the above criteria as well as the results of the viewshed analyses, the overall level of visibility of the production facility infrastructure within the study area is expected to be **high**. The level of visibility of the topographical alterations and loss of vegetation is expected to be **moderate**, as these impacts will occur close to ground level and should therefore more readily be hidden from view.

Furthermore, the level of visual exposure of receptors within the study area to the proposed project infrastructure is also expected to be **high**.

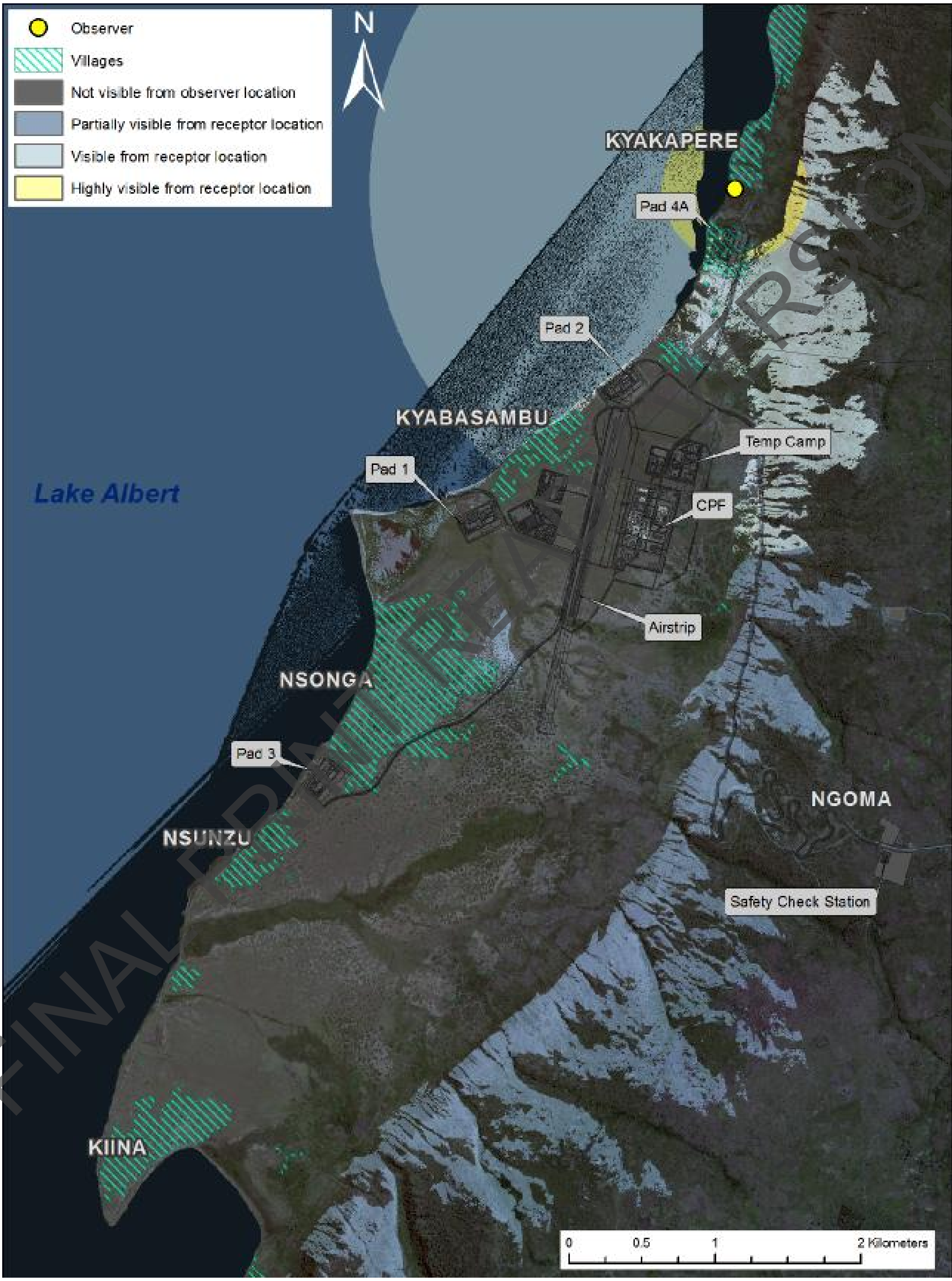


Figure 11: Visibility of project infrastructure from Kyakapere village (receptor-based viewshed)

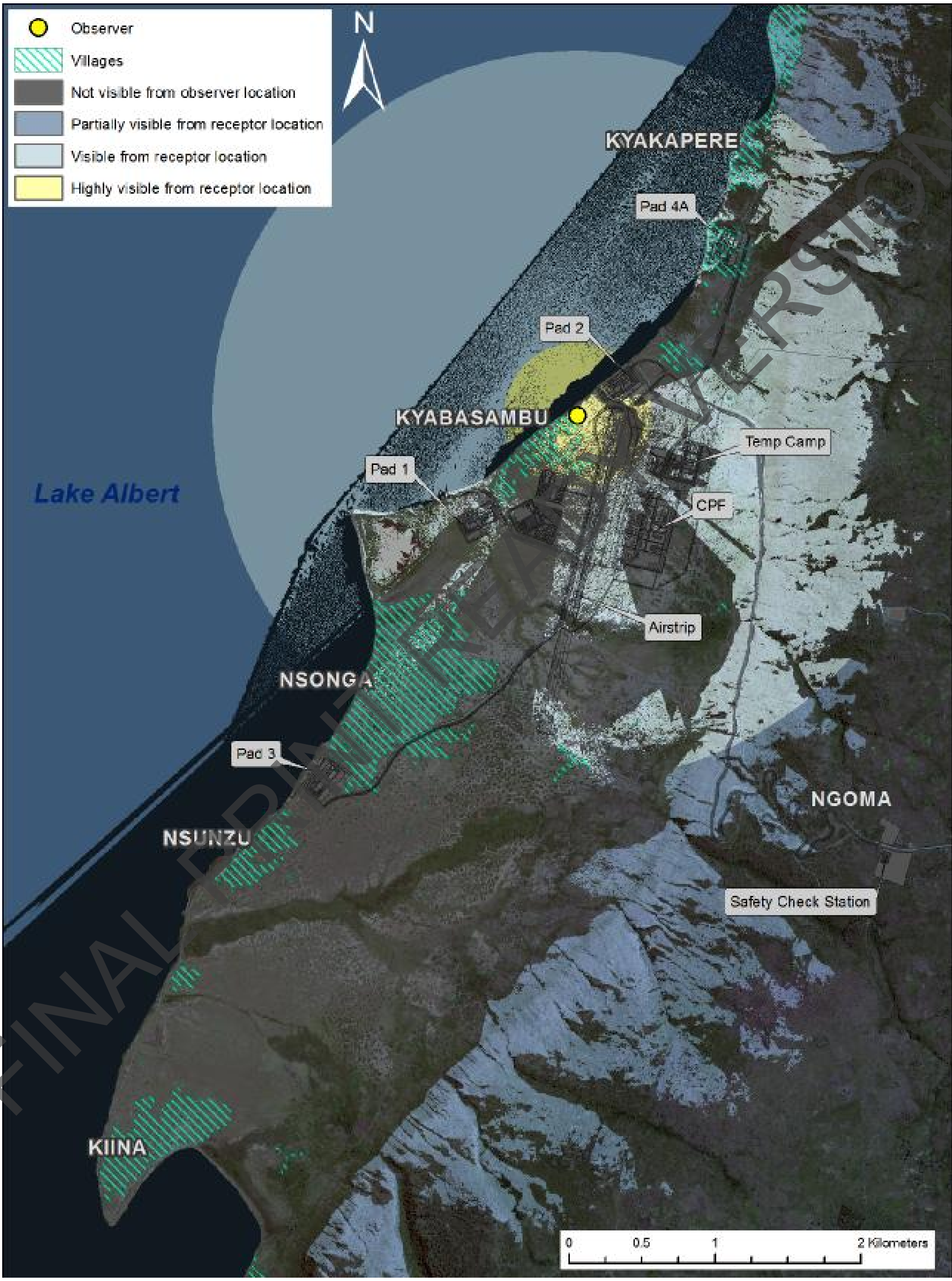


Figure 12: Visibility of project infrastructure from Kyabasambu village (receptor-based viewshed)

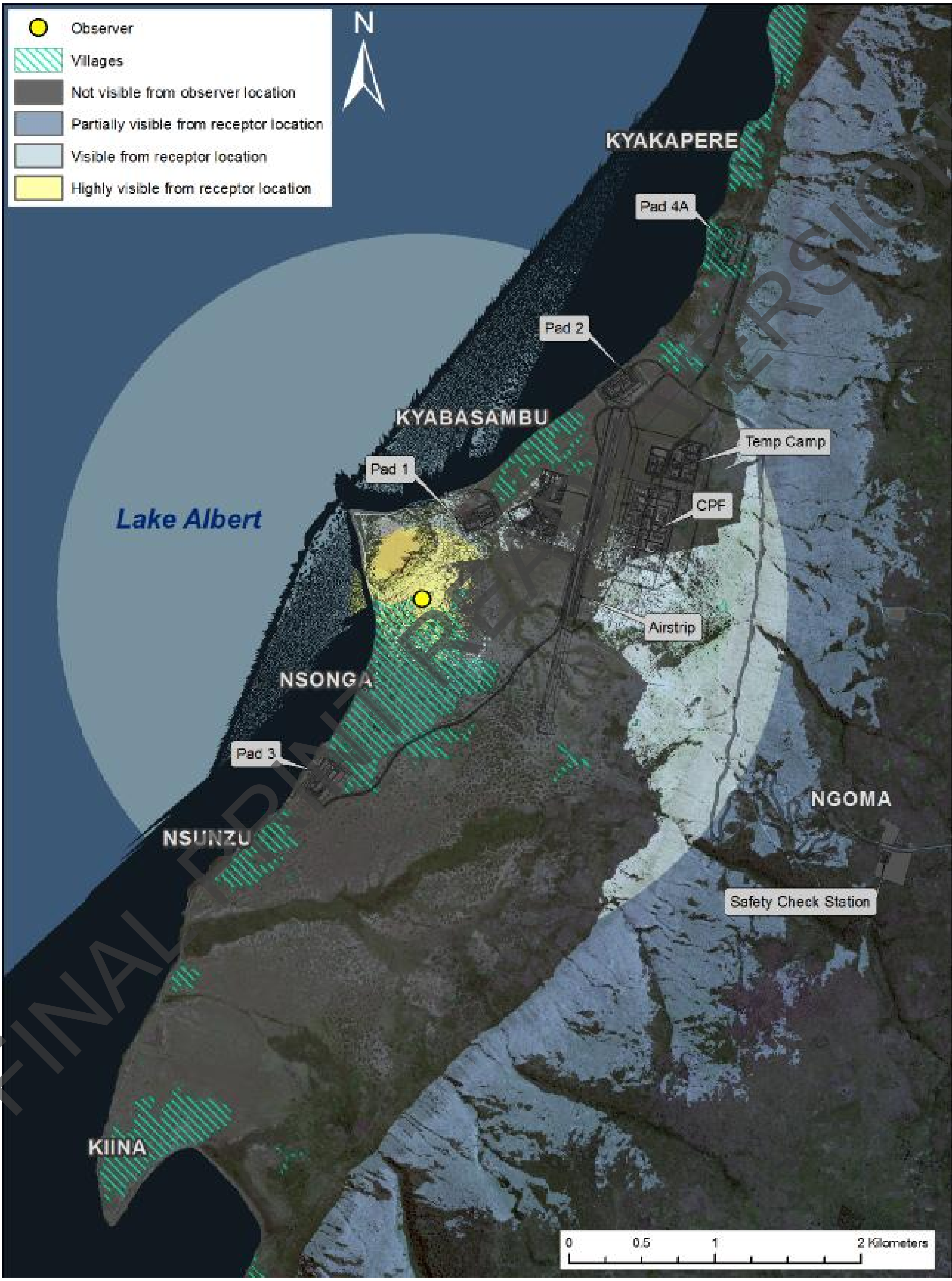


Figure 13: Visibility of project infrastructure from Nsonga village north (receptor-based viewshed)

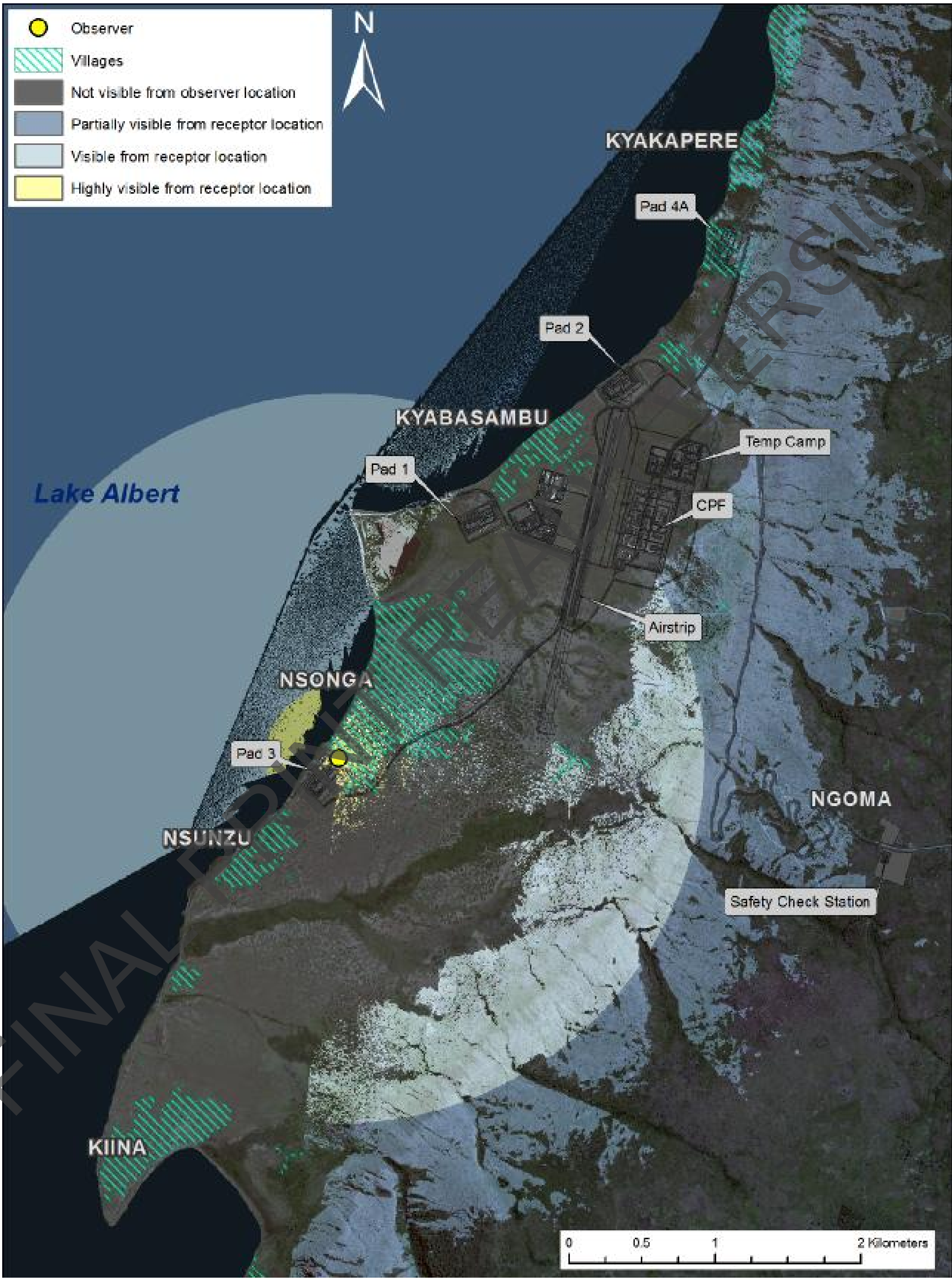


Figure 14: Visibility of project infrastructure from Nsonga village south (receptor-based viewshed)

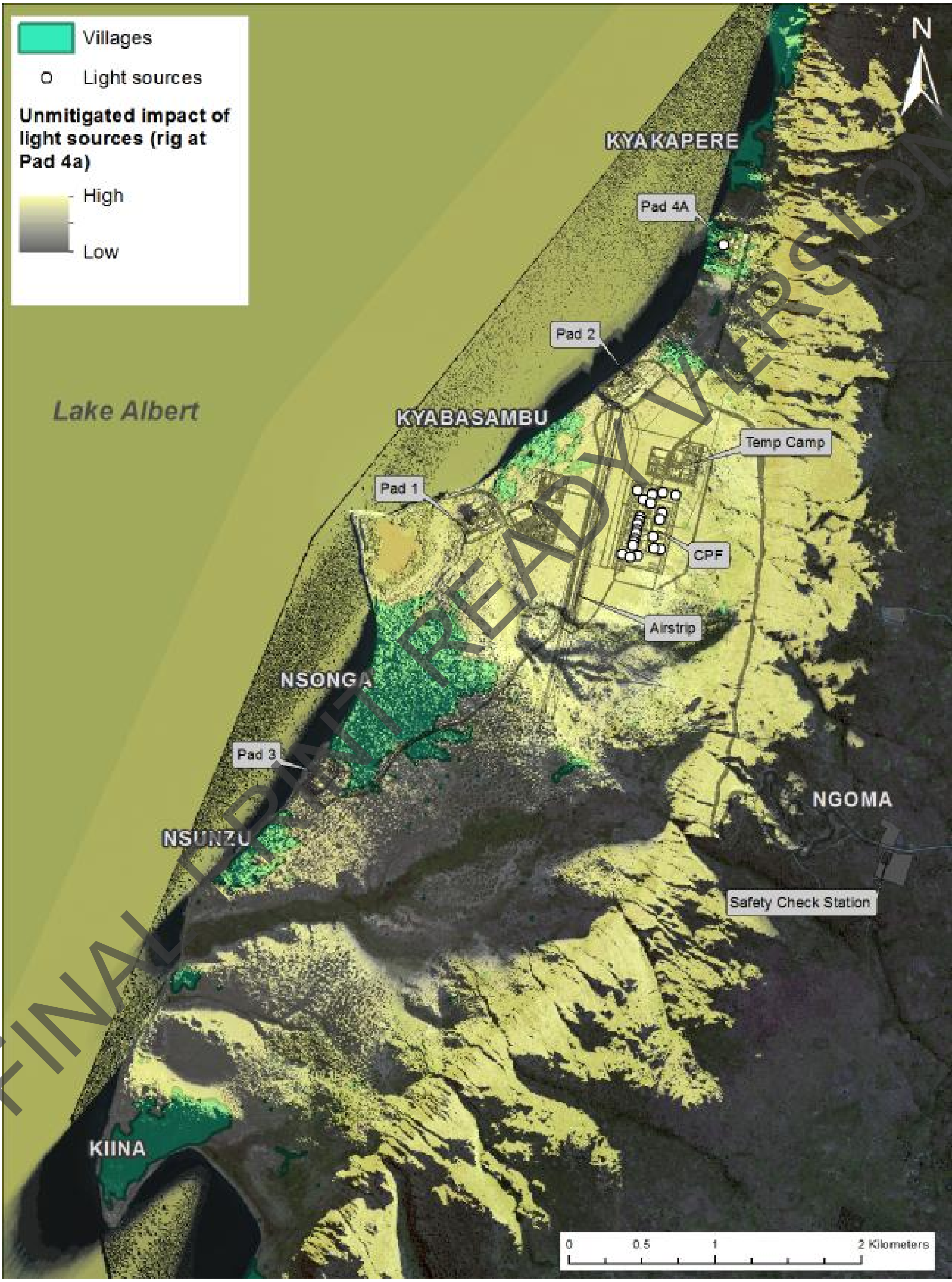


Figure 15: Night-time illumination within study area for CPF and drill rig at well pad 4 (impactor-based viewshed)

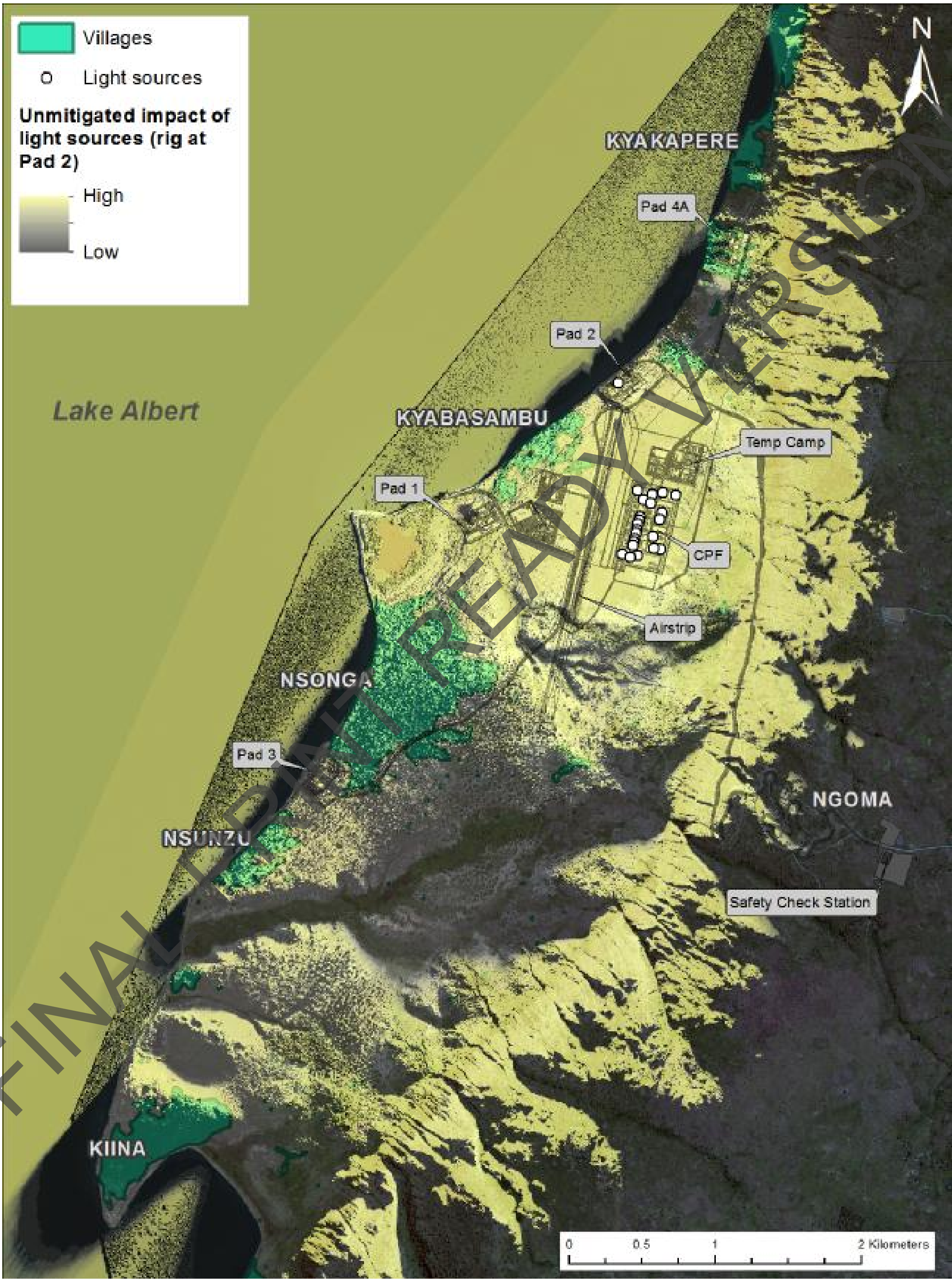


Figure 16: Night-time illumination within study area for CPF and drill rig at well pad 2 (impactor-based viewshed)

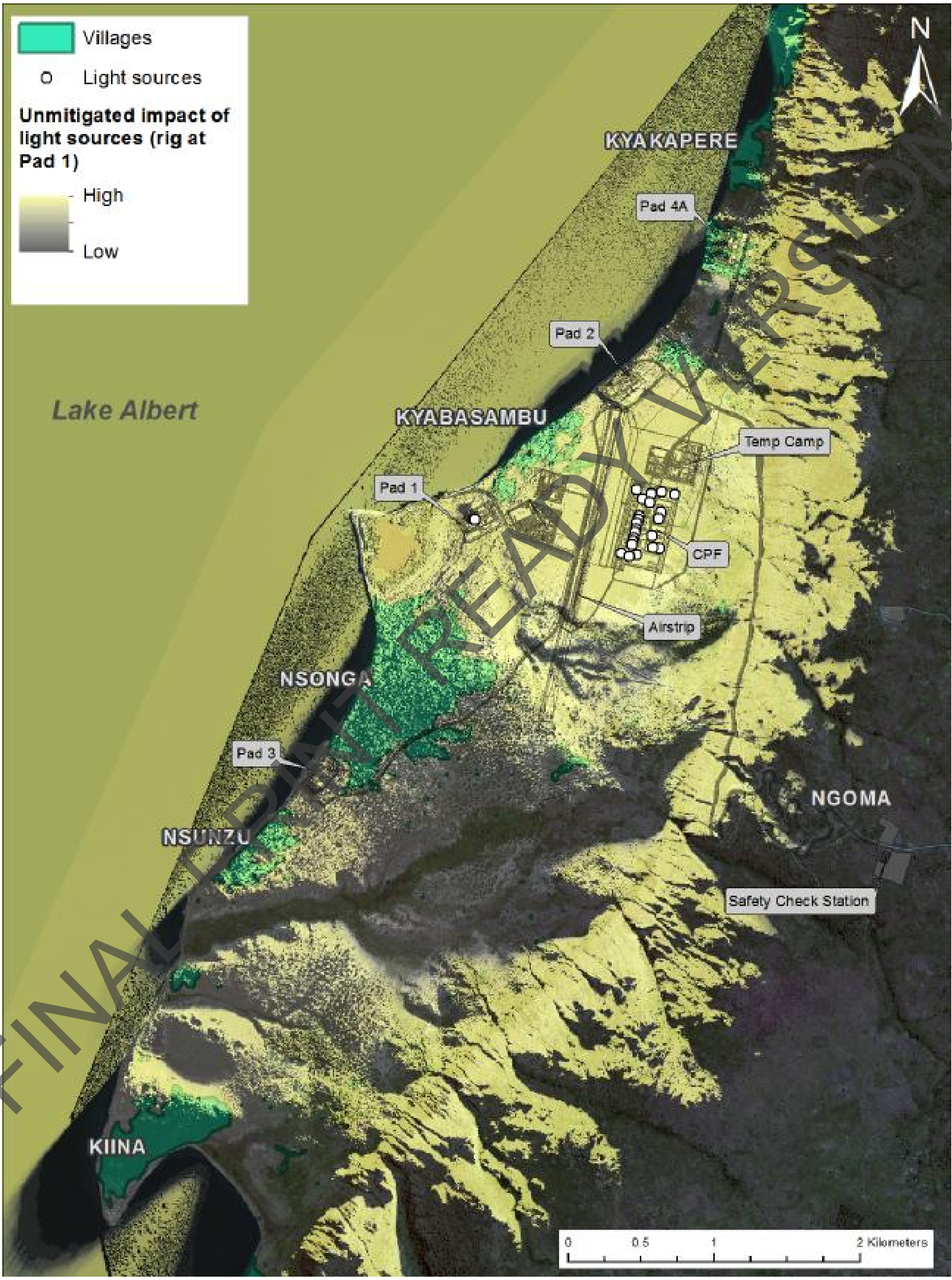


Figure 17: Night-time illumination within study area for CPF and drill rig at well pad 1 (impactor-based viewshed)

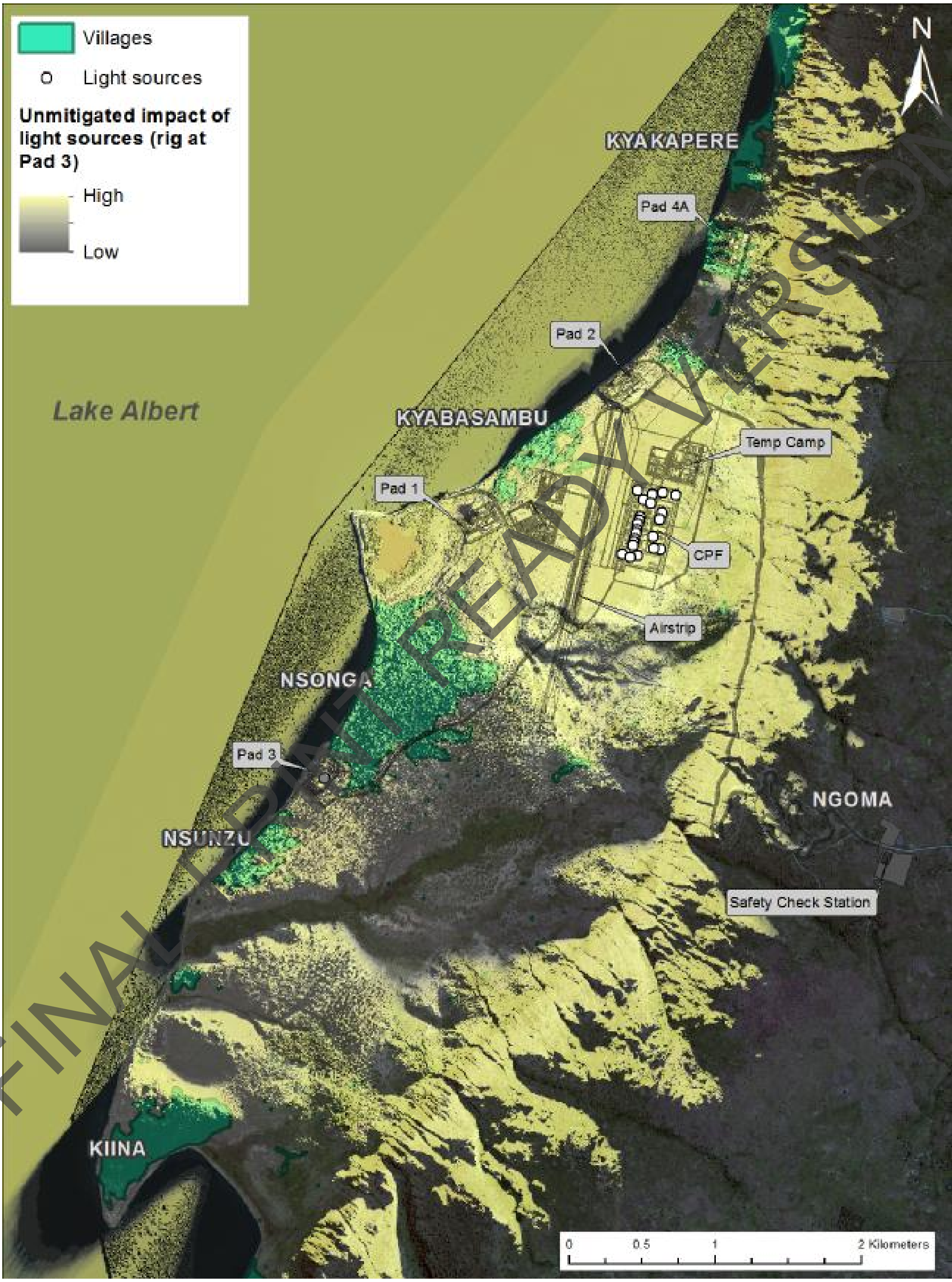


Figure 18: Night-time illumination within study area for CPF and drill rig at well pad 3 (impactor-based viewshed)

5.3.2.3 Visual intrusion

Visual intrusion deals with how well the project components fit into the ecological and cultural aesthetic of the landscape as a whole. An object will have a greater negative impact on scenes considered to have a high visual quality than on scenes of low quality, because the most scenic areas have the "most to lose".

The visual impact of a proposed landscape alteration also decreases as the complexity of the context within which it takes place, increases. If the existing visual context of the site is relatively simple and uniform any alterations or the addition of human-made elements tend to be very noticeable, whereas the same alterations in a visually complex and varied context do not attract as much attention. Especially as distance increases, the object becomes less of a focal point because there is more visual distraction, and the observer's attention is diverted by the complexity of the scene (Hull, R.B and Bishop, I.E, 1998). The expected level of visual intrusion of the main project infrastructure elements is assessed below.

The visual intrusion caused by the project at day is mainly as a result of the bright, contrasting primary colours and strongly geometric shapes of the production infrastructure, as well as vertical height in the case of the drill rig Figure 19. The level of visual intrusion is further emphasised when this infrastructure is viewed against the sky as backdrop, which further emphasises its manmade and artificial appearance.

It is anticipated that the CPF and especially supporting infrastructure components will be somewhat less intrusive, mainly due to their smaller height and somewhat simpler shapes. Furthermore when viewed against the escarpment as backdrop the effect is somewhat muted, as the existing access road excavations could be argued to be more intrusive than the additional infrastructure (Figure 20).

The greatest degree of visual intrusion by far is expected to occur at night when the infrastructure will be brightly lit, as already the case with the existing rig and support infrastructure. The effect is most conspicuous in views where there is no existing infrastructure present, as indicated by Figure 21. However, the effect is still clearly evident in instances where the existing and additional infrastructure is viewed from relatively close, such as the nearby villages (Figure 22). Furthermore, the effect is particularly drastic when viewed from elevated locations such as along the escarpment, as there is no vegetation or other landscape elements that could potentially screen or obscure the light (Figure 23).

Based on the above evaluation the day-time visual intrusion of the project infrastructure and associated changes in site topography and loss of vegetation cover is rated as **moderate**, whereas the night-time level of visual intrusion is rated as **high**.

Figure 19: The well pad drill rig is the most visually intrusive element of the project

Figure 20: Daytime view of the CPF site from the northwest, after construction of the project infrastructure

Figure 21: Night-time view of the CPF site from the northwest, before (top) and after (bottom) construction of the project infrastructure

Figure 22: Night-time view of the permanent camp, CPF site and well pads 1 and 2 positions, before (top) and after (bottom) construction of the project infrastructure

Note: in the “after” (bottom) image, the drill rig has been moved from well pad 2 further north to well pad 1, located approximately 500 m from the viewer

Figure 23: Night-time panoramic view of the peninsula and production site from the southeast along the escarpment, before (top) and after (bottom) construction of the project infrastructure

- In summary, the visual impact criteria ratings for each of the primary project impacts performed in Section 5.3.2 above are indicated in
-

Table 7.

Table 6: Visual impact criteria rating

Visual impact	Visual impact criteria			Total rating score
	Visibility	Visual exposure	Visual intrusion	
Alteration of site topography and loss of vegetation cover	Moderate (2)	High (3)	Moderate (2)	**7 (Moderate)***
Visually intrusive infrastructure (day-time impact)	High (3)	High (3)	Moderate (2)	**8 (High)***
Light pollution (night-time impact)	High (3)	High (3)	High (3)	**9 (High)***

(**Where for the total rating score: 3-5 = low; 6-7 = moderate; and 8-9 = high*)

5.3.3 Impact intensity

The intensity of each visual impact is determined using

Table 7; as a function of the visual resource value of the receiving landscape study area, together with the visual impact criteria (Table 6). The visual resource value of the production facility study area as a whole is high (see Section 5.2).

Table 7: Visual impact intensity

Visual resource value	Visual impact criteria rating		
	High	Moderate	Low
High	High (4)	High (4)	Moderate (3)
Moderate	High (4)	Moderate (3)	Low (2)
Low	Moderate (3)	Low (2)	Very Low (1)

Accordingly, the intensity of each impact is as follows:

- Alteration of site topography and loss of vegetation cover – **high (4)**;
- Visually intrusive infrastructure (day-time impact) – **high (4)**;
- Light pollution (night-time impact) – **high (4)**; and
- Resultant loss of sense of place as secondary impact – **high (4)**.

5.3.4 Impact magnitude

The process followed from Sections 5.2.1 to 5.3.3 above is specific to the discipline of visual impact assessment, and is based on industry-accepted standards and criteria. However, the determination of the impact magnitude and significance was done using standard impact assessment criteria, in order to allow for the results of the VIA to be incorporated into the overall ESIA process and deliverables. This process was also done so that the impact assessment process can be more readily understood by stakeholders.

To help readers understand the results of the impact assessment, the VIA aimed to answer the following questions to derive the magnitude of the impact:

- Is the effect good or bad? This is the direction of an effect.
- How large an area will be affected? How far will the effect reach? This is the geographic extent of an effect.
- How long will the effect last? This is the duration of an effect.
- Will the effect be reversible or not?

Each of these is discussed in more detail below.

5.3.4.1 Direction

Direction describes the trend of the effect compared with baseline conditions. There are three options for direction:

- Adverse – effect is worsening or is undesirable;
- Neutral – effect is not changing compared with baseline conditions and trends; and
- Positive – effect is improving or is desirable.

5.3.4.2 Geographic extent

Geographic extent describes the quantitative measurement of area within which an effect occurs. Effects are described in terms of whether they are limited to the site or local study area, the region, or extend farther:

- Local (1) – effect is limited to the project site and immediate surroundings;
- Regional (2) – effect extends beyond the immediate surroundings, but is limited to the general region; and
- Beyond regional (3) – effect extends beyond the region to a provincial/national or international level.

5.3.4.3 Duration

Duration refers to how long an effect lasts. Duration is described in relation to the phases of the development of the project, although effects may last longer than the phases of the project for some valued components. The following framework was used: construction, operations, decommissioning, and far-future.

For the purposes of this VIA, the far future is a duration criterion that is meant to capture effects lasting several generations after decommissioning and rehabilitation. This relates to effects that the project may have on the area's environmental and social sustainability (or not), including cumulative impacts.

- Short-term (1) – effect is limited to the construction period (~2 years), or the period of decommissioning activities (~2 years);
- Medium-term (2) – effect extends throughout the project operations, that is, 25 years;
- Long-term (3) – effect extends beyond the 25 years of operation; and
- Far future (4) – effect extends more than 30 years after closure.

5.3.4.4 Reversibility

This criterion describes whether the effect is reversible or not. This can be associated with duration, as many effects eventually could be considered to be reversible (that is, in geological time). However, the extinction of a species can be considered as irreversible. For the purposes of the VIA, the level of reversibility was defined as follows:

- Fully reversible (1) – all visual impacts will cease when the project infrastructure is removed/activity has ceased;
- Largely reversible (2) – residual or secondary visual impacts remain when the project infrastructure is removed but are expected to diminish over time or are minor in relation to the primary visual impacts;
- Partially reversible (3) – permanent residual or secondary impacts will remain that are not expected to diminish; and
- Non-reversible (4) – the primary project visual impacts are permanent as a consequence of the nature and lifespan of the project.

The magnitude of each of the primary visual impacts were subsequently determined using the impact intensity determine in Section 5.3.3 above, as well as the above criteria, indicated in Table 8.

Table 8: Visual impact magnitude

Visual impact (Adverse)	Impact magnitude determination criteria				Total magnitude score
	Intensity	Extent	Duration	Reversibility	
Alteration of site topography and loss of vegetation cover	High (4)	Local (1)	Long-term (3)	Largely (2)	10
Visually intrusive infrastructure	High (4)	Local (1)	Medium-term (2)	Largely (2)	9
Light pollution	High (4)	Beyond regional (3)	Medium-term (2)	Fully (1)	10
Loss of sense of place	High (4)	Local (1)	Long-term (3)	Largely (2)	10

The total magnitude score was applied to the criteria summarised in Table 9 in order to determine the magnitude of each visual impact.

Table 9: Magnitude assessment criteria and rating scale

Criteria	Rating scales
Magnitude (the expected magnitude or size of the impact)	**4-6 = Negligible:** where the impact affects the environment in such a way that natural, and /or cultural and social functions and processes are negligibly affected and valued, important, sensitive or vulnerable systems or communities are negligibly affected.
	7-9 = Low: where the impact affects the environment in such a way that natural, and/or cultural and social functions and processes are minimally affected and valued, important, sensitive or vulnerable systems or communities are minimally affected. No obvious changes prevail on the natural, and / or cultural/ social functions/ process as a result of project implementation
	10-12 = Moderate: where the affected environment is altered but natural, and/or cultural and social functions and processes continue albeit in a modified way, and valued, important, sensitive or vulnerable systems or communities are moderately affected.
	13–15 = High: where natural and/or cultural or social functions and processes are altered to the extent that they will temporarily or permanently cease, and valued, important, sensitive or vulnerable systems or communities are substantially affected. The changes to the natural and/or cultural / social- economic processes and functions are drastic and commonly irreversible

Accordingly, the magnitude of each impact is as follows:

- Alteration of site topography and loss of vegetation cover – **moderate**;
- Visually intrusive infrastructure (day-time impact) – **low**;
- Light pollution (night-time impact) – **moderate**; and
- Resultant loss of sense of place as secondary impact – **moderate**.

5.3.5 Impact significance

To determine the significance of a visual impact, the expected receptor sensitivity is determined based: on the number of people that are likely to be exposed to a visual impact (incidence factor); and their expected perception of the value of the visual landscape and project impact (sensitivity factor). The sensitivity factor is then considered in terms of the overall magnitude of the visual impact, as was determined in Section 5.3.4.

5.3.5.1 Visual receptor sensitivity

Potential viewers or visual receptors are people that might see the proposed development, as visual impact is primarily concerned with human interests and perceptions. Receptor sensitivity refers to the degree to which an activity will actually impact on receptors and depends on how many persons see the project, how frequently they are exposed to it and their perceptions regarding aesthetics. Receptors of the proposed project can be broadly categorised into two main groups, namely:

- People who live or work in the area and who will frequently be exposed to the project components (resident receptors); and
- People who travel through the area, and are only temporarily exposed to the project components (transient receptors).

The project site is located in a remote section of the Ugandan countryside and is geographically isolated from major settlements. As such the number of resident receptors is limited and is restricted to the inhabitants of the nearby villages. However, local residents which have subsistence-based livelihoods are expected to attach a high level of value to landscape and are therefore expected to have a high level of sensitivity towards the project.

Due to the remote location of the site the number transient receptors is also expected to be limited. Specific locations within the greater region and other parts of the lake are tourism destinations of varying significance, the project site is remote from these localities and therefore expected to impact on a small number of transient receptors. Visitors to the region are therefore mainly tourists, and are expected to at least have a moderate level of sensitivity to significant changes in the appearance of the study area.

In summary, the overall number of people that will be visually exposed to the project (expressed as incidence factor) is expected to be **moderate** and is limited to only several thousand people. Conversely the overall sensitivity factor of the majority of receptors is expected to be **high**, as compared in Table 10.

Table 10: Visual receptor sensitivity

Receptor perceived landscape value	Number of receptors that will see the project (incidence factor)		
	Large	Moderate	Small
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Very low

Based on the very high perceived landscape value determined for the study area and the fact that a moderate number of people are expected to be exposed to the project, a **high** overall receptor sensitivity was determined for the project study area.

5.3.5.2 Impact significance assessment

The significance of each visual impact was subsequently determined as a function of the magnitude of the impact, together with the visual receptor sensitivity, as summarised in Table 11:

Table 11: Determination of impact significance

Magnitude of Impact	Sensitivity of receptor			
	Very low	Low	Medium	High
Negligible	1 Negligible	2 Minor	3 Minor	4 Minor
Low	2 Minor	4 Minor	6 Moderate	8 Moderate
Moderate	3 Minor	6 Moderate	9 Moderate	12 Major
High	4 Minor	8 Moderate	12 Major	16 Major

Accordingly, the significance of each impact is as follows:

- Alteration of site topography and loss of vegetation cover – **major**;
- Visually intrusive infrastructure (day-time impact) – **moderate**;
- Light pollution (night-time impact) – **major**; and
- Resultant loss of sense of place as secondary impact – **major**.

5.3.6 Visual impact mitigation

Visual mitigation can typically be approached in two ways, and usually a combination of the two methodologies is most effective. The first option is to implement measures that attempt to reduce the level of visibility of the source of a visual impact. Thus an attempt is made to "hide" the source of the visual impact from view, by placing visually appealing elements between the viewer and the source of the visual impact. The second option aims to minimise the degree of visual intrusion of the source of the impact by altering its physical appearance, i.e. shape/profile, colour and/or texture, or by decreasing the size of visual disturbance.

Construction and especially operational mitigation possibilities are likely to be limited for this project, as a result of functional/operational requirements of the infrastructure, and the visual character of the study area. Visual mitigation efforts will largely focus on screening the project infrastructure from view from the respective villages, as well as eliminating potential long term/post-closure impacts to ensure that the sense of place of the study area is restored.

The proposed visual mitigation measures for the individual visual impacts as identified are discussed below.

5.3.6.1 Temporary impacts

5.3.6.1.1 Dust pollution

- Water down any large bare areas associated with the construction and rehabilitation phases as frequently as is required to minimise airborne dust;
- Rehabilitate temporary bare areas as soon as feasible using appropriate vegetation species;
- Place a sufficiently deep layer of crushed rock or gravel over parking surfaces for vehicles and machinery ;
- Apply chemical dust suppressants if wet dust suppression is insufficient; and
- Implement a dust bucket fallout monitoring system.

5.3.6.1.2 Increased construction equipment/plant, vehicles, and materials handling activities

- Maintain the construction and rehabilitation phase sites in a neat and orderly condition at all times;
- Create designated areas for: material storage, waste sorting and temporary storage, batching, and other potentially intrusive activities;
- Limit the physical extents of areas cleared for material laydown, vehicle parking and the like as much as possible and rehabilitate these areas as soon as is feasible; and
- Repair project related erosion damage to steep or bare slopes as soon as possible and re-vegetate these areas using a suitable mix of indigenous grass species.

5.3.6.2 Daytime impacts - visually intrusive project elements

5.3.6.2.1 Vegetation screens

- Identify optimal locations for proposed vegetation screens on site, based on the results of the screened receptor and impactor-based viewshed analyses, as illustrated by Figure 24 to Figure 27, and Figure 30 to Figure 34 respectively. The extent and orientation of the individual tree screens should be determined on site by conducting line-of-sight evaluations from the respective villages to the individual project infrastructure sites (Figure 28);
- Conduct trials to identify the most suitable tree and shrub species to be utilised for establishing the vegetative screens. The selection of plant species must be cognisant of local soil conditions and rainfall, maintenance requirements, and expected lifespan and foliage density into consideration. In this regard it is anticipated that *Eucalyptus saligna* will likely be suitable, although management measures would need to be put in place to ensure that the plants do not become invasive and spread beyond the screens;

- Establish the vegetation screens as soon as possible, to minimise the time delay before the trees reach a suitable height to act as effective visual barriers. In this regard it must be noted that the trees will likely only be effective as screens once they reach a height of 7 or 8 m, which will require a number of years for the trees to achieve. The implication is that the project infrastructure will not be screened from view from the adjacent villages for a significant percentage of the operational lifespan of the project; and
- Construction of earthen embankments and berms should not be considered as visual screening measures, as these elements will cause additional visual impact due to their geometric and linear shapes. Furthermore the long-term impact of these artificial landforms will likely not be fully rehabilitated after closure, which will result in a permanent impact on the study area sense of place.

5.3.6.2.2 Architectural and landscaping measures

- To reduce the visual intrusion of the buildings, where feasible roofing and cladding material should not be white, shiny (e.g. bare galvanized steel that causes glare) or brightly coloured;
- Buildings and workshops exteriors should also be painted in colours that are complementary to the surrounding landscape, such as olive green, light grey, blue-grey, or variations of tan and ochre;
- Retain existing trees wherever possible, as they already provide valuable screening; and
- Appropriate landscaping using indigenous vegetation should be introduced within the permanent camp facility as well as entrance areas to other facilities, in order to create a more welcoming overall appearance.

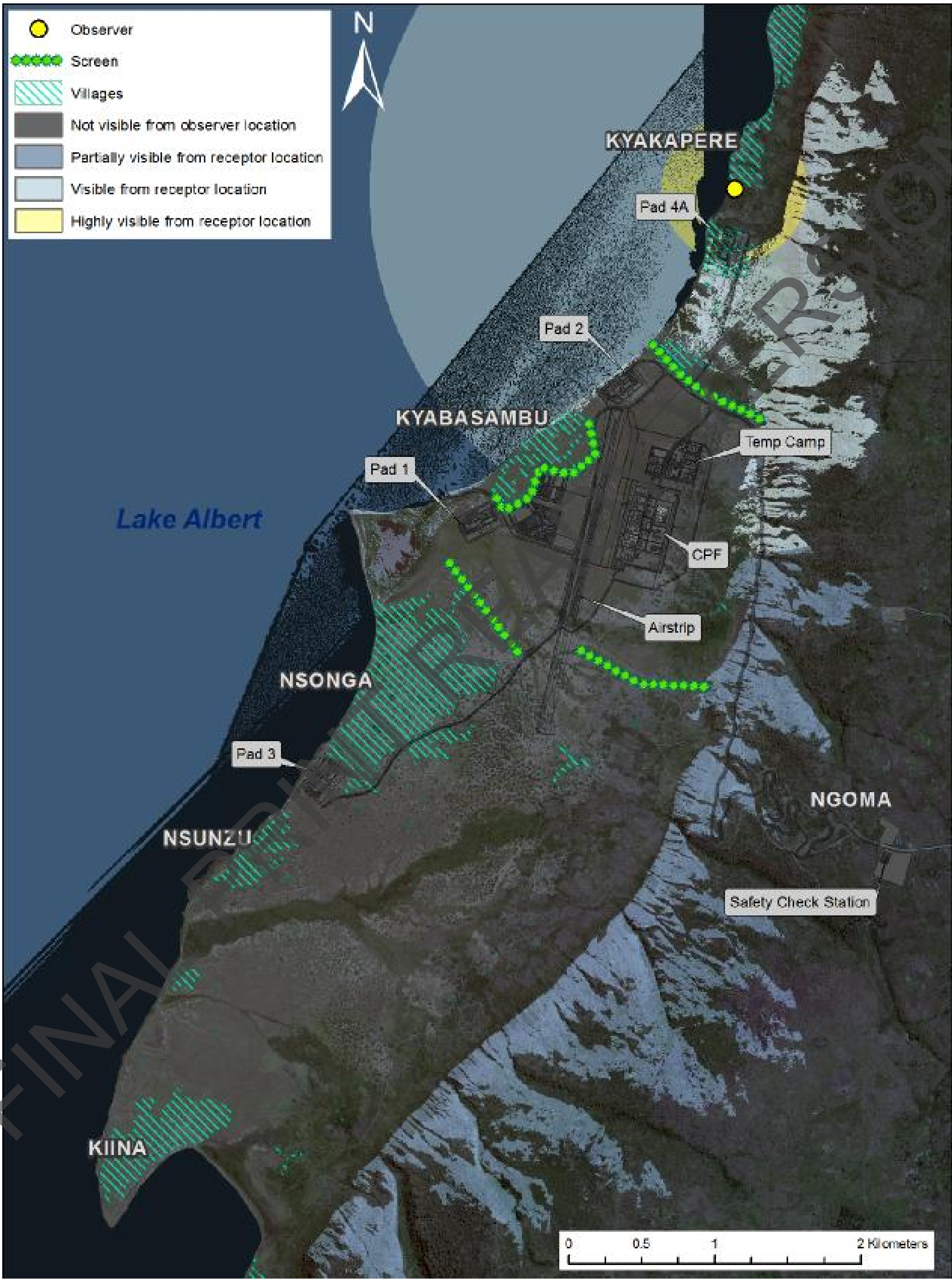


Figure 24: Visibility of project infrastructure from Kyakapere village (receptor-based viewshed) after visual screening

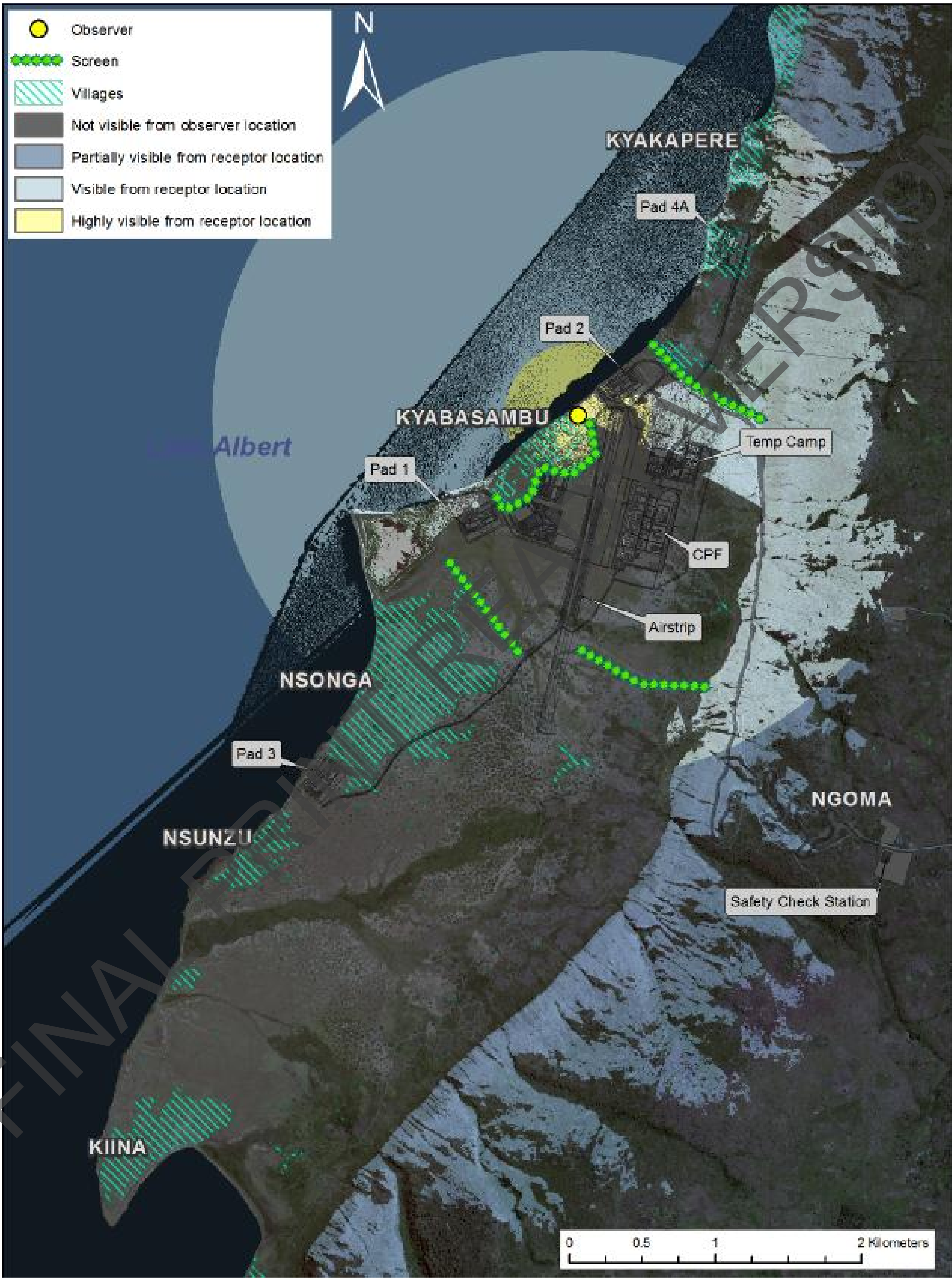


Figure 25: Visibility of project infrastructure from Kyabasambu village (receptor-based viewshed) after screening

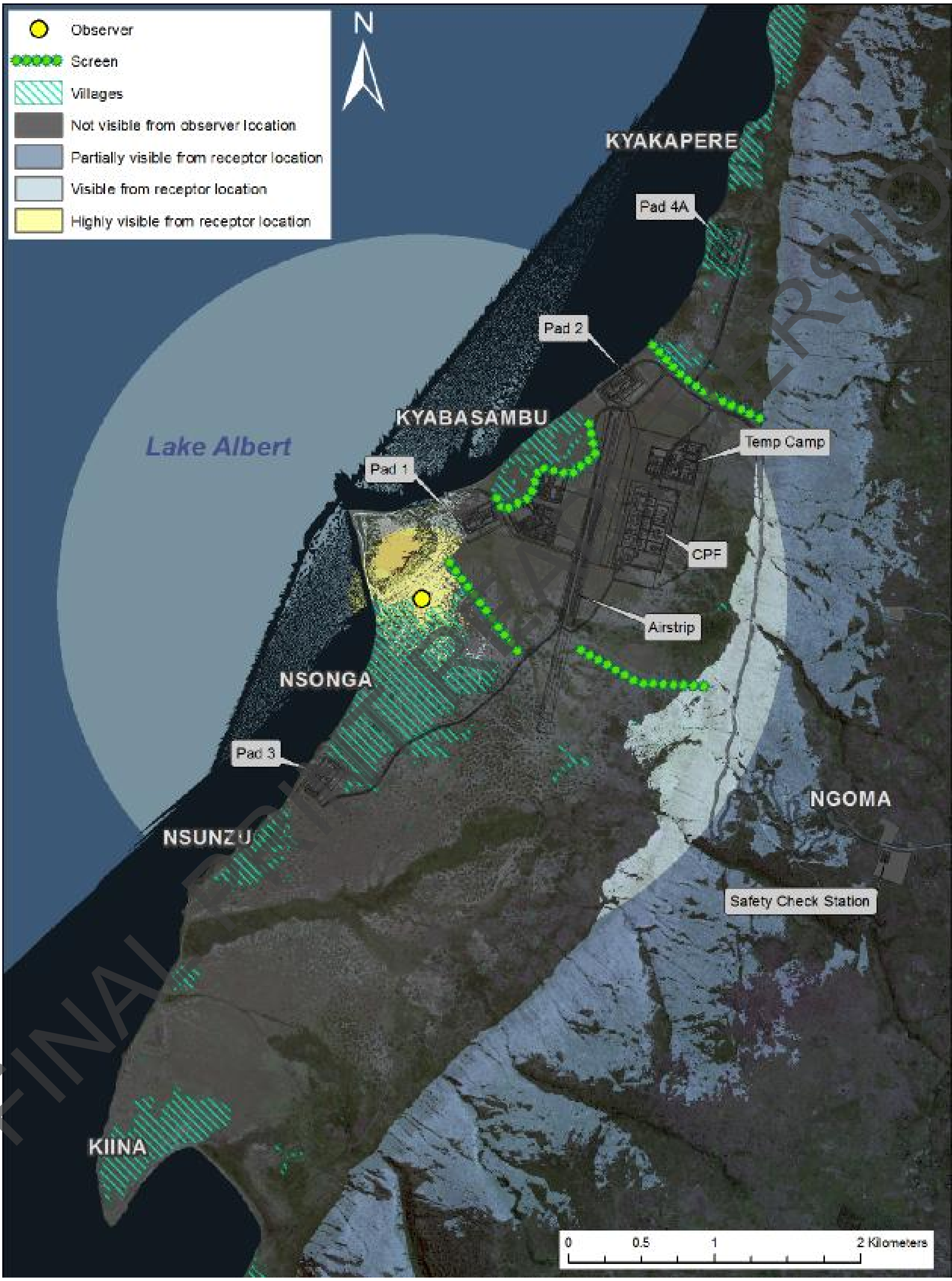


Figure 26: Visibility of project infrastructure from Nsonga village north (receptor-based viewshed) after screening

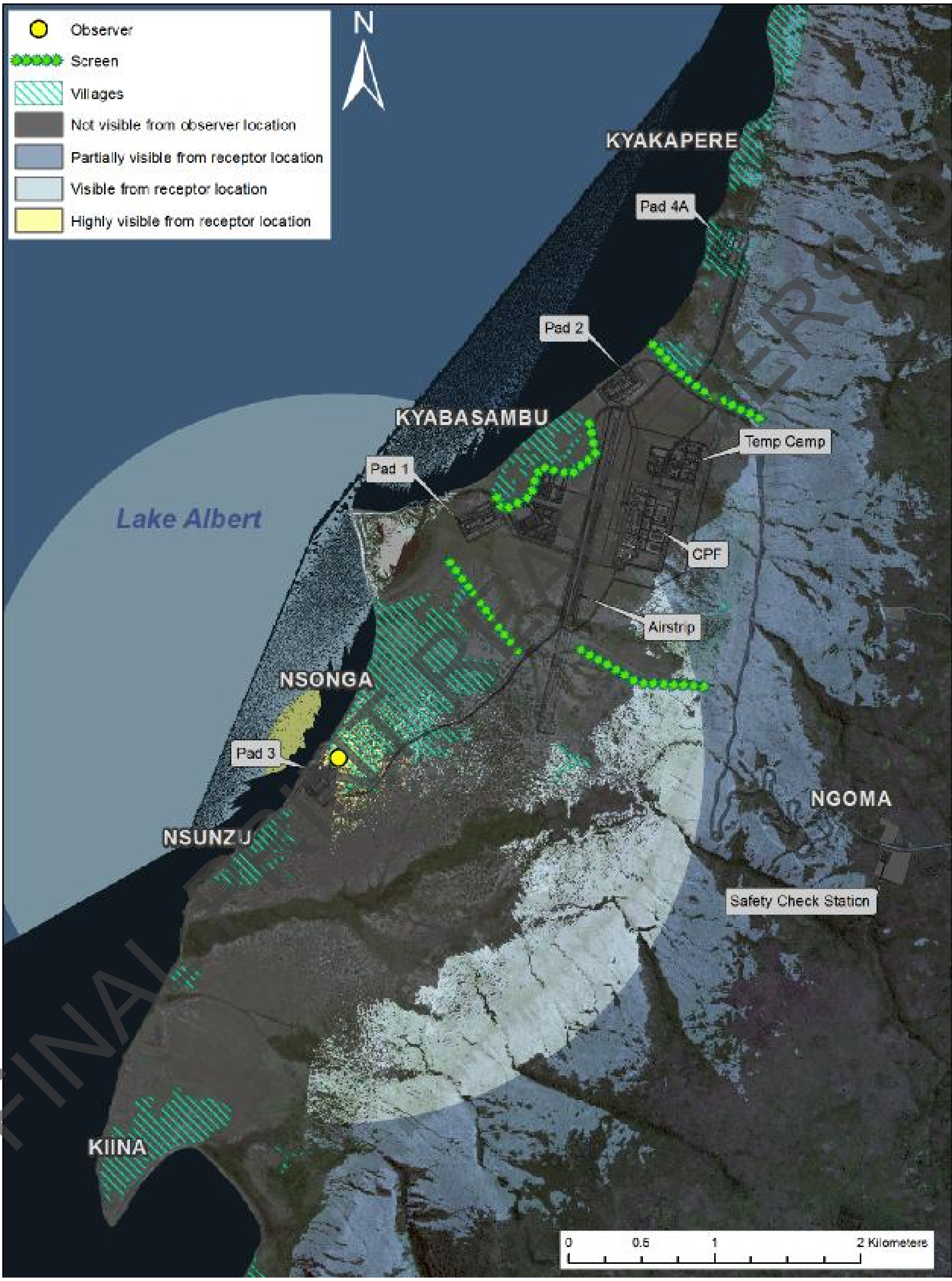


Figure 27: Visibility of project infrastructure from Nsonga village south (receptor-based viewshed) after screening

Figure 28: Daytime view of the CPF site from the northwest, before (top) and after (bottom) visual mitigation

5.3.6.3 Night-time light pollution

Full cut-off shielding in light fixtures is the essential remedy for both glare and sky glow. A lamp should send all of its light more or less downwards where the light is intended to be used, and not upward or sideways. "Full cut off" is usually taken to mean that no direct light rays from the fixture shine above the horizon, and that at least 90 percent of the light is blocked in the near-sideways range, from 0° to 20° below the horizontal plane. Light that shines in this near-sideways range creates a dazzling annoyance to nearby receptors and contributes nothing to most lighting needs, as it merely dissipates uselessly into the distance.

To minimise both direct glare and indirect sky glow or haze, the following measures are recommended:

- Identify zones of high and low lighting requirements, focusing on only illuminating areas to the minimum extent possible to allow safe operations at night and for security surveillance;
- Plan the lighting requirements of the facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination;
- Reduce the heights of light post where possible and develop a lighting plan that focusses on illuminating the required areas through strategically placed individual lights rather than mass light flooding;
- Utilise security lights that are movement activated rather than permanently switched on where feasible, to prevent unnecessary constant illumination;
- Fit all security lighting with 'blinkers' or specifically designed fixtures, to ensure light is directed downwards while preventing side spill. Light fixtures of this description are commonly available for a variety of uses and should be used to the greatest extent possible; and
- Eliminate any ground-level spotlights as these invariable result in both direct glare and increased sky glow, and cannot be effectively mitigated.

In addition to the above measures, the proposed vegetation screens should be as dense as possible and maintained to ensure that no breaks in the tree-line are formed, as this will compromise their effectiveness (Figure 29 to Figure 32). Multiple rows of trees that are rotationally coppiced and pruned will likely be required to ensure that sufficient foliage density is achieved (Figure 33 and Figure 34).

It is important that the local villagers be consulted beforehand in this regard, to ensure that the trees are not cut down for firewood. Critically, the project design team should ensure that the proposed tree screens do not compromise any sites of cultural or spiritual significance, as this is sure to result in them being cut down.

5.3.6.4 Loss of sense of place

As previously mentioned, the likely loss of sense of place during the operational phase will be significant, as the visual impact of the project infrastructure during the day and light pollution at night respectively can only be partially mitigated. While the proposed vegetation screens may block the infrastructure to some extent, the drill rig will still be visible from most locations due to its height. Furthermore, the infrastructure cannot be effectively screened from views along the escarpment or from large portions of the adjacent lake surface.

For this reason, it is imperative that the project site be effectively and completely rehabilitated once the operational lifespan of the project has ended, to ensure that no residual visual impacts remain. To this end, the original site topography should be recreated as closely as possible and the original vegetation cover reinstated. All traces of the vegetation screens should also be removed, to ensure that the exotic Eucalyptus trees do not become naturalised and spread after closure. This action would also include soil amelioration as required, to ensure that the natural vegetation can be successfully re-established.

Additionally, all buildings, production and infrastructure including associated footprint disturbances should be removed and rehabilitated, and any potential soil contamination should be effectively remediated. It is furthermore recommended that an attempt be made to operationally rehabilitate the spoil rock piles below the access road where possible, to reduce the level of long-term impact associated with this feature.

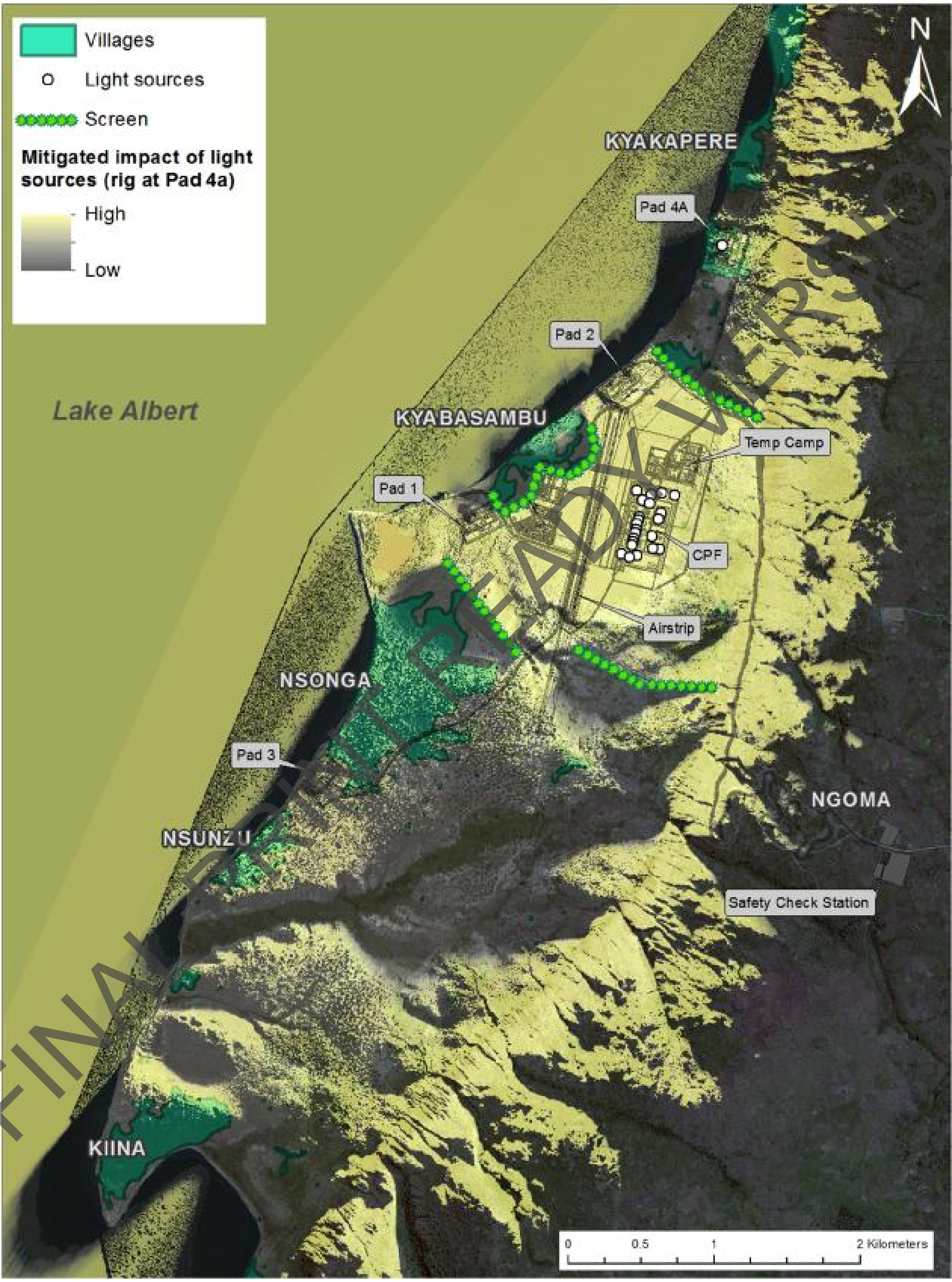


Figure 29: Night-time illumination (impactor-based viewshed) within study area for CPF and drill rig at well pad 4, after screening

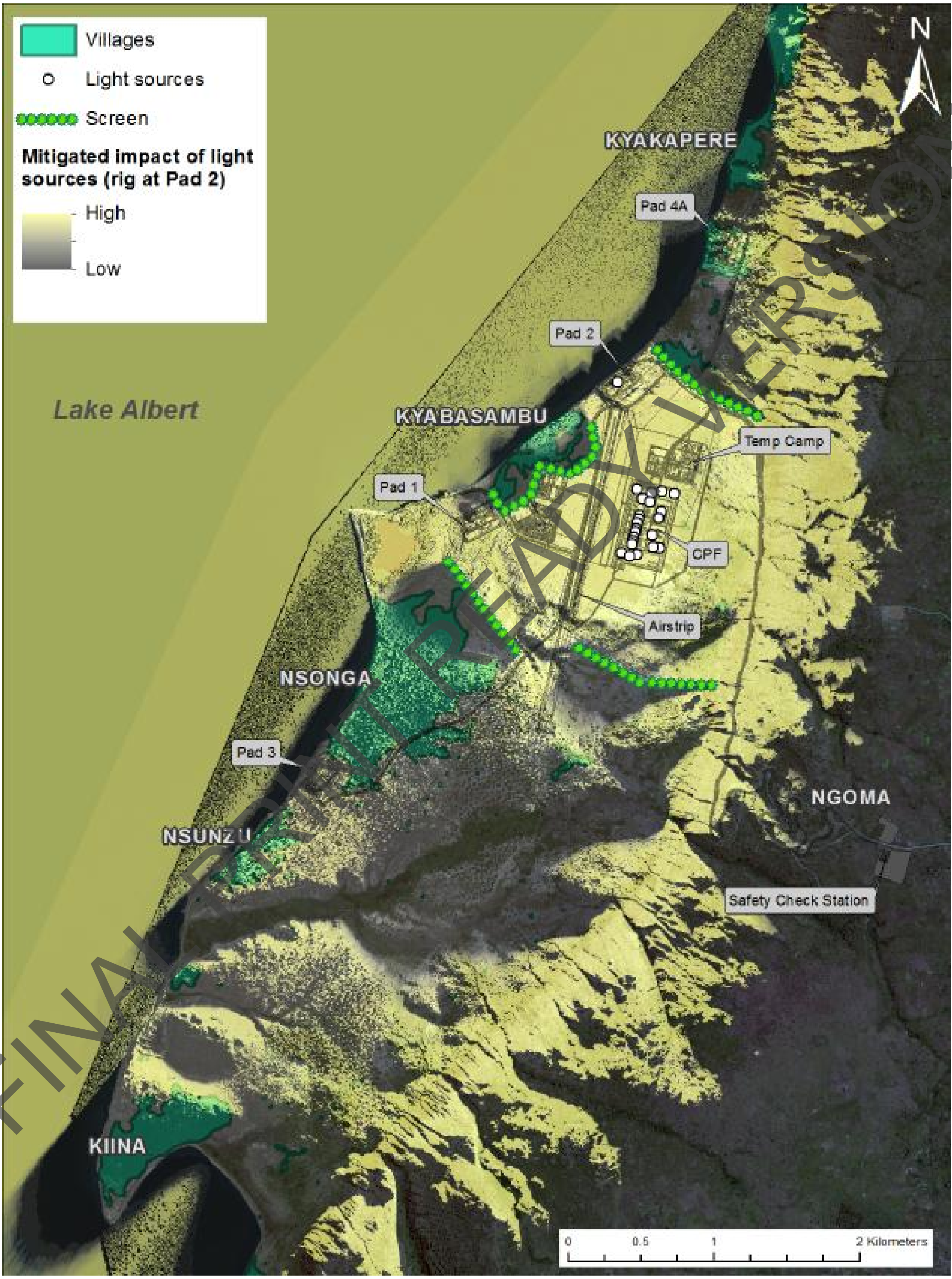


Figure 30: Night-time illumination (impactor-based viewshed) within study area for CPF and drill rig at well pad 2, after screening

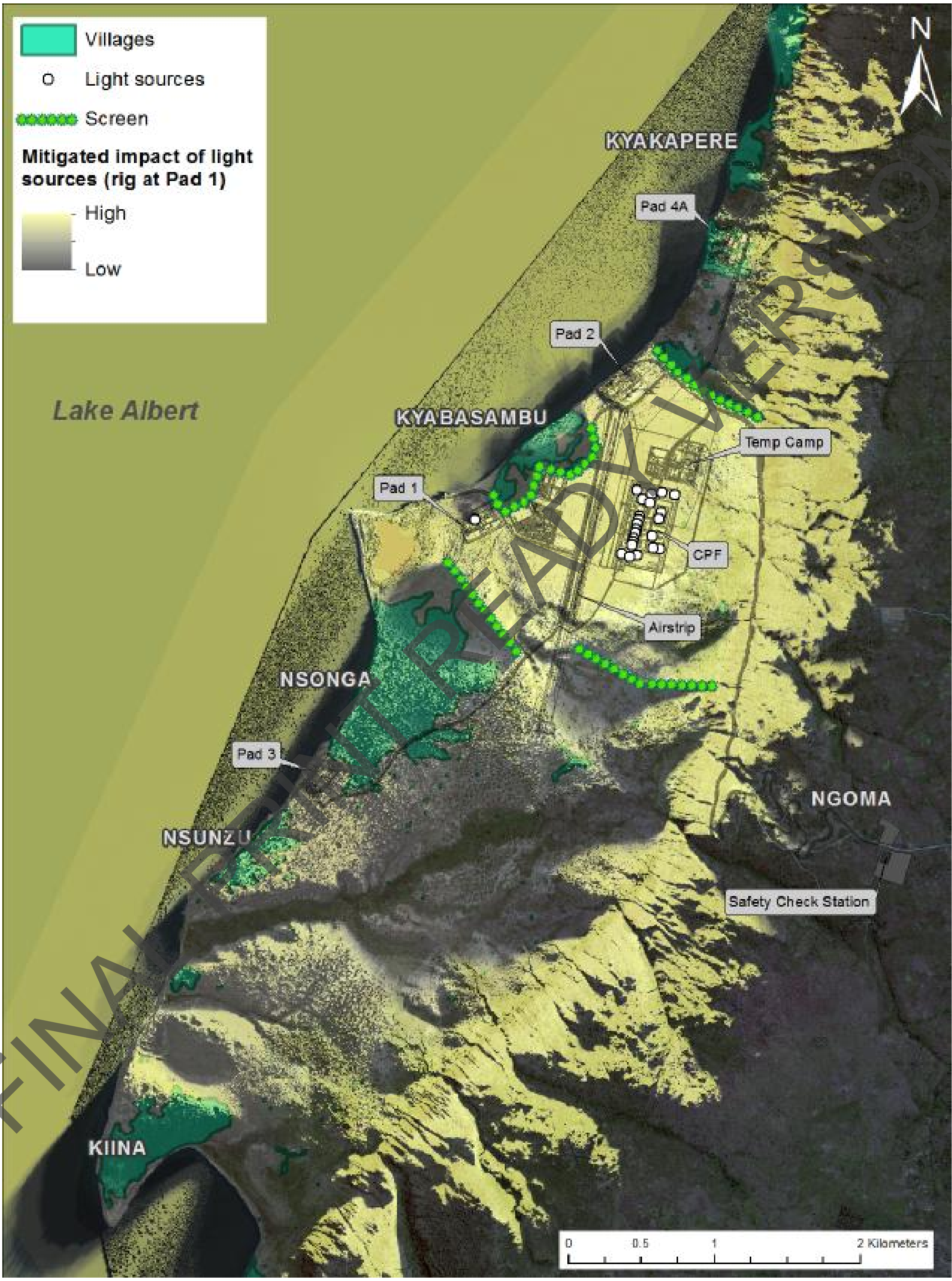


Figure 31: Night-time illumination (impactor-based viewshed) within study area for CPF and drill rig at well pad 1, after screening

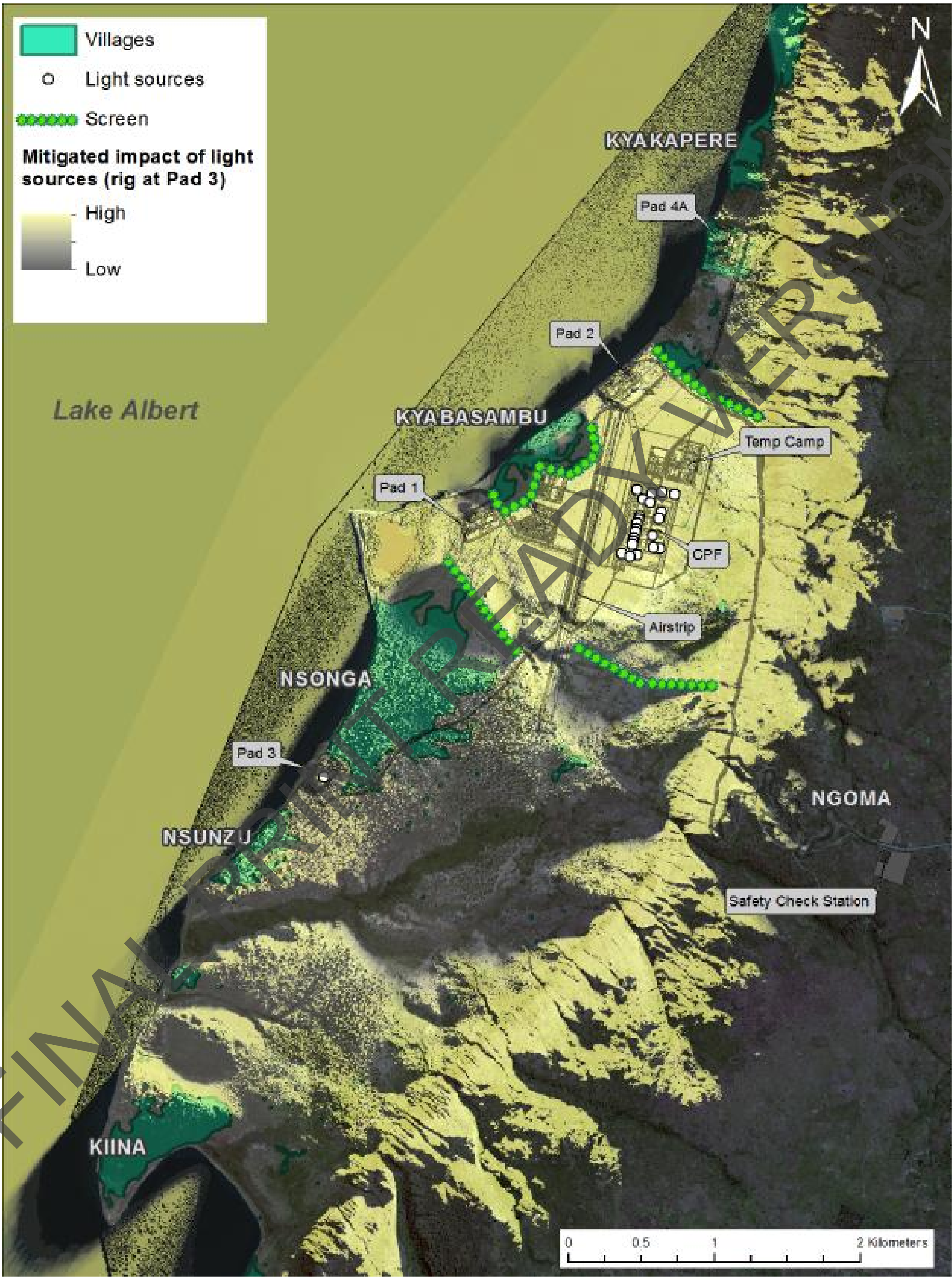


Figure 32: Night-time illumination (impactor-based viewshed) within study area for CPF and drill rig at well pad 3, after screening

Figure 33: Night-time view of the permanent camp, CPF site and drill rig at well pads 1, before (top) and after (bottom) implementation of screening

Figure 34: Night-time view of the CPF site from the northwest, before (top) and after (bottom) implementation of screening

Table 12: Summary of pre- and post-mitigation impact significance

Impact	Pre-mitigation			Post-mitigation		
	Receptor sensitivity	**Magnitude**	**Significance**	**Receptor sensitivity**	**Magnitude**	**Significance**
Alteration of site character including topography and loss of vegetation cover during operations	High	Moderate	Major	High	Low	Moderate
Visually intrusive infrastructure (day-time impact) during operations	High	Low	Moderate	High	Low	Moderate
Light pollution (night-time impact) during operations	High	Moderate	Major	High	Low	Moderate
Long-term resultant loss of sense of place as secondary impact	High	Moderate	Major	High	Negligible	Minor

6.0 PIPELINE CORRIDOR

6.1 Study area

As discussed in Section 3.0 and illustrated by Figure 2, the CNOOC Kingfisher oil Field project entails two main components. Section 2 of this VIA dealt with the main production facility located adjacent to Lake Albert, whereas Section 3 assesses the visual impact of the distribution pipeline that will connect the production facility with a new refining facility to be constructed at Kabaale, 52 km to the east.

The pipeline will be completely buried, and as such the majority of visual impacts are therefore expected to occur during the construction phase of the project. The proposed pipeline alignment also traverses a visual environment that is already significantly altered, mainly passing through agricultural farmland and timber plantations, as well as numerous villages and larger urban areas. In most instances the visual impacts caused during the construction process are therefore unlikely to be visible over medium or long-range distances, due to the screening effect of existing vegetation, local topographical landforms and development. The only exceptions will be in instances where the pipeline traverses fields or expansive clearings, or where there are elevated viewpoints surrounding the pipeline corridor, and longer range views are therefore possible. For the purposes of the VIA, the pipeline study area therefore only comprises the pipeline corridor and its immediate surroundings, to an average range of no more than 500 m.

6.2 Baseline visual resource value assessment

6.2.1 Landscape visual character

The topography along the supply pipeline route from the Buhuka Flats and the refinery at Kabaale varies greatly, however the majority of the inland area east of Lake Albert and the escarpment is characterised by rolling hills. The larger watercourses are usually associated with wide valleys and more hilly terrain, whereas large parts of the interior are relatively featureless and somewhat flat. The visual resource value of the topography therefore varies throughout the pipeline study area, but on the whole is considered to be **low (1)**.

While a number of fairly large rivers and lesser watercourses are encountered along the pipeline corridor, these elements are often partially or completely screened by vegetation or development in longer-range views. In the majority of instances the banks of the watercourses have also been partially transformed by human activity or erosion, and are sometimes littered with rubbish and debris. Appealing views of waterbodies are encountered in a number of instances, but they are only significant on a local scale. For this reason the visual resource value of the water features along the pipeline corridor is rated as **low (1)**.

Large parts of the countryside have historically been cleared and are characterised by a mosaic of croplands, timber plantations, low density rural settlements, secondary vegetation regrowth and isolated clumps of remaining forest vegetation. Stretches of land now characterised by grassland or savannah-like conditions may once also have been covered by forests, and are also frequently encountered along the pipeline corridor. As a result the vegetation cover encountered along the pipeline corridor also varies greatly, but in most instances still retains a degree of visual appeal and the visual resource value is therefore rated as **moderate (2)**.

As can be expected from the above descriptions, the visual absorption capacity of the study area varies greatly along the pipeline corridor, depending on the prevalent land cover and uses. In instances where large open fields are encountered the visual absorption capacity of the existing landscape is quite low, whereas that of the built-up urban and village areas is significantly higher. However the absorption capacity of the majority of the study area varies somewhat between these extremes, and as a whole is therefore rated as being **moderate (2)**.

Small villages and settlements that dot the greater region are the frequently encountered along the pipeline corridor, and many retain a certain rural character especially where more traditional construction methods are used. The larger towns are typical of a developing African nation, and are characterised by a degree of disarray and a somewhat haphazard overall structure and lower visual appeal than the more rural settlements. The substantial length of the pipeline corridor study area and the varying visual character encountered makes it impossible to describe its sense of place as a whole. However with the possibility of a few localised exceptions, the visual character of the pipeline study area is typical of the greater region and therefore rated as possessing a **low (1)** sense of place.

6.2.2 Visual resource value assessment

The visual resource value ratings assigned to each of the visual attributes determined in Section 6.2.1 are summarised in Table 13 below.

Table 13: Pipeline corridor study area visual resource summary

Visual baseline attribute	Topography	Water bodies	Vegetation	VAC	Sense of place
Visual resource value score	low (1)	low (1)	moderate (2)	moderate (2)	low (1)
Total visual resource value score					**7***

*(*Where: 13 – 15 = High; 9 – 12 = Moderate; 5 – 8 = Low)*

From the assessment performed in Section 6.2.1 and the score ranges presented in Table 13, it is concluded that the visual resource value of the pipeline study area as a whole is **low**. However, it must be borne in mind that localised areas with moderate or even high visual resource are still be encountered, especially where the landscape is still mostly untransformed and appealing features such as rivers and indigenous vegetation are encountered.

An assessment of the expected visual impacts that would arise as a consequence of the construction of the pipeline was subsequently conducted as described in Section 6.3.

6.3 Visual impact assessment

Figure 35 below illustrates a number of representative pipeline construction sites in countryside settings and along an existing road, indicating typical visual impacts associated with projects of this nature. The level of visibility, visual intrusion and proximity of the production facility to identified receptors was evaluated in Sections 6.3.3.1 to 6.3.3.2 respectively. No viewshed analyses were performed for the pipeline, due to the relatively short construction period and generally limited visual range of the study area around the pipeline corridor. Accordingly the visibility and visual exposure to the project was subjectively estimated based on previous experience on similar projects.

6.3.2 Project phases and potential visual impacts

Positioning and lowering of a pipeline along an existing servitude/clearing through a wooded area

Final placement of a pipeline along a newly created corridor through a wooded area

Positioning of a pipeline within a servitude using an existing road as access way

Temporary pipeline and material laydown area

Figure 35: Typical construction related activities and visual impacts associated with the construction phase of a large pipeline project (images Wikipedia, 2017; CCPipeline, 2017)

6.3.3 Visual impact criteria

6.3.3.1 Visibility

The pipeline construction activities will continuously move along the corridor as one section is opened up, the pipe sections placed and the excavations subsequently closed. The degree to which these activities will be visible at any given point in time will therefore vary considerably, as a function of the local topography and land cover. Large sections of the pipeline will be constructed adjacent to existing roads or within servitudes for other linear services, which will increase the visibility of these construction sites somewhat. However, given that these views will in most instances still be reduced to within short (500 m) or at most medium range (i.e. around 2.5 km) the overall visibility of the project construction activities is rated as **low (1)**.

6.3.3.2 Visual exposure

The degree of visual exposure of receptors to the pipeline construction activities in a given area will also vary, depending on the proximity of that section of pipeline to human activity. However, large sections of the pipeline will be located adjacent to roads and will also pass close by numerous villages, and in these instances the visual receptors will be situated close to the construction site and activities. The level of visual exposure at any given area of construction is therefore rated as **high (3)**.

6.3.3.3 Visual intrusion

Regardless of its limited extent, the construction site involves a number of visually intrusive elements including an open pipe trench and soil stockpiles, bare access way and laydown areas, stockpiled sections of pipe, various construction machinery and safety barricades. The locality of the construction site is also characterised by intense activity as machinery, construction materials and people are constantly in motion. Furthermore, the construction site can be a source of nuisance when located where people live or commute, as the site is usually dusty, noisy and results in traffic disruption. For this reason the level of visual intrusion of the site during the construction phase is rated as being **moderate (2)**. Once construction has been completed the degree of visual intrusion will progressively decrease, as rehabilitation measures are implemented and re-vegetation progresses.

In summary, the visual impact criteria ratings for the construction and operational phases of the project performed in Section 6.3.3 above are indicated in Table 14.

Table 14: Visual impact criteria rating

Visual impact	Visual impact criteria			Total rating score
	Visibility	Visual exposure	Visual intrusion	
Visual impact associated with construction phase	Low (1)	High (3)	Moderate (2)	**6 (Moderate)**
Visual impact associated with operational phase	Low (1)	High (3)	Low (1)	**5 (Low)**

(*Where for the total rating score: 3-5 = low; 6-7 = moderate; and 8-9 = high*)

6.3.4 Impact intensity

The intensity of each visual impact was then determined as a function of the visual resource value of the receiving landscape study area (Table 13**)**, together with the visual impact criteria, as summarised in Table 14.

Table 15: Visual impact intensity

Visual resource value	Visual impact criteria rating		
	High	Moderate	Low
High	High (4)	High (4)	Moderate (3)
Moderate	High (4)	Moderate (3)	Low (2)
Low	Moderate (3)	Low (2)	Very low (1)

Accordingly, the intensity of the visual impacts associated with the pipeline section of the project is as follows:

- Visual impact associated with construction phase – **Low (2)**; and
- Visual impact associated with operational phase – **Very low (1)**.

6.3.5 Impact magnitude

The magnitude of each of the construction and operational impacts were determined using the impact intensity determine in Section 6.3.4 above and the criteria listed in Section 5.3.4 indicated in Table 16 below.

Table 16: Visual impact magnitude

Visual impact (Adverse)	Impact magnitude determination criteria				Total magnitude score*
	Intensity	Extent	Duration	Reversibility	
Visual impact associated with construction phase	Low (2)	Local (1)	Short-term (1)	Largely (2)	6
Visual impact associated with operational phase	Very low (1)	Local (1)	Medium-term (2)	Largely (2)	6

*(*Where for the total magnitude score 4-6 = Negligible; 7-9 = Low; 10-12 = Moderate; 13-15 = High)*

Accordingly, the magnitude of each impact is as follows:

- Visual impact associated with construction phase – **Negligible**; and
- Visual impact associated with operational phase – **Negligible**.

6.3.6 Impact significance

6.3.6.1 Visual receptor sensitivity

Visual receptors of the pipeline construction process will be a mixture of transient and resident receptors, and will be largely dependent on where construction is taking place at a specific point in time. In a general sense, resident receptors are expected to attach a higher value to the character and appearance of the visual landscape than transient receptors would, as the former live in and are therefore exposed to any landscape changes for as long as they last. However adopting a conservative approach the perceived landscape value of the majority of potential visual receptors to the pipeline project is expected to at least be **moderate**. Furthermore, the number of potential receptors to a given section of pipeline construction will also vary greatly for obvious reasons, however where the pipeline is located near village or towns or along frequently travelled sections of road, the number of receptors could be significant. For this reason the receptor incidence was rated as **high**.

Table 17: Visual receptor sensitivity

Receptor perceived landscape value	Number of receptors that will see the project (incidence factor)		
	Large	Moderate	Small
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Very low

Based on the anticipated varying levels of perceived landscape value towards the study area and the fact that large numbers of people will likely to be exposed to sections of the project, the overall receptor sensitivity for the pipeline was determined to be **high**.

6.3.6.2 Impact significance assessment

The significance of each visual impact was determined as a function of the magnitude (Table 16) of the impact, together with the visual receptor sensitivity (Table 17); as summarised in Table 18:

Table 18: Determination of impact significance

Magnitude of Impact	Sensitivity of receptor			
	Very low	**Low**	**Medium**	**High**
Negligible	1 Negligible	2 Minor	3 Minor	4 Minor
Low	2 Minor	4 Minor	6 Moderate	8 Moderate
Moderate	3 Minor	6 Moderate	9 Moderate	12 Major
High	4 Minor	8 Moderate	12 Major	16 Major

Accordingly, the significance of each impact is as follows:

- Visual impact associated with construction phase – **Minor**; and
- Visual impact associated with operational phase – **Minor**.

6.3.7 Visual impact mitigation

Opportunities for visual mitigation during the construction phase is limited due to practical constraints and safety considerations, as well as the relatively short time period that construction will take place in any given area. Nevertheless, a high standard of general housekeeping and management of the construction site should be maintained to ensure that further impacts are avoided.

The bulk of visual mitigation must focus on reversing the visually intrusive and unsightly effects of the construction process, by rehabilitating the closed-up sections of the pipeline trench and access roads as quickly as possible. Specific rehabilitation activities will be highly site-specific, however Figure 36 illustrates a typical sequence of rehabilitation activities in this regard.

Initial backfilled pipeline corridor along a steep embankment protected against erosion with mulch and sediment netting (left) and subsequently soil binding polymers (right)

Corridor re-vegetated with grasses and stabilised with erosion-prevention structures, which will in time be re-colonised with suitable tree species (images Beneterra, 2017)

Figure 36: Rehabilitation of a backfilled pipeline corridor

Table 19: Summary of pre- and post-mitigation impact significance

Impact	Pre-mitigation			Post-mitigation		
	Receptor sensitivity	Magnitude	Significance	Receptor sensitivity	Magnitude	Significance
Visual impact associated with construction phase	High	Negligible	Minor	High	Negligible	Minor
Visual impact associated with operational phase	High	Moderate (if adequate rehabilitation is not implemented)	Major	High	Negligible	Minor

7.0 CONCLUSION

The CNOOC Kingfisher Oil Field involves two main components, mainly the construction of a new production facility on the Buhuka flats on the south-eastern shore of Lake Albert; and a crude oil pipeline from the facility will be transferred to delivery point about 52 km northeast of the Kingfisher project. The project is expected to result in a number of visual impacts, which will vary in significance for the two main project components.

The visual resource value of the production facility study area as a whole is considered to be high, based on the appeal of its physical characteristics, as well as the innate and strongly defined sense of place of the study area. The development of the production facility will introduce various visually contrasting infrastructure components into the landscape, which will negatively impact on the visual resource value of the study area. Furthermore the infrastructure will be brightly lit at night which will result in significant visual intrusion, due to the close proximity of local villages to the infrastructure site.

A high overall receptor sensitivity was determined for the project study area, based on the very high perceived landscape value and number of local villagers that will be permanently exposed to the production facility for its operational lifespan. Accordingly, the majority of operational visual impacts for the production facility have been rated as having a high social significance, and it is imperative to ensure that appropriate visual mitigation is implemented.

The majority of operational mitigation centres on screening the main infrastructure elements from critical viewpoints by implementing vegetation screens, as well as reducing the amount of wasteful or disturbing lighting at night. However the extent to which operational impacts can be mitigated is expected to be limited. The balance of the visual mitigation efforts must therefore focus on ensuring that the project does not result in any lasting or long-term impacts once the site has been decommissioned and rehabilitated, as this would greatly reduce the uniqueness of the site's sense of place.

In contrast, the visual resource value of the pipeline study area is generally low, although localised areas with moderate or even high visual resources are still encountered in certain locations. Based on the anticipated varying levels of perceived landscape value towards the study area and the fact that large numbers of people will likely to be exposed to sections of the project, the overall receptor sensitivity for the pipeline is expected to still be high.

The majority of the visual impact associated with the pipeline will occur during the construction phase, and will be relatively localised and of short duration. The resultant significance of these impacts are therefore deemed to be of relatively minor social significance. The bulk of the visual mitigation will focus on reversing the visually intrusive and unsightly effects of the construction process, by rehabilitating the closed-up sections of the pipeline trench and access roads as quickly as possible.

8.0 RECOMMENDATIONS AND WAY FORWARD

It is recommended that the following be conducted going forward, to ensure that appropriate and successful visual mitigation measures are identified and implemented:

- On-site verification should be conducted to identify optimal locations for proposed vegetation screens at the production facility site, based on the results of the viewshed analyses. The extent and orientation of the individual tree screens should be determined on site by conducting line-of-sight evaluations from the respective villages to the individual project infrastructure sites; aware of
- Trials must be conducted to identify the most suitable tree and shrub species to be utilised for establishing the vegetation screens. The selection of plant species must be cognisant of local soil conditions and rainfall, maintenance requirements, expected lifespan and foliage density, as well as the potential for the plants to become invasive;
- A lighting plan and lighting specifications must be developed for the production facility beforehand, with the aim of focussing illumination on critical areas only and minimising sideways and upwards light pollution;

- The impact of night-time illumination of the infrastructure on other biota is acknowledged but has not been assessed as part of this VIA, and will need to be determined using precedent studies and possibly on-site trials; and
- The local villagers must be consulted as part of the visual mitigation planning process, to ensure that proposed measures do not compromise any sites of cultural or spiritual significance.

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APPENDIX A

Document Limitations

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