

**PROPOSED AGGENEIS – ORANJEMOND 400KV POWER LINE AND  
SUBSTATIONS UPGRADE**

**VISUAL IMPACT ASSESSMENT**

Produced for:  
**ESKOM HOLDINGS (LTD)**



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MetroGIS (Pty) Ltd, specialising in visual assessment and Geographic Information Systems, undertook this visual assessment in collaboration with V&L Landscape Architects CC.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990.

The team undertaking the visual assessment has extensive practical knowledge in spatial analysis, environmental modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable.

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the proposed Aggeneis-Oranjemond Power Line Project. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

## 1. INTRODUCTION

Eskom Holdings Limited is proposing the establishment of a new 400kV transmission line which will connect the existing Aggeneis and Oranjemond substations in the Northern Cape Province over an approximate distance of 240km. The envisaged project also includes the upgrade of both substations within the existing HV yards to accommodate the new transmission line.

The study site is located within the Eskom Western Grid and forms part of the Northern Cape Strengthening Project.

It is proposed that the transmission line be constructed as a 400kV line but be operated at 220kV for the first 5-10 years. The envisaged project also includes the upgrade of both substations within the existing HV yards to accommodate the new transmission line.

Four technically feasible alternative alignment corridors have been identified for investigation through the EIA process (Refer to **Map 1**):

- o The first alternative follows the existing power line alignment which links the Aggeneis, the Nama, the Gromis and the Oranjemond Transmission Substations. The length of this corridor is **302.989km**.

The alternative runs in a south westerly direction from the Aggeneis Transmission Substation, roughly parallel to the N14 to Okiep and Springbok.

Beyond Springbok, the corridor follows the R355 for a short distance before swinging north west to link with the Gromis Substation. From Gromis, the corridor banks to the north and follows the coastline at a distance of approximately 10km, all the way to the Oranjemond substation.



**Figure 1:** Aerial view of a section of the N17 national road, running between Aggeneys and Springbok.

In addition to traversing the escarpment near Springbok, this alternative also crosses the Buffels River in two places, and cuts through the northern most tip of the Goegap Nature Reserve.

- The second alternative has a total length of **275.593km**. It runs in a westerly direction from the Aggeneis Transmission Substation, cutting straight cross-country for approximately 100 km.

After crossing over the N7, the alignment banks to the north west, bypassing the town of Steinkopf, before swinging sharply to the west, to follow the R382 toward the coast. Approximately 10km from the coast, the corridor turns to the north, following the coastline at a constant distance, to the Oranjemond Transmission Substation.

This alternative traverses the escarpment near Steinkopf.

- Alternative 3 runs in a slightly north westerly direction from the Aggeneis Transmission Substation, cross country over flat open plains towards Steinkopf. The corridor bypasses Steinkopf to the north, banking slightly to the north. The alignment continues in a north-north-westerly direction before turning north approximately 15km south-west of Lekkersing.

From this point, the corridor heads straight for the Oranjemond Transmission Substation at a distance of about 15km from the coastline.

Alternative 3 traverses the escarpment just north of Steinkopf, and runs about 70km south of the southernmost tip of the Ai-Ais/Richtersveld Transfrontier Park. It also crosses both the Holgat and Kamma Rivers. The total length of Corridor 3 is **248.861km**.



**Figure 2:** Aerial view of the area surrounding Steinkopf.

- The fourth alternative follows largely the same alignment as Alternative 2. The difference in this alignment is a more gradual westward bend just to the west of Steinkopf. It then follows the R382 toward the coast.

Some 10km from the coast, the alignment turns to the north to follow the existing power line alignment all the way to the Oranjemond Transmission Substation.

The total length of Corridor 4 is **270.570 km**.

The four alternatives are illustrated on **Map 1**.

Ancillary development includes access roads for construction and maintenance purposes as well as the upgrading of relevant substations.

It is uncertain what the lifespan of the power lines are expected to be.

## **2. SCOPE OF WORK**

The study area for the visual assessment encompasses a geographical area of approximately 24 000km<sup>2</sup> (the extent of the maps displayed below) and includes a minimum 5km buffer (i.e. extending 5km on either side) from the centreline of each of the proposed power line corridors.

The scope of work for this assessment includes the determination of the potential visual impacts in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed power line.

Issues related to the proposed power line alternatives include:

- The visibility of the power line to, and potential visual impact on, observers travelling along the national (N7 and N14), arterial (R382 and R355) and secondary roads within the study area.
- The visibility of the power line to, and potential visual impact on built-up centres and populated places (i.e. the town of *Springbok*) within the study area.
- The visibility of the power line to, and potential visual impact on farmsteads and settlements within the study area.
- The visibility of the power line to, and potential visual impact on protected and conservation areas within the region (i.e. the *Goegap Nature Reserve and Hester Malan Nature Wild Flower Reserve*).
- The potential impact of the power line on the visual character and sense of place of the region and the scenic Northern Cape.
- The potential impact of the power line on tourism, with specific reference to tourist access routes (i.e. the N7, N14, R382, R355 and secondary roads), scenic drives (i.e. secondary roads) and passes (i.e. the *Spektakel*, the *Nanaams* and the *Anenous*) and tourist destinations;
- The potential impact of the power line on the declared and tentatively listed World Heritage sites (i.e. the *Richtersveld Cultural and Botanical Landscape* and the *Namaqualand Copper Mining Landscape* respectively).
- The potential visual impact of the power line on scenic and sensitive topographical features, particularly the mountains including *Aggeneys se Berg*, *Swartberg*, *Lemoenpoortberg*, *Langberg*, *Naaib se Berg*, *Nuwefontein se Berge*, *Haromkaroep*, *Karasberg*, *Ouareb se Berge* and the rivers (*Orange*, *Holgat*, *Kamma*), of the region.
- The potential visual impact of associated infrastructure and development (i.e. access roads) on observers in close proximity to the proposed power line.
- Potential cumulative visual impacts.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

The substation upgrades will take place within the existing substation HV yards, and therefore associated visual impacts are likely to be limited in extent to that of the existing substations. There will therefore be no change in the existing impact. This assessment therefore excludes the proposed substation upgrades.

### **3. METHODOLOGY**

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed infrastructure. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Surveyor General.

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

The approach utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc;
- The identification of sensitive environments upon which the proposed infrastructure could have a potential impact;
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed power line alternatives, as well as offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

- **Determine potential visual exposure**

The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed power lines were not visible, no impact would occur.

Viewshed analyses of the proposed power line alternatives, based on a 20 m interval digital terrain model of the study area, indicate the potential visibility.

- **Determine visual distance / observer proximity**

In order to refine the visual exposure of the infrastructure on surrounding areas / receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the infrastructure.

Proximity offsets for the proposed development site are created in order to indicate the scale and viewing distance of the infrastructure and to determine the prominence of the structures in relation to their environment.

The visual distance theory and the observer's proximity to the infrastructure are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed infrastructure.

- **Determine viewer incidence / viewer perception**

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers, then there would be no visual impact. If the visual perception of the structure is favourable to all the observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed power line alternatives.

It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

- **Determine the visual absorption capacity of the landscape**

This is the capacity of the receiving environment to absorb or screen the potential visual impact of the proposed infrastructure. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

The digital terrain model utilised in the calculation of the visual exposure of the infrastructure does not incorporate the potential visual absorption capacity (VAC) of the region. It is therefore necessary to determine the VAC by means of the interpretation of the natural visual characteristics, supplemented with field observations.

- **Determine the visual impact index**

The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the severity of each impact.

#### **4. THE AFFECTED ENVIRONMENT**

Regionally, the study area is located within the north western part of the Northern Cape Province, with elevation ranging from 0 to 1380m a.s.l. The mountains surrounding the Orange River range from less than 350m (elevation) to 1380m a.s.l.

The terrain west of the town of Aggeneys is described as *plains* with even slopes, while the rest of the study area consists of *low mountains* of the escarpment and *slightly undulating plains* along the coast.

The Orange River is the most prominent hydrological feature in the area, but other rivers, such as the Buffels, the Holgat and the Kamma Rivers are also prominent. Refer to **Map 1**.

Land use is largely unspecified within the study area, consisting of wide open land, mostly left in its natural state. Some low density agricultural practices (livestock farming) occur, and extensive mining takes place along the coastline between Alexander Bay and Kleinsee.

The major towns in the area include Springbok, Nababeep, Kleinsee, Port Nolloth and Alexander Bay. In addition, a number of farms and homesteads also occur within the study area.

The above mentioned major towns, as well as the smaller towns of Eksteensfontein, Vioolsdrift, Aggeneys, Okiep, Concordia, Bulletrap and Steinkopf, account for the highest population concentration within the region, which has a very sparse average of 2 people per km<sup>2</sup>.

Of relevance is that most of these towns have a history extending back to the mid-19th century and have historic significance.

Industrial infrastructure includes existing power lines extending along the western seaboard, as well as to the east and the south of the study area. The N7, the N14 and arterial roads, including the R382 and the R355, traverse the area. In addition, a number of secondary roads interconnect within the region.

Outside of the towns and mining areas, large tracts of land are still in an undisturbed and natural state with some areas, particularly the mountains, maintaining a virtually pristine condition. This is due mainly to the low population density of the area and the relative remoteness and inaccessibility of the terrain.

Land cover is mostly *Thicket and Bushland* with a large zone of *herbland* in the north west of the study area, adjacent to the Orange River. Small patches of *Grassland* are evident in the east and limited extents of *irrigated agriculture* occurs along the river.

Land cover is undisturbed for large sections in the study area, but significant degraded areas are found in the area between Aggeneys and the N7 arterial route. This is likely due to agricultural activities and settlement patterns. Mining occurs to a large extent within the first 10km of the coastline. Refer to **Map 2**.

The natural vegetation types include *Strandveld of West Coast* along the coastline, giving rise to a combination of *Succulent Karoo* and *Namaqualand Broken Veld* in the vicinity of Springbok. To the east, the vegetation consists of *Mountain renoster-bush Veld*.<sup>1</sup>

The study area includes two large conservation or protected areas, these being the Goegap Nature Reserve situated to the east of Springbok, and the Ai-Ais/Richtersveld Transfrontier Park, situated to the far north, near Alexander Bay. In addition to these, the Hester Malan Nature Wild Flower Reserve is a small reserve located just outside of Springbok.

The greater region is generally seen as having a high scenic value and high tourism value potential. It is well known for its scenic natural beauty (West Coast as a whole) and annual wild flower displays (Namaqualand)<sup>2</sup>.

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<sup>1</sup> Information sourced from DEAT (ENPAT Northern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland) and NLC2000 (ARC/CSIR).

<sup>2</sup> Namaqualand stretches from the small town of Garies in the south to the Orange River to the north, its western border is the wild Atlantic coast, the remote town of Pofadder marks the eastern border (<http://www.discoverthecape.com/namaqualand/flower-route.html> )

Within this scenic context, it is of relevance that the mining areas along the coastline are significantly disturbed and visually apparent due to the scale and nature of the surface based mining.

The arterial R382 and the R355 roads offer scenic drives through Namaqualand, especially where these traverse the escarpment. In this respect, the *Spektakel Pass*, located on the R555 some 25km west of Springbok and the *Nonaams* and *Aneous Pass*, some 15km west of Steinkopf on the R382 are of relevance.

In addition to their scenic offering, both these routes are primary access roads linking the N7 with Kleinsee and Port Nolloth respectively, and thus carry both commuters and tourists.

During the flower season, a number of secondary roads are favoured by tourists. These include the road to the east of the N7 running from Okiep to Steinkopf and from Okiep via Concordia to the Orange River. Other roads include those linking the R382 with Eksteenfontein and Lekkersing in the Richtersveld.

The latter roads are also used by the Richtersveld Community and visitors to the Richtersveld National Park and thus represent alternative access routes for many tourists.

In 2007 large portions of the Richtersveld National Park and surrounding communal lands were declared a World Heritage Site, namely the *Richtersveld Cultural and Botanical Landscape*.

Furthermore, in 2009, parts of Okiep, Springbok, Concordia and Port Nolloth as well as the historic railway line between Okiep and Port Nolloth<sup>3</sup> were nominated as the *Namaqualand Copper Mining Landscape* on South Africa's tentative list of World Heritage Sites<sup>4</sup>.

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<sup>3</sup> No complete spatial information on the alignment of this historic railway line is available, so it is assumed to run parallel to the N7 between Okiep and Steinkopf, and parallel to the R383 up to the Aneous pass and then straight cross country to Port Nolloth.

<sup>4</sup> Information sourced from the Heritage Impact Assessment: Proposed Aggeneis-Oranjemond 400kv Line and Substations Upgrade, Northern Cape Province (ACO Associates, 2011).



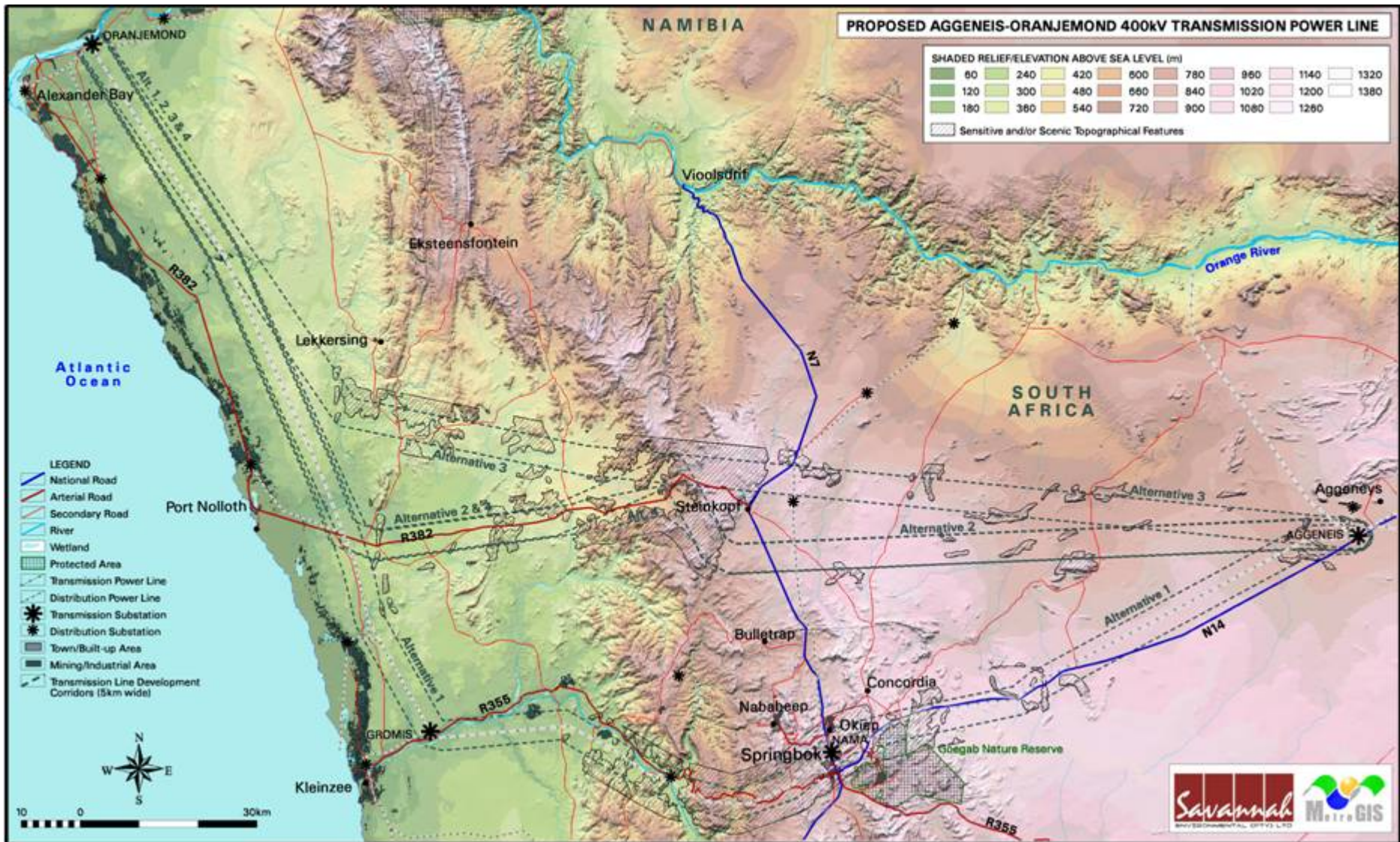
**Figure 3:** Aerial view of the mountains surrounding the Orange River Valley.

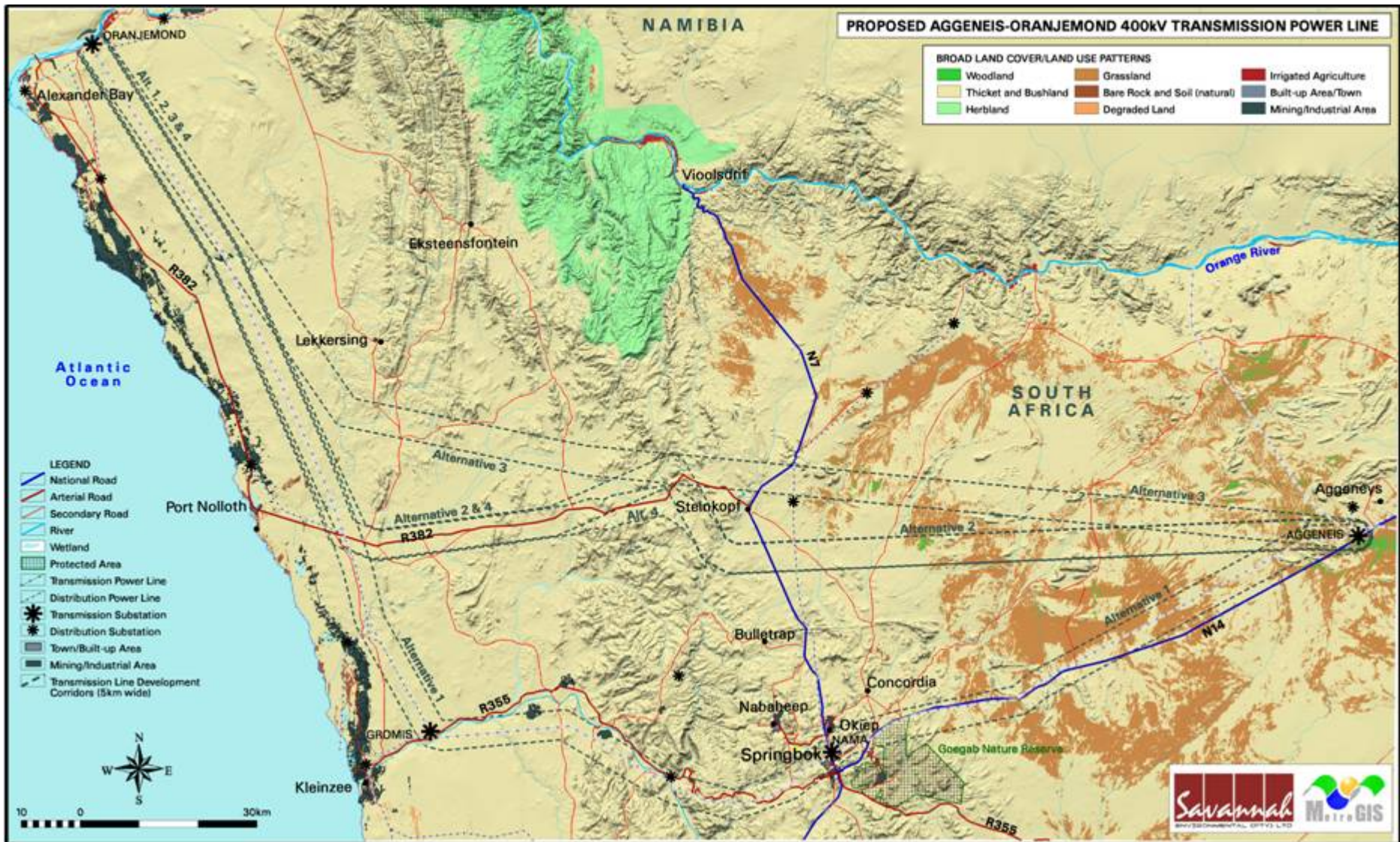


**Figure 4:** Aerial view of the mountains surrounding the Okiep and Springbok area.



**Figure 5:** Aerial view of the open plains (thicket and bushland) west of Aggeneys.





Map 2: Broad land cover and land use within the study area.

## 5. RESULTS

### 5.1. Potential visual exposure

The visibility analyses for each of the transmission line alternatives was calculated from the centreline of each corridor, for a distance of 5km on either side at an offset height of 35m above ground level (i.e. the maximum height of the pylon structures) in order to simulate a worst case scenario.

Maps 3-6 indicate the areas from which each of the 4 power line Alternatives could potentially be visible.

All four alternative alignments will be visually exposed to large areas within their respective 5km offsets. This is due mainly to the relatively tall (35m) transmission line infrastructure associated with 400kV power lines.

In addition, all four alternatives tend to display an even potential exposure pattern where they traverse flat terrain and more scattered patterns where they encounter elevated and hilly topography.

It is envisaged that all 4 power line alternatives would be easily and comfortably visible to observers (i.e. people travelling along roads, residing in towns and at homesteads or visiting the region), especially within a 5km offset of the corridor in question, and could potentially constitute a high visual prominence, potentially resulting in a visual impact.

The following is of specific relevance regarding the proposed power line corridors:

#### 5.1.1. Alternative 1

This Alternative (refer to **Map 3**) runs alongside an existing power line for its entire length. The alignment crosses a number of large rivers and passes through the mountainous area between Goegap Nature Reserve and the escarpment for a distance of about 65km. Although the nature of the terrain offers some visual screening due to the hilly topography, it also represents natural features sensitive to visual intrusion (i.e. the scenic mountains).

Stretches of the N14 and R355 will be exposed to potential visual impact along lengths where the proposed Alternative runs alongside the road. Both of these are important tourist access routes, and the Spektakel Pass west of Springbok on the R355 is particularly scenic.

In addition, short stretches of the N7, the R382 and various secondary roads will be exposed to potential visual impact where the proposed Alternative crosses over.

Residents of and visitors to the town of Springbok (which has some historic status) and visitors to the northern parts of the Goegap Nature Reserve and to the Hester Malan Nature Wild Flower Reserve just outside Springbok may also be affected.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed for this Alternative, although this part of the Heritage Site is already impacted upon by the presence of the existing power line.

Lastly, the Namaqualand Copper Mining Landscape may be potentially impacted upon at Springbok, and for a very short stretch where the Alignment crosses the historic railway line (i.e. in the vicinity of the R382).

### **5.1.2. Alternative 2**

This Alternative (refer to **Map 4**) takes a more direct route to the west, before zigzagging through mountainous terrain between Steinkopf and the escarpment. In addition to this roughly 40km stretch through the mountains, the alignment also crosses a few minor drainage lines.

Long stretches of the R382 will be exposed to potential visual impact along lengths where the proposed Alternative runs alongside the road. This is also an important tourist access route, and the Anenous and Nonaams Passes west of Steinkopf on the R382 are particularly scenic.

In addition, short stretches of the N14, the N7 and various secondary roads lie within the zone of potential visual exposure where the proposed Alternative crosses over. The two secondary roads leading north off the R382 to Lekkersing and Eksteenfontein are popular scenic drives during the flower season.

No towns (historic or otherwise) fall within the zone of potential visual exposure.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed for this Alternative, although this part of the Heritage Site is already impacted upon by the presence of the existing power line.

Lastly, the Namaqualand Copper Mining Landscape may be potentially visually impacted upon where the historic railway line runs adjacent to the R382 between Steinkopf and Port Nolloth.

### **5.1.3. Alternative 3**

This Alternative (refer to **Map 5**) is even more direct in its alignment than Alternative 2. The stretch through the mountains between Steinkopf and the escarpment is, however, somewhat longer, measuring approximately 70km. The alignment also crosses a few minor rivers.

Short stretches of the R382, the N14, the N7 and various secondary roads will be exposed to potential visual impact where the proposed Alternative crosses over or bypasses nearby. Two of the secondary roads leading north off the R382 to Lekkersing and Eksteenfontein are popular scenic drives during the flower season and the Anenous and Nonaams Passes west of Steinkopf on the R382 are particularly scenic.

No towns (historic or otherwise) fall within the zone of potential visual exposure.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed for this Alternative. This is the only Alternative that does not correspond with the existing power line in this part of the Heritage Site and therefore represents a new visual impact.

Lastly, the Namaqualand Copper Mining Landscape may be potentially impacted upon for a very short stretch of the historic railway line in the vicinity of Anenous and Nonaams Passes.

#### 5.1.4. Alternative 4

This Alternative (refer to **Map 6**) follows mostly the same alignment as Alternative 2, but takes a shortcut through the mountains west of Steinkopf. In addition to this roughly 35km stretch through the mountains, the alignment also crosses a few minor drainage lines.

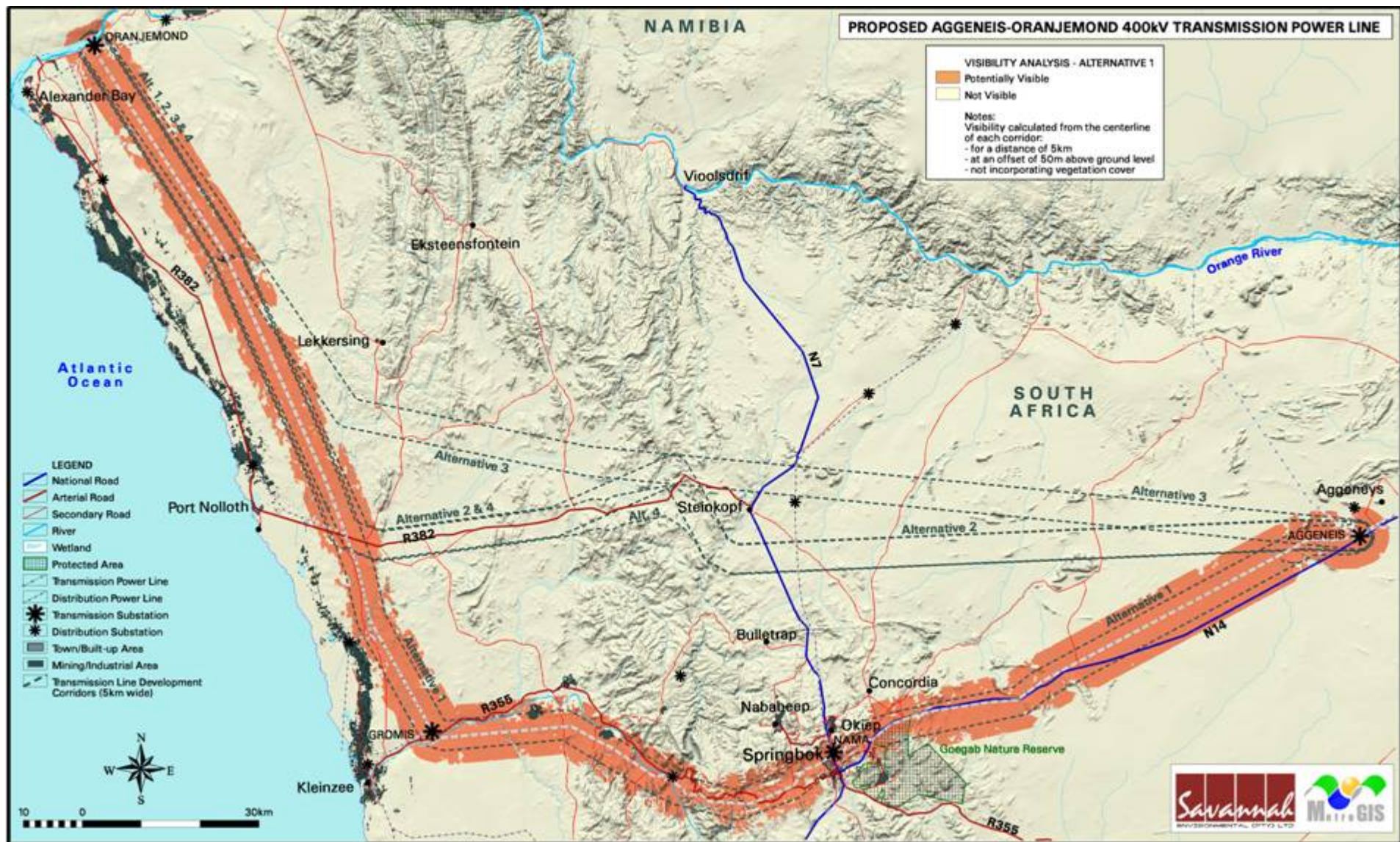
Long stretches of the R382 will be exposed to potential visual impact along lengths where the proposed Alternative runs alongside the road. This is also an important tourist access route, and the Anenous and Nonaams Passes west of Steinkopf on the R382 are particularly scenic.

In addition, short stretches of the N14, the N7 and various secondary roads lie within the zone of potential visual exposure where the proposed Alternative crosses over. The two secondary roads leading north off the R382 to Lekkersing and Eksteenfontein are popular scenic drives during the flower season.

No towns (historic or otherwise) fall within the zone of potential visual exposure.

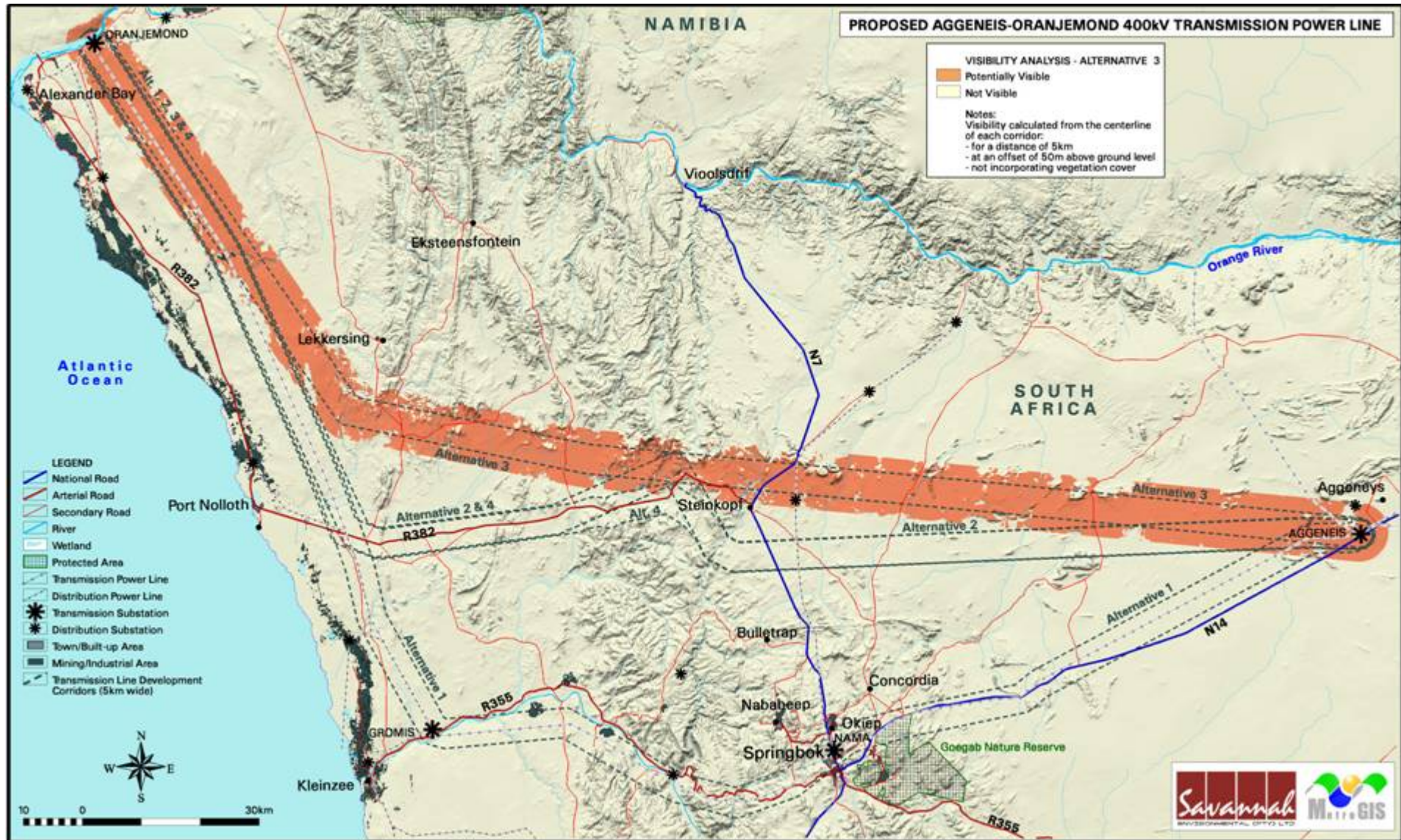
The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed for this Alternative, although this part of the Heritage Site is already impacted upon by the presence of the existing power line.

Lastly, the Namaqualand Copper Mining Landscape may be potentially impacted upon where the historic railway line runs along the R382 between Steinkopf and Port Nolloth.

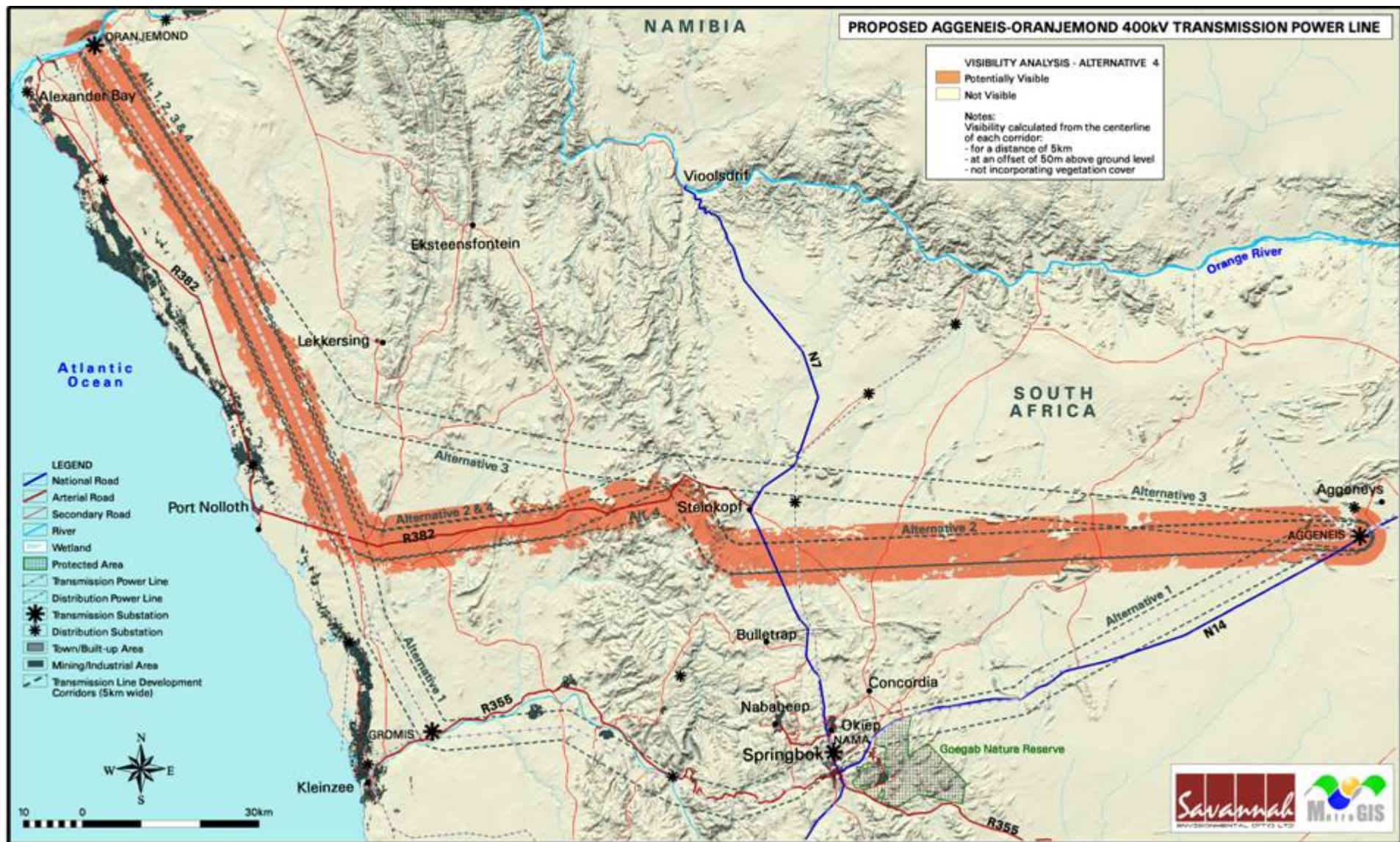


Map 3: Potential visual exposure of proposed Alignment Alternative 1.





Map 5: Potential visual exposure of proposed Alignment Alternative 3.



Map 6: Potential visual exposure of proposed Alignment Alternative 4.

## 5.2. Visual distance / observer proximity

MetroGIS determined proximity offsets based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure).

The proximity offsets (calculated from the centre line of each Alignment) are shown on **Map 7** and are as follows:

- 0 – 500m - Short distance view where the infrastructure would dominate the frame of vision and constitute a very high visual prominence.
- 500 - 1000m - Medium distance views where the infrastructure would be easily and comfortably visible and constitute a high visual prominence.
- 1000 – 2000m - Medium to longer distance view where the infrastructure would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.
- Greater than 2000m - Long distance view where the infrastructure would still be visible though not as easily recognisable. This zone constitutes a low visual prominence for the infrastructure.

## 5.3. Viewer incidence / viewer perception

Refer to **Map 7**. Viewer incidence is calculated to be the highest along the national and arterial roads (i.e. the N7, N14, R355 and R382) as well as the secondary roads within the study area. Commuters and tourists using these roads will be negatively impacted upon by visual exposure to the proposed power line.

Other than along the above roads, viewer incidence is concentrated in the populated places within the study area. These include the major towns (i.e. Springbok, Nababeep, Kleinsee, Port Nolloth and Alexander Bay) and the smaller towns (i.e. Eksteensfontein, Vioolsdrift, Aggeneys, Okiep, Concordia, Bulletrap and Steinkopf).

Homesteads and settlements also occur within 500m of each of the corridors as follows:

- Alternative 1: approximately 3 are within 500m of the alignment and 9 between 500m and 2km from the alignment. All are located east of the N7.
- Alternative 2: approximately 4 are within 500m of the alignment and 5 between 500m and 2km from the alignment. All are located east of the N7.
- Alternative 3: approximately 3 are within 500m of the alignment and 6 between 500m and 2km from the alignment. All are located east of the N7.
- Alternative 4: approximately 4 are within 500m of the alignment and 5 between 500m and 2km from the alignment. All are located east of the N7.

*It is uncertain whether all of the potentially affected settlements are inhabited or not, so it is assumed that they are all inhabited.*

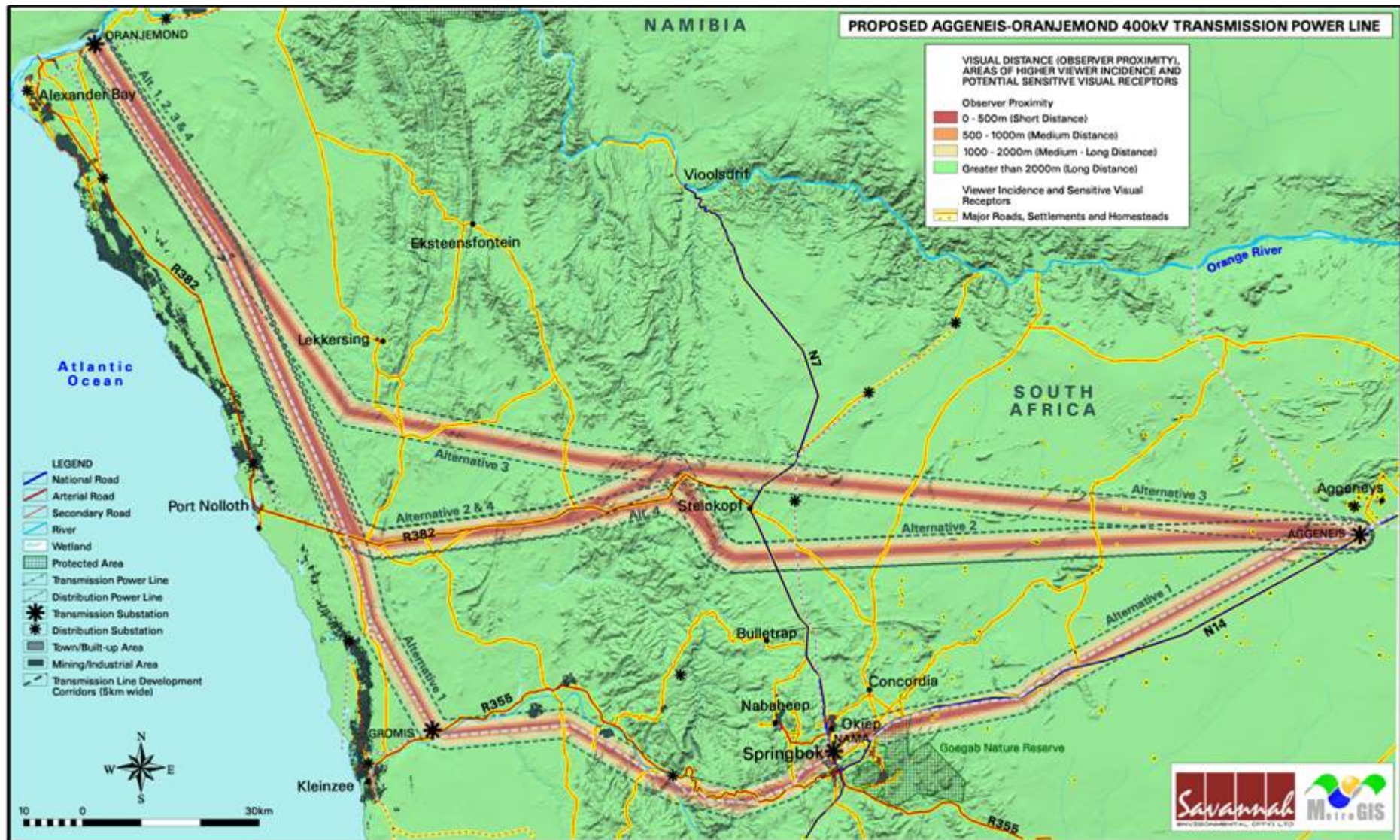
The remainder of the study area consists predominantly of undeveloped natural land or grazing with a low occurrence of receptors.

The region as a whole has a high scenic value, and an associated tourism value and sense of place. The harsh, rugged, wide open spaces have a specific aesthetic appeal, and during the flower season, the environment is completely transformed.

In addition, the declared and tentatively listed World Heritage Sites (i.e. the Richtersveld Cultural and Botanical Landscape and the Namaqualand Copper Mining Landscape respectively) contribute further to the tourism value of the areas.

Tourists and visitors to this area are therefore seen as sensitive visual receptors upon which the construction of the new power line could have a negative visual impact.

The severity of the visual impact on these receptors decreases with increased distance from the proposed infrastructure.



**Map 7:** Observer proximity to the proposed corridor Alternatives and areas of high viewer incidence.

## 5.4 Visual absorption capacity

With its arid climate, the study area receives less than 120mm of rainfall per annum. Land cover is mostly *Thicket and Bushland*, which is generally short and sparse vegetation which is less than 2m tall.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is deemed to be negligible by virtue of the vegetation and the low occurrence of development.

VAC will therefore not be taken into account.

## 5.5. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the respective power line corridor Alternatives are displayed on **Maps 8-11**.

Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, high frequency of visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

It is important to note the undeveloped and natural landscape character as well as the tourism value of the area, both in terms of tourist access routes and destinations.

In addition, the construction of the power line in close proximity to features of natural beauty (such as the mountains), conservation areas and tourist attractions is likely to impact on the sense of place and aesthetic appeal of the landscape.

The following is of specific relevance regarding the proposed power line corridor alternatives:

### 5.5.1. Alternative 1

Refer to **Map 8**, as well as to Maps 12-21, which are enlargements of the referenced sections of Map 8. These enlargements have been included as an appendix to this document.

- The visual impact index map clearly indicates a core area of potentially **high** visual impact within a 500m offset on either side of the proposed power line (i.e. short distance).

This zone of potentially high visual impact includes a far northern strip of the Goegap Nature Reserve. Within the mountains (i.e. between Goegap and the escarpment), some visually protected patches occur, shielded from potential impact by virtue of the topography.

Potential areas of **very high** visual impact within the short distance include the following:

- Stretches of the N14, R355 and various secondary roads (where the alignment runs adjacent to the road);
  - Very short stretches of the N7, the R355, the R382 and various secondary roads (where the alignment crosses the road);
  - The far north western parts of Springbok, which has some historic status;
  - A number of settlements (approximately 3 in the east of the study area);
  - Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 65km section of alignment between Goegap and the escarpment, and to a lesser extent in the east between Goegap and Aggeneys and
  - A short stretch of the historic railway line in the vicinity of the R382 Alignment crossing.
- The extent of visual impact remains high in the medium distance (i.e. between the 500m and 1000m offset), especially in the mountainous areas between Goegap and the escarpment. Potential visual impact is mostly **moderate** within this zone, which includes a northern strip of the Goegap Nature Reserve.

Potential areas of **high** visual impact within the medium distance include the following:

- Stretches of the N14, R355 and various secondary roads (where the alignment runs adjacent to the road);
  - Very short stretches of the N7, the R355, the R382 and various secondary roads (where the alignment crosses the road);
  - The north western parts of Springbok, which has some historic status;
  - A number of settlements (approximately 2 in the east of the study area);
  - The mountains and steep slopes in the 65km section of alignment between Goegap and the escarpment, and to a lesser extent in the east between Goegap and Aggeneys and
  - A short stretch of the historic railway line in the vicinity of the R382 Alignment crossing.
- The extent of visual impact is somewhat reduced in the medium to longer distance (i.e. between the 1000m and 2000m offset), especially in the mountainous areas between Goegap and the escarpment. Potential visual impact is mostly **low** within this zone, which includes a northern strip of the Goegap Nature Reserve.

Potential areas of **moderate** visual include:

- Stretches of national, arterial and secondary roads (where the alignment runs adjacent to or crosses the road);
- The Spektakel Pass west of Springbok on the R355;
- The south eastern parts of Springbok (which has some historic status) and surrounds;
- A number of settlements (approximately 7 in the east of the study area);
- The mountains and steep slopes in the 65km section of alignment between Goegap and the escarpment, and to a lesser extent in the east between Goegap and Aggeneys; and

- A short stretch of the historic railway line in the vicinity of the R382 Alignment crossing.
- Beyond the 2000m offset (i.e. long distance), potential visual impacts are mostly **very low**. Exceptions are the mountainous areas, the roads, the settlements (where these occur) and the town of Springbok (which has some historic status. Potential visual impact for these receptors is expected to be **low**.

### 5.5.2. Alternative 2

Refer to **Map 9**, as well as to Maps 22-30, which are enlargements of the referenced sections of Map 8. These enlargements have been included as an appendix to this document.

- The visual impact index map clearly indicates a core area of potentially **high** visual impact within a 500m offset on either side of the proposed power line (i.e. short distance).

Within the mountainous areas (i.e. between Steinkopf and the escarpment), patches of visually protected areas occur, shielded from potential impact by virtue of the topography.

Potential areas of **very high** visual impact within the short distance include the following:

- Stretches of the R382 (where the alignment runs adjacent to the road);
- The Anenous and Nonaams Passes west of Steinkopf on the R382;
- Very short stretches of the N7 and various secondary roads (where the alignment crosses the road);
- A number of settlements (approximately 4 in the east of the study area);
- Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 40km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and
- Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.
- The extent of visual impact remains high in the medium distance (i.e. between the 500m and 1000m offset), especially in the mountainous areas between Steinkopf and the escarpment. Potential visual impact is mostly **moderate** within this zone.

Potential areas of **high** visual impact within the medium distance include the following:

- Stretches of the R382 (where the alignment runs adjacent to the road);
- Very short stretches of the N7 and various secondary roads (where the alignment crosses the road);
- A number of settlements (approximately 3 in the east of the study area);
- The mountains and steep slopes in the 40km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and

- Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.
- The extent of visual impact is somewhat reduced in the medium to longer distance (i.e. between the 1000m and 2000m offset), especially in the mountainous areas between Steinkopf and the escarpment. Potential visual impact is mostly **low** within this zone.

Potential areas of **moderate** visual include:

- Stretches of national, arterial and secondary roads (where the alignment runs adjacent to or crosses the road);
- A number of settlements (approximately 2 in the east of the study area);
- The mountains and steep slopes in the 40km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and
- Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.
- Beyond the 2000m offset (i.e. long distance) potential visual impacts are mostly **very low**. Exceptions are the mountainous areas, the roads and the settlements, where these occur. Potential visual impact for these receptors is expected to be **low**.

### 5.5.3. Alternative 3

Refer to **Map 10**, as well as to Maps 31-39, which are enlargements of the referenced sections of Map 8. These enlargements have been included as an appendix to this document.

- The visual impact index map clearly indicates a core area of potentially **high** visual impact within a 500m offset on either side of the proposed power line (i.e. short distance).

Within the mountainous areas (i.e. between Steinkopf and the escarpment), patches of visually protected areas occur, shielded from potential impact by virtue of the topography.

Potential areas of **very high** visual impact within the short distance include the following:

- Very short stretches of the N7 and various secondary roads (where the alignment crosses the road);
- A number of settlements (approximately 3 in the east of the study area); and
- Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 70km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys.
- A very short stretch of the historic railway line in the vicinity of Anenous and Nonaams Passes.
- The extent of visual impact remains high in the medium distance (i.e. between the 500m and 1000m offset), especially in the mountainous areas between Steinkopf and the escarpment. Potential visual impact is mostly **moderate** within this zone.

Potential areas of **high** visual impact within the medium distance include the following:

- Very short stretches of the N7, the R382 and various secondary roads (where the alignment crosses the road);
  - Parts of the Anenous and Nonaams Passes west of Steinkopf on the R382;
  - A number of settlements (approximately 2 in the east of the study area);
  - The mountains and steep slopes in the 70km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and
  - A very short stretch of the historic railway line in the vicinity of Anenous and Nonaams Passes.
- The extent of visual impact is somewhat reduced in the medium to longer distance (i.e. between the 1000m and 2000m offset), especially in the mountainous areas between Steinkopf and the escarpment. Potential visual impact is mostly **low** within this zone.

Potential areas of **moderate** visual include:

- Very short stretches of national, arterial and secondary roads (where the alignment runs adjacent to or crosses the road);
  - Parts of the Anenous and Nonaams Passes west of Steinkopf on the R382;
  - A number of settlements (approximately 4 in the east of the study area);
  - The mountains and steep slopes in the 70km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys; and
  - A very short stretch of the historic railway line in the vicinity of Anenous and Nonaams Passes.
- Beyond the 2000m offset (i.e. long distance), potential visual impacts are mostly **very low**. Exceptions are the mountainous areas, the roads and the settlements, where these occur. Potential visual impact for these receptors is expected to be **low**.

#### 5.5.4. Alternative 4

Refer to **Map 11**, as well as to Maps 40-48, which are enlargements of the referenced sections of Map 8. These enlargements have been included as an appendix to this document.

- The visual impact index map clearly indicates a core area of potentially **high** visual impact within a 500m offset on either side of the proposed power line (i.e. short distance).

Within the mountainous areas (i.e. between Steinkopf and the escarpment), patches of visually protected areas occur, shielded from potential impact by virtue of the topography.

Potential areas of **very high** visual impact within the short distance include the following:

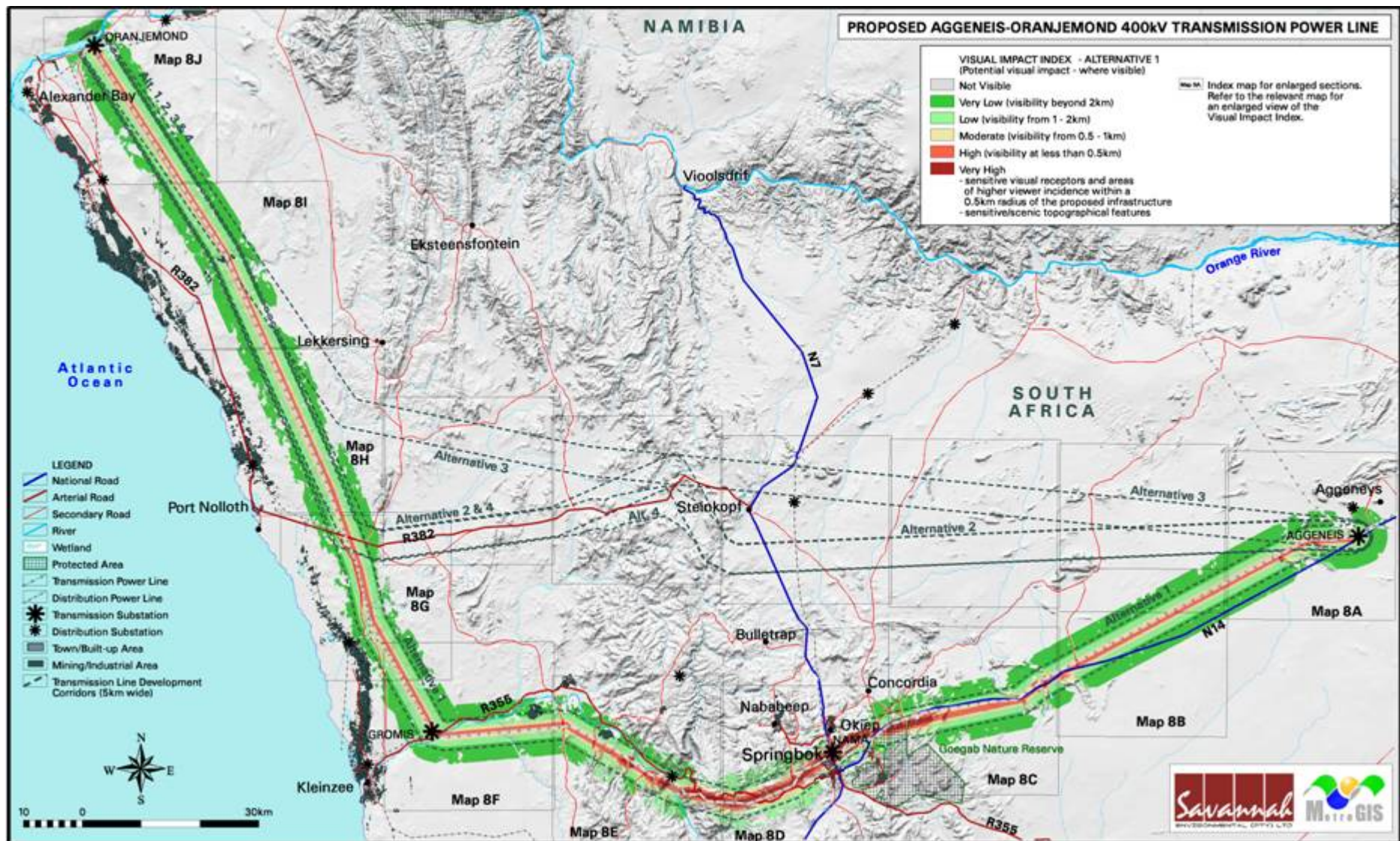
- Stretches of the R382 (where the alignment runs adjacent to the road);
  - Very short stretches of the N7 and various secondary roads (where the alignment crosses the road);
  - A number of settlements (approximately 4 in the east of the study area); and
  - Topographically sensitive features such as mountains and steep slopes. These occur primarily in the 35km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys.
- The extent of visual impact remains high in the medium distance (i.e. between the 500m and 1000m offset), especially in the mountainous areas between Steinkopf and the escarpment. Potential visual impact is mostly **moderate** within this zone.

Potential areas of **high** visual impact within the medium to longer distance include the following:

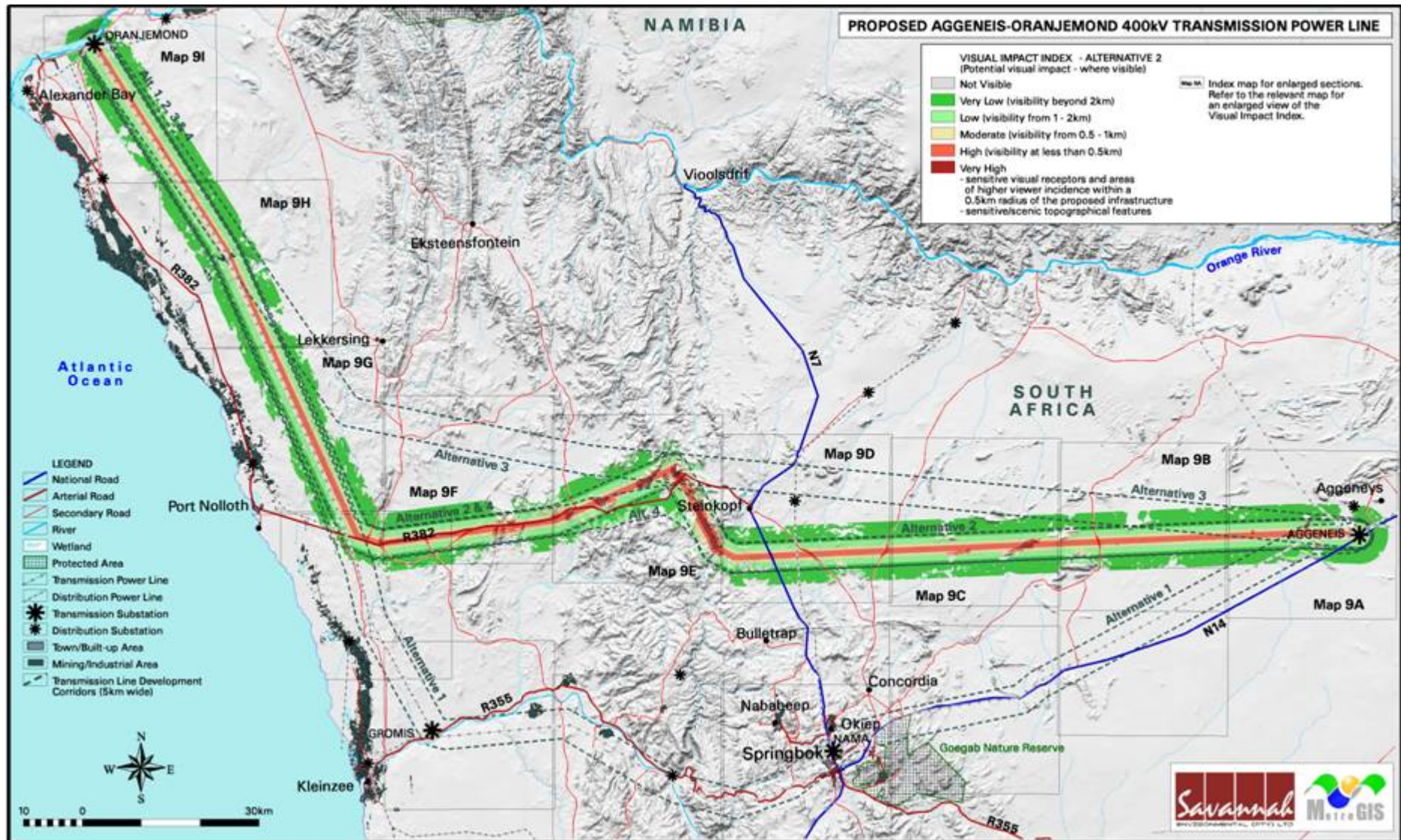
- Stretches of the R382 (where the alignment runs adjacent to the road);
  - Parts of the Anenous and Nonaams Passes west of Steinkopf on the R382;
  - Very short stretches of the N7 and various secondary roads (where the alignment crosses the road);
  - A number of settlements (approximately 3 in the east of the study area);
  - The mountains and steep slopes in the 35km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys and
  - Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.
- The extent of visual impact is somewhat reduced in the medium to longer distance (i.e. between the 1000m and 2000m offset), especially in the mountainous areas between Steinkopf and the escarpment. Potential visual impact is mostly **low** within this zone.

Potential areas of **moderate** visual include:

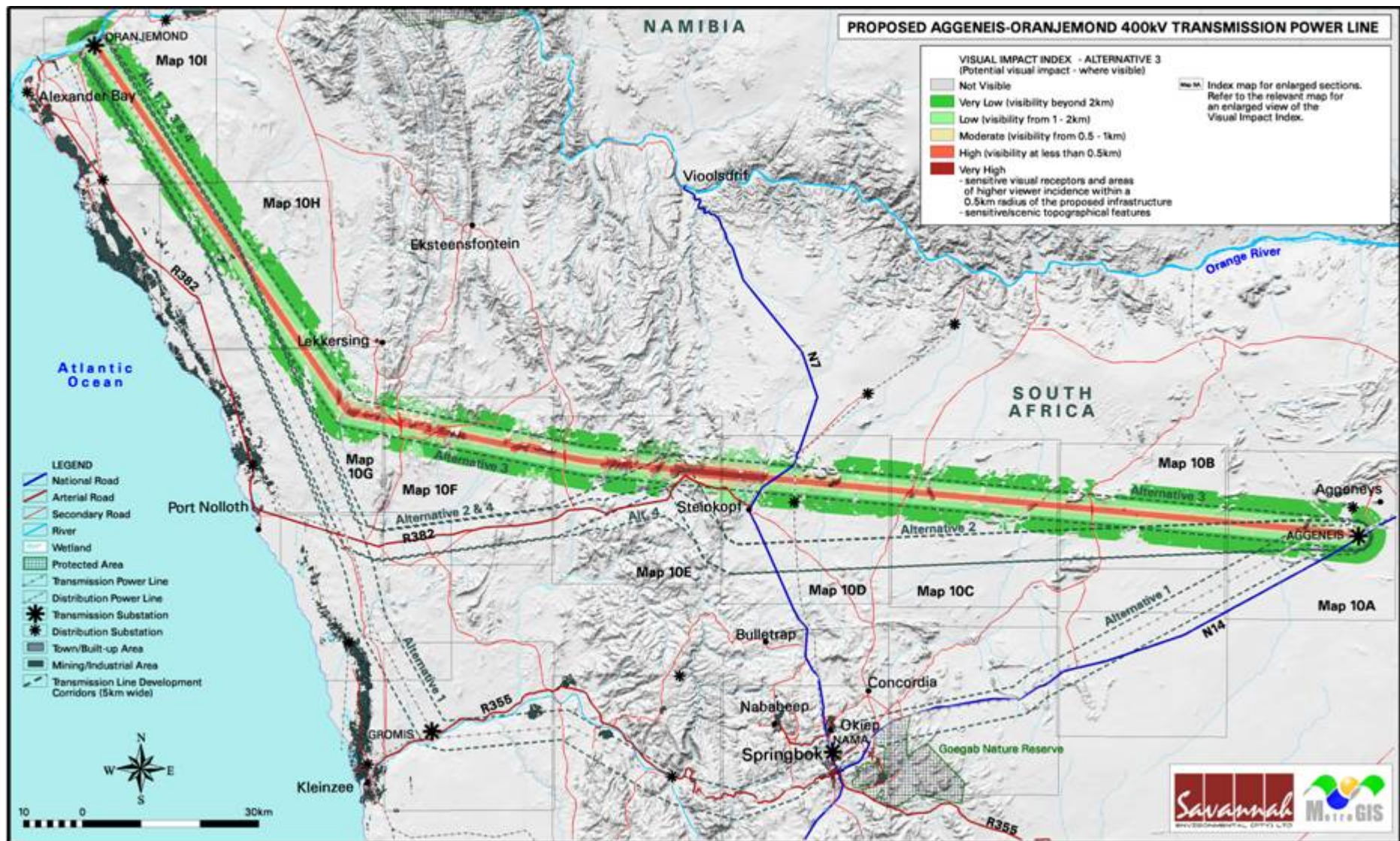
- Stretches of national, arterial and secondary roads (where the alignment runs adjacent to or crosses the road);
  - Parts of the Anenous and Nonaams Passes west of Steinkopf on the R382;
  - A number of settlements (approximately 2 in the east of the study area);
  - The mountains and steep slopes in the 35km section of alignment between Steinkopf and the escarpment, and to a lesser extent in the east between Steinkopf and Aggeneys and
  - Stretches of the historic railway line where this line runs adjacent to the R382 between Steinkopf and Port Nolloth.
- Beyond the 2000m offset (i.e. long distance), potential visual impacts are mostly **very low**. Exceptions are the mountainous areas, the roads and the settlements, where these occur. Potential visual impact for these receptors is expected to be **low**.



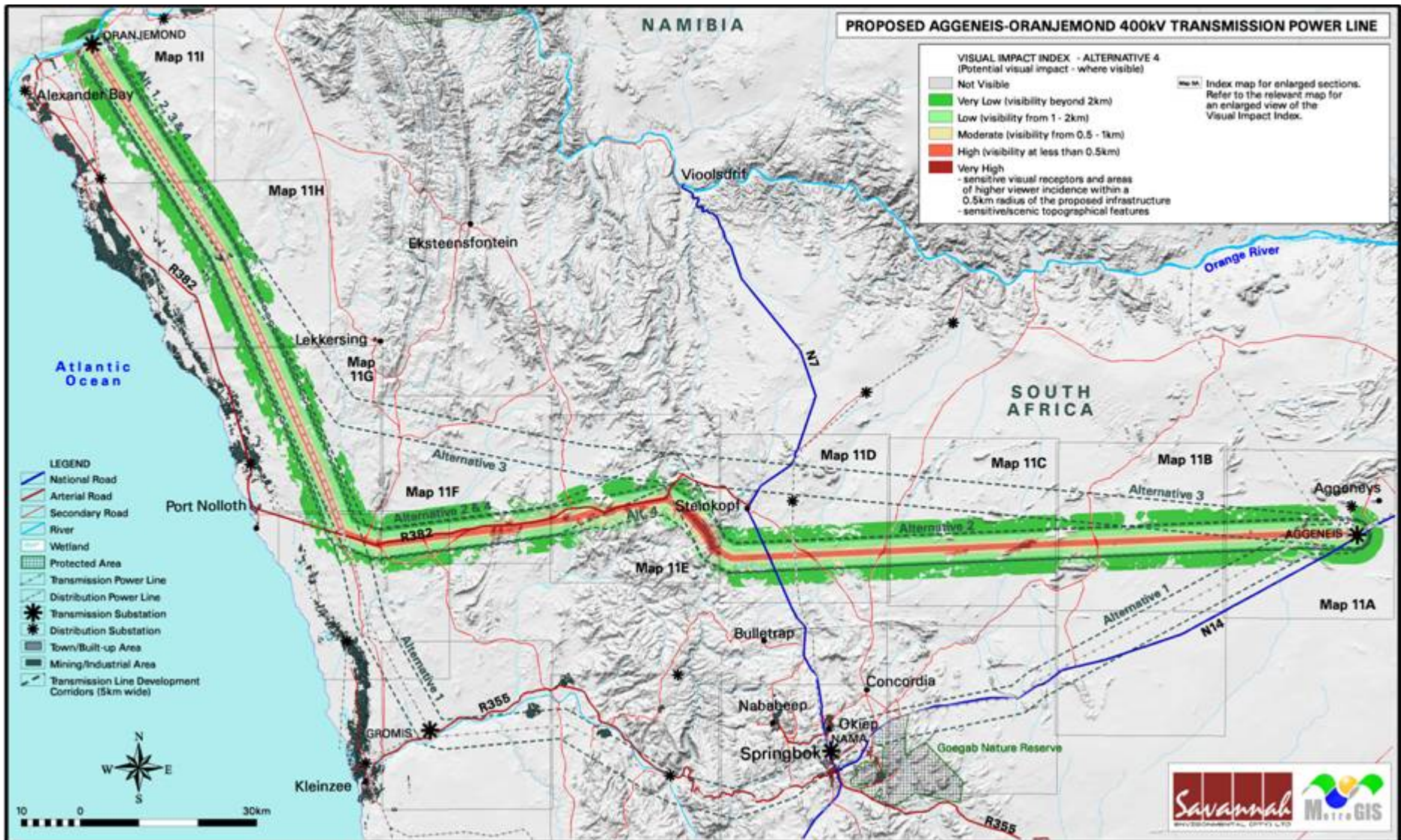
Map 8: Visual impact index of the proposed transmission line corridors.



Map 9: Visual impact index of proposed of Alignment Alternative 2.



Map 10: Visual impact index of proposed of Alignment Alternative 3.



Map 11: Visual impact index of proposed of Alignment Alternative 4.

## 5.6 Visual impact assessment: methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Chapter 2: SCOPE OF WORK) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed infrastructure) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1)
- **Duration** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5)
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10)
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5)
- **Status** (positive, negative or neutral)
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5)
- **Significance** - low, medium or high

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e. **significance = consequence (magnitude + duration + extent) x probability**).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 31-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)
- >60: High (where the impact must have an influence on the decision to develop in the area)

*Please note that due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.*

## 5.7 Visual impact assessment: primary impacts

### Potential visual impact on users of major roads (N7, N14, R382 and R355) and secondary roads in close proximity to the proposed power line.

Potential visual impact on users of national, arterial and secondary roads in close proximity of the proposed power line (i.e. within 500m) are expected to be of **high** significance for Alternatives 1 and 2 and of **moderate** significance for Alternatives 3 and 4. No mitigation is possible. The table below illustrates this impact assessment.

*Note: The frequency of exposure to roads (based on the frequency of road crossings and / or the presence of these roads within the 500m offset) influences the probability rating for each of the alternatives.*

**Table 1:** Impact table summarising the significance of visual impacts on users of national, arterial and secondary roads in close proximity to the proposed power line

<b>Nature of Impact:</b> Potential visual impact on users of national, arterial and secondary roads in close proximity to the proposed power lines.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a
<b>Duration</b>	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
<b>Magnitude</b>	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a
<b>Probability</b>	Definite (5)	N/a	High (4)	N/a	Improbable (2)	N/a	Probable (3)	N/a
<b>Significance</b>	High (90)	N/a	High (72)	N/a	Moderate (36)	N/a	Moderate (54)	N/a
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

### Potential visual impact on the residents of Springbok in close proximity to the proposed power line

The potential visual impact on residents of Springbok within 500m of the proposed power line is expected to be of **high** significance for Alternative 1 only. Of relevance is the historic value of Springbok as a mid-19th century settlement.

No mitigation is possible. The table below illustrates this impact assessment.

**Table 2:** Impact table summarising the significance of visual impacts on the residents Springbok in close proximity to the proposed power line

<b>Nature of Impact:</b> Potential visual impact on residents of Springbok in close proximity to the proposed power lines.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Local (4)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Duration</b>	Long term (4)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Magnitude</b>	Very high (10)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Probability</b>	Definite (5)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Significance</b>	High (90)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Status (positive or negative)</b>	Negative	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

### Potential visual impact on the residents of farmsteads and settlements in close proximity to the proposed power line

The potential visual impact on residents of farmsteads and settlements within 500m of the proposed power line is expected to be of **high** significance for all Alternatives. No mitigation is possible. The table below illustrates this impact assessment.

*Note: The frequency of exposure to farmsteads and settlements (based on the frequency of occurrence within a 500m offset) influences the probability rating for each of the alternatives.*

**Table 3:** Impact table summarising the significance of visual impacts on the residents of settlements and farmsteads in close proximity to the proposed power line

<b>Nature of Impact:</b> Potential visual impact on residents of settlements and farmsteads in close proximity to the proposed power lines.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a	Local (4)	N/a
<b>Duration</b>	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
<b>Magnitude</b>	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a	Very high (10)	N/a
<b>Probability</b>	High (4)	N/a	Definite (5)	N/a	High (4)	N/a	Definite (5)	N/a
<b>Significance</b>	High (72)	N/a	High (90)	N/a	High (72)	N/a	High (90)	N/a
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

**Potential visual impact on sensitive visual receptors (residents of towns, settlements and homesteads) within the region.**

Where these occur, the visual impact on the settlements and homesteads within the region (beyond the 500m offset) is expected to be of **moderate** significance for Alternatives 1 and 3 and of **low** significance for Alternative 2 and 4. No mitigation is possible. The table below illustrates this impact assessment.

*Note: The frequency of exposure to farmsteads and settlements (based on the frequency of occurrence beyond a 500m offset) influences the probability rating for each of the alternatives.*

**Table 4:** Impact table summarising the significance of visual impacts on sensitive visual receptors within the region.

<b>Nature of Impact:</b> Potential visual impact on sensitive visual receptors within the region.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
<b>Duration</b>	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
<b>Magnitude</b>	High (8)	N/a	High (8)	N/a	High (8)	N/a	High (8)	N/a
<b>Probability</b>	High (4)	N/a	Improbable (2)	N/a	Probable (3)	N/a	Improbable (2)	N/a
<b>Significance</b>	Moderate (60)	N/a	Low (30)	N/a	Moderate (45)	N/a	Low (30)	N/a
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and ancillary infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

**Potential visual impact on conservation areas.**

The potential visual impact on the Goegap Nature Reserve and the Hester Malan Nature Wild Flower Reserve is expected to be of **moderate** significance for Alternative 1 only. No mitigation is possible. The table below illustrates this impact assessment.

**Table 5:** Impact table summarising the significance of visual impacts on conservation areas.

<b>Nature of Impact:</b> Potential visual impact on conservation areas.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Regional (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Duration</b>	Long term (4)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Magnitude</b>	Very high (10)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Probability</b>	Improbable (2)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Significance</b>	Moderate (34)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Status (positive or negative)</b>	Negative	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	N/a	N/a	N/a	N/a	N/a	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

### **Potential visual impact of access roads on observers in close proximity to the proposed power line**

Access roads will be required, firstly to construct the power line, and secondly to maintain it (operational phase). These access roads have the potential of manifesting as landscape scarring, and thus a potential visual impact within the viewshed areas. This is especially relevant for steep slopes where cut and fill may be required to render access possible in high lying areas and on steep slopes. Graded slopes could be vulnerable to erosion over time. This also represents a potential visual impact.

No dedicated viewshed has been generated for the access roads, nor is a proposed layout available for each corridor. However, it is assumed, but that the area of potential visual exposure will lie within that of the power line.

The table overleaf illustrates the assessment of this anticipated impact, which is likely to be of **moderate** significance for all Alternatives. Mitigation can reduce the significance of impacts to **low**.

**Table 6** Impact table summarising the significance of visual impact of access roads on observers in close proximity to the power line

<b>Nature of Impact:</b> Potential visual impact of access roads on observers in close proximity to the power line.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)
<b>Duration</b>	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)
<b>Magnitude</b>	High (8)	Moderate (6)	High (8)	Moderate (6)	High (8)	Moderate (6)	High (8)	Moderate (6)
<b>Probability</b>	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
<b>Significance</b>	Moderate (48)	Low (28)	Moderate (48)	Low (28)	Moderate (48)	Low (28)	Moderate (48)	Low (28)
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
<b>Irreplaceable loss of resources?</b>	No	No	No	No	No	No	No	No
<b>Can impacts be mitigated during operational phase?</b>	No	No	No	No	No	No	No	No
<b>Mitigation:</b> Planning: Use of existing roads where possible and layout and construction of roads and infrastructure with due cognisance of the topography. Construction: rehabilitation. Decommissioning: ripping and rehabilitation of the roads.								
<b>Cumulative impacts:</b> The construction of the access roads will increase the cumulative visual impact of road type infrastructure within the region.								
<b>Residual impacts:</b> None. The visual impact of the power line and associated access roads will be removed after decommissioning.								

### Potential visual impact of construction on visual receptors in close proximity to the proposed power line

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and land owners in the area. Mitigation entails proper planning, management and rehabilitation of all construction sites to forego visual impacts. The table below illustrates the assessment of this anticipated impact, which is likely to be of **moderate** significance for all Alternatives, and may be mitigated to **low**.

**Table 7:** Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed power line

<b>Nature of Impact:</b>								
Potential visual impact of construction on visual receptors in close proximity to the power line.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)	Local (4)
<b>Duration</b>	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)	Very short term (1)
<b>Magnitude</b>	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
<b>Probability</b>	High (4)	Improbable (2)	High (4)	Improbable (2)	High (4)	Improbable (2)	High (4)	Improbable (2)
<b>Significance</b>	Moderate (44)	Low (18)	Moderate (44)	Low (18)	Moderate (44)	Low (18)	Moderate (44)	Low (18)
<b>Status (positive or negative)</b>	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
<b>Reversibility</b>	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
<b>Irreplaceable loss of resources?</b>	No	No	No	No	No	No	No	No
<b>Can impacts be mitigated?</b>	Yes							
<b>Mitigation:</b>								
Construction: Proper planning, management and rehabilitation of the construction sites								
<b>Cumulative impacts:</b>								
None.								
<b>Residual impacts:</b>								
None.								

## 5.8 Visual impact assessment: secondary impacts

### Potential visual impacts of the proposed infrastructure on the visual character and sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

Specific aspects contributing to the sense of place of this region include the rugged, undeveloped nature of the area, the wide open vistas and the scenic beauty of the landscape and the mountains.

The anticipated visual impact of the infrastructure on the regional visual character, and by implication, on the sense of place, is expected to be of **moderate** significance for Alternative 1 and **low** for Alternative 2, 3 and 4.

There is no mitigation for this impact. The table overleaf illustrates the assessment of this anticipated impact.

**Table 8:** Impact table summarising the significance of visual impacts on the visual character and sense of place of the region.

<b>Nature of Impact:</b> Potential visual impact on the visual character and sense of place of the region.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
<b>Duration</b>	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
<b>Magnitude</b>	High (8)	N/a	High (8)	N/a	High (8)	N/a	High (8)	N/a
<b>Probability</b>	Probable (3)	N/a	Improbable (2)	N/a	Improbable (2)	N/a	Improbable (2)	N/a
<b>Significance</b>	Moderate (45)	N/a	Low (30)	N/a	Low (30)	N/a	Low (30)	N/a
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

## **Potential visual impact of the proposed infrastructure on tourist routes, tourist destinations and tourism potential within the region.**

The greater region is generally seen as having a high scenic value. The N14 is a primary tourist access route linking Gauteng with the Namaqualand and Springbok, while the N7 links Springbok with Cape Town.

The arterial R382 and the R355 roads offer scenic drives through Namaqualand, especially where these traverse the escarpment. In this respect, the *Spektakel Pass*, located on the R555 some 25km west of Springbok (affected by Alternative 1) and the *Nonaams* and *Anenous Pass*, some 15km west of Steinkopf on the R382 (affected by Alternatives 2, 3 and 4) are of relevance.

In addition to their scenic offering, both these routes are primary access roads linking the N7 with Kleinsee and Port Nolloth respectively, and thus carry both commuters and tourists.

The Namaqualand area is already a known tourist destination, specifically in terms of eco-tourism. The annual Namaqualand flower displays are a world renowned attraction.

During the flower season, a number of secondary roads are favoured by tourists. These include the road to the east of the N7 running from Okiep to Steinkopf and from Okiep via Concordia to the Orange River. Other roads include those linking the R382 with Eksteenfontein and Lekkersing in the Richtersveld.

The latter roads are also used by the Richtersveld Community and visitors to the Richtersveld National Park and thus represent alternative access routes for many tourists.

Visual intrusion through the development of industrial type infrastructure within this environment could affect the area's tourism value and potential. The anticipated visual impact of the power lines on existing tourist routes, as well as on the tourism value and potential of the region is expected to be of **high** significance for Alternative 1 and of **moderate** significance for Alternatives 2, 3 and 4.

There is no mitigation for this impact. The table overleaf illustrates the assessment of this anticipated impact.

### *Notes:*

- *The magnitude of impact on tourist access routes, scenic drives and passes influences the magnitude rating used in the assessment of this impact.*
- *The frequency of exposure to major and secondary roads that are recognised tourist access routes and scenic drives (based on the frequency of occurrence beyond a 500m offset) influences the probability rating for each of the alternatives.*

**Table 9:** Impact table summarising the significance of visual impacts on tourist routes, tourist destinations and tourist potential within the region.

<b>Nature of Impact:</b> Potential visual impact on tourist routes, tourist destinations and tourist potential within the region.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
<b>Duration</b>	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
<b>Magnitude</b>	Very High (10)	N/a	Very High (10)	N/a	Very High (10)	N/a	Very High (10)	N/a
<b>Probability</b>	High (4)	N/a	Probable (3)	N/a	Improbable (2)	N/a	Probable (3)	N/a
<b>Significance</b>	High (68)	N/a	Moderate (51)	N/a	Moderate (34)	N/a	Moderate (51)	N/a
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

## **Potential visual impact of the proposed infrastructure on the declared and tentatively listed World Heritage sites within the region.**

In 2007 large portions of the Richtersveld National Park and surrounding communal lands were declared a World Heritage Site, namely the *Richtersveld Cultural and Botanical Landscape*.

The far south western corner of the Richtersveld Cultural and Botanical Landscape falls within the viewshed of all the power line Alternatives, although for Alignments 1, 2 and 4, this part of the Heritage Site is already impacted upon by the presence of the existing power line. Alignment 3 is the only Alternative that does not correspond with the existing power line in this part of the Heritage Site and therefore represents a new visual impact. This effectively increases the probability of this impact occurring.

In 2009, parts of Okiep, Springbok, Concordia and Port Nolloth as well as the historic railway line between Okiep and Port Nolloth<sup>5</sup> were nominated as the *Namaqualand Copper Mining Landscape* on South Africa's tentative list of World Heritage Sites<sup>6</sup>.

This cultural landscape may be potentially impacted upon wherever the historic railway line falls within the viewshed.

Visual intrusion through the development of industrial type infrastructure within this environment could affect the area's cultural and heritage value. The anticipated visual impact of the power lines on the declared and tentatively listed World Heritage Sites is expected to be of **low** significance for all Alternatives.

There is no mitigation for this impact. The table overleaf illustrates the assessment of this anticipated impact.

### *Notes:*

- *The frequency of exposure to historic towns (i.e. Springbok) and to the historic railway line (based on the frequency of occurrence beyond a 500m offset) influences the magnitude for each of the alternatives.*
- *The occurrence of a new visual impact within the Richtersveld Cultural and Botanical Landscape (i.e. Alternative 3) influences the probability rating for the Alternatives considered.*

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<sup>5</sup> No complete spatial information on the alignment of this historic railway line is available, so it is assumed to run parallel to the N7 between Okiep and Steinkopf, and parallel to the R383 up to the Anenous pass and then straight cross country to Port Nolloth.

<sup>6</sup> Information sourced from the Heritage Impact Assessment: Proposed Aggeneis-Oranjemond 400kv Line and Substations Upgrade, Northern Cape Province (ACO Associates, 2011).

**Table 10:** Impact table summarising the significance of visual impacts on the declared and tentatively listed World Heritage Sites within the region.

<b>Nature of Impact:</b> Potential visual impact on the declared and tentatively listed World Heritage Sites within the region.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a	Regional (3)	N/a
<b>Duration</b>	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a	Long term (4)	N/a
<b>Magnitude</b>	Minor (2)	N/a	Moderate (6)	N/a	Minor (2)	N/a	Low (4)	N/a
<b>Probability</b>	Improbable (2)	N/a	Improbable (2)	N/a	Probable (3)	N/a	Improbable (2)	N/a
<b>Significance</b>	Low (18)	N/a	Low (26)	N/a	Low (27)	N/a	Low (22)	N/a
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a	Recoverable (3)	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								

**Potential visual impact of the proposed infrastructure on scenic and sensitive topographical features within the region.**

The nature of the mountainous terrain is such that it offers some degree of visual absorption, but it is also sensitive to visual intrusion. The mountainous part of the study are also some of the most scenic, and the construction of a power line within such areas will constitute a visual impact, rendered more significant due to the sensitive nature of the natural features. Similarly, visual impact on the rivers of the region will be significant.

The anticipated visual impact of the power line on the scenic and sensitive mountains and rivers of the study area is expected to be of **moderate** significance for all Alternatives. There is no mitigation for this impact. The table below illustrates the assessment of this anticipated impact.

*Note: The length of the section traversing mountainous areas influences the probability rating for each of the alternatives.*

**Table 11:** Impact table summarising the significance of visual impacts on scenic and sensitive topographic features within the region.

<b>Nature of Impact:</b> Potential visual impact of the proposed infrastructure on scenic and sensitive topographical features within the region.								
	<b>ALTERNATIVE 1</b>		<b>ALTERNATIVE 2</b>		<b>ALTERNATIVE 3</b>		<b>ALTERNATIVE 4</b>	
	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>	<b>No mitigation</b>	<b>Mitigation considered</b>
<b>Extent</b>	Regional <b>(3)</b>	N/a	Regional <b>(3)</b>	N/a	Regional <b>(3)</b>	N/a	Regional <b>(3)</b>	N/a
<b>Duration</b>	Long term <b>(4)</b>	N/a	Long term <b>(4)</b>	N/a	Long term <b>(4)</b>	N/a	Long term <b>(4)</b>	N/a
<b>Magnitude</b>	Very high <b>(10)</b>	N/a	Very high <b>(10)</b>	N/a	Very high <b>(10)</b>	N/a	Very high <b>(10)</b>	N/a
<b>Probability</b>	Probable <b>(3)</b>	N/a	Improbable <b>(2)</b>	N/a	Probable <b>(3)</b>	N/a	Improbable <b>(2)</b>	N/a
<b>Significance</b>	Moderate <b>(51)</b>	N/a	Moderate <b>(34)</b>	N/a	Moderate <b>(51)</b>	N/a	Moderate <b>(34)</b>	N/a
<b>Status (positive or negative)</b>	Negative	N/a	Negative	N/a	Negative	N/a	Negative	N/a
<b>Reversibility</b>	Recoverable <b>(3)</b>	N/a	Recoverable <b>(3)</b>	N/a	Recoverable <b>(3)</b>	N/a	Recoverable <b>(3)</b>	N/a
<b>Irreplaceable loss of resources?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Can impacts be mitigated during operational phase?</b>	No	N/a	No	N/a	No	N/a	No	N/a
<b>Mitigation:</b> Decommissioning: removal of the power line and associated infrastructure once the lifespan has expired.								
<b>Cumulative impacts:</b> The construction of the power line will increase the cumulative visual impact of electrical type infrastructure within the region. This is specifically relevant in light of the existing transmission power lines, distribution power lines, distribution substations (6) and transmission substations (4) present in the study area.								
<b>Residual impacts:</b> None. The visual impact of the power line will be removed after decommissioning.								



## 5.9. The potential to mitigate visual impacts

- The primary visual impact, namely the presence of the power line is not possible to mitigate.
- Mitigation of visual impacts associated with the construction of access roads is possible through the use of existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

Access roads which are not required post-construction or later, post-decommissioning should be ripped and rehabilitated.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, entails proper planning, management and rehabilitation of all construction sites. Construction should be managed according to the following principles:
  - Reduce the construction period through careful planning and productive implementation of resources.
  - Plan the placement of lay-down areas and any potential temporary construction camps along the corridor in order to minimise vegetation clearing.
  - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
  - Ensure that rubble, litter and disused construction materials are managed and removed regularly.
  - Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way
  - Reduce and control construction dust through the use of approved dust suppression techniques.
  - Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
  - Rehabilitate all disturbed areas, construction areas, road servitudes and cut and fill slopes to acceptable visual standards.
- Secondary impacts anticipated as a result of the proposed power line (i.e. impacts on visual character and sense of place) are not possible to mitigate.
- There is no mitigation to ameliorate the negative visual impacts on tourist routes and destinations, and on the Goegap Nature Reserve (Alternative 1).
- After decommissioning, all infrastructure should be removed and all disturbed areas appropriately rehabilitated.

The possible mitigation of both primary and secondary visual impacts as listed above should be implemented and maintained on an ongoing basis.

## 6. COMPARATIVE ASSESSMENT OF THE ALTERNATIVES

The scope of work undertaken in Chapter 5 has revealed much in terms of the anticipated nature and significance of the visual impacts likely to result from the proposed power line Alternatives. This exercise was not sufficient, however to distinguish between and compare the 4 Alternatives from a visual perspective.

In this respect, it is necessary to undertake a comparative assessment of the 4 Alternatives according to relevant visual criteria. The aim of the assessment is to identify which of the 4 Alternatives is most and least preferable from a visual perspective.

The following visual criteria are applied<sup>7</sup>:

- The **length** of the proposed transmission line corridor. The longer the alignment, the greater the visual impact, and therefore the less desirable the alternative.
- The exposure to **major roads** (national and arterial), based on the frequency of road crossings and / or the proximity of these roads within a 500m offset (i.e. along the length of the corridor). The greater the exposure, the greater the visual impact, and therefore the less desirable the alternative.
- The exposure to **secondary roads**, based on the frequency of road crossings and / or the proximity of these roads within a 500m offset (i.e. along the length of the corridor). The greater the exposure, the greater the visual impact, and therefore the less desirable the alternative.
- The exposure to **urban centres** and built up areas (i.e. Springbok) within a 2km offset. Only Alternative 1 will register a value here.
- The exposure to farmsteads and **settlements** based on the frequency of occurrence within a 2km offset. The higher the number of farmsteads and settlements, the greater the number of visual receptors, and therefore the less desirable the alternative.
- The exposure to conservation and **protected areas** within a 2km offset. Only Alternative 1 will register a value here.
- The exposure to scenic and sensitive topographical features based on the length of the section traversing **mountainous areas**. The longer the section of alignment through the mountains, the greater the visual impact, and therefore the less desirable the alternative.
- The proximity of **existing power lines** along the alignment. It may be argued that the presence of an existing visual impact will 'absorb' the potential visual impact of the power line to some extent. The concentration of linear infrastructure within this environment is considered preferable, as it localises the cumulative extent of potential visual impact. The shorter the section of alignment adjacent to existing power line infrastructure, the greater the visual impact, and therefore the less desirable the alternative.

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<sup>7</sup> It is important to note that none of these criteria should be viewed in isolation, as all are relevant in the comparison between alternatives. It is the actual comparison of the 4 alignments making use of these criteria (included as table 12) that is of importance.

- The significance of potential visual impacts on **tourism** (i.e. tourist routes, tourist destinations and tourist potential) within the region.

The table below shows the application of the above criteria to each Alternative. Values of 1-4 are used, with a value of 4 indicating the highest visual impact and a value of 1 indicating the lowest.

The sum of accumulated values gives an indication of which Alternative is likely to have the greatest visual impact. The Alternative with the highest total is the least desirable, while that with the lowest is the preferred option from a visual perspective.

**Table 12:** Comparative assessment of the power line Alternatives.

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
<b>Total length</b>	<b>4</b> (302.989km)	<b>3</b> (275.593km)	<b>1</b> (248.861km)	<b>2</b> (270.570km)
<b>Major roads</b>	<b>4</b> (N14, R355, N7)	<b>3</b> (N14, N7, R382)	<b>1</b> (N14, N7)	<b>2</b> (N14, N7, R382)
<b>Secondary roads</b>	<b>4</b> (12 crossings)	<b>3</b> (8 crossings)	<b>2</b> (7 crossings)	<b>3</b> (8 crossings)
<b>Urban centres</b>	<b>1</b> (Springbok)	<b>0</b>	<b>0</b>	<b>0</b>
<b>Settlements</b>	<b>4</b> (Approx 12)	<b>3</b> (Approx 9)	<b>3</b> (Approx 9)	<b>3</b> (Approx 9)
<b>Protected areas</b>	<b>1</b> (Goegap NR)	<b>0</b>	<b>0</b>	<b>0</b>
<b>Mountainous areas</b>	<b>3</b> (Approx 65km)	<b>2</b> (Approx 40km)	<b>4</b> (Approx 70km)	<b>1</b> (Approx 35km)
<b>Existing power lines</b>	<b>1</b> (entire length)	<b>3</b> (last 25%)	<b>4</b> (last 10%)	<b>2</b> (last 30%)
<b>Tourism</b>	<b>4</b> (high impact)	<b>3</b> (moderate impact)	<b>2</b> (moderate impact)	<b>3</b> (moderate impact)
<b>TOTAL</b>	<b>26</b>	<b>20</b>	<b>17</b>	<b>16</b>

Overall, considering all relevant criteria, Alternative 4 is considered preferable, while Alternative 1 is the least desirable from a visual perspective.

## 7. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed Aggeneis-Oranjemond 400kV Power Line and its associated infrastructure will have a visual impact on the scenic resources of this region.

The power line infrastructure will be visible within an area that is generally seen as having a high quality natural and scenic landscape and a resultant tourism value and potential. The infrastructure would thus be visible within an area that incorporates various sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive.

The mountainous area leading up to and making up the escarpment is of particular scenic beauty, and the proposed power line is expected to transform the natural character of these ridges for the entire operational phase of the infrastructure. In addition, the tourism and heritage value of the region must not be overlooked, specifically its location within Namaqualand, the Richtersveld

Cultural and Botanical Landscape World Heritage Site and the tentatively listed Namaqualand Copper Mining Landscape World Heritage Site.

There are not many options as to the mitigation of the visual impact of the power lines. The infrastructure spans hundreds of kilometres and no amount of vegetation screening or landscaping would be able to hide structures of these dimensions.

In term of the Alternatives, all four alternative alignments will be visually exposed to large areas within their respective 2000m offsets. This is due to the tall (35m) transmission line infrastructure associated with 400kV power lines.

In addition, all four alternatives tend to display an even potential exposure pattern where they traverse flat terrain and more scattered patterns where they encounter elevated topography.

Alternatives 2, 3 and 4 cross fewer roads and mountains, and are shorter than Alternative 1. They also have a reduced number of potentially sensitive receptors.

Alternative 1 is likely to have the highest visual impact on tourism routes, destinations and potential, while Alternative 3 is expected to have the lowest.

Overall, considering all relevant criteria, Alternative 4 is considered the preferred alternative, and is recommended from a visual perspective.

The following (as detailed in section 5.9) is also recommended:

- Mitigate secondary visual impacts associated with the construction of roads by using existing roads wherever possible. Where new roads are required, these should be planned carefully, taking due cognisance of the topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

Access roads which are not required post-construction or later, post-decommissioning should be ripped and rehabilitated.

- Mitigate visual impacts associated with the construction phase, albeit temporary, through proper planning, management and rehabilitation of all construction sites.
- After decommissioning, all infrastructure should be removed and all disturbed areas appropriately rehabilitated.

## **8. IMPACT STATEMENT**

In light of the results and findings of the Visual Impact Assessment undertaken for the proposed Aggeneis-Oranjemond 400kV Power Line, it is acknowledged that the natural and relatively unspoiled wide-open views adjacent to the power line alignment will be transformed for the entire operational lifespan of the infrastructure.

The following is a summary of impacts remaining, assuming Alternative 4 is selected, as mitigation as recommended is exercised:

- The potential visual impact of the infrastructure on users of national, arterial and secondary roads in close proximity to the proposed infrastructure will be of **moderate** significance.
- The anticipated visual impact on residents of settlements and homesteads in close proximity to the proposed infrastructure will be of **high** significance.
- Within the greater region, the potential visual impact on sensitive visual receptors (i.e. residents of settlements and homesteads) will be of **low** significance.
- In terms of access roads, the anticipated visual impact will be of **low** significance.
- Similarly, the visual impact of construction is also expected to be of **low** significance.
- In terms of secondary visual impacts, the significance of the anticipated impact on the visual character and sense of place of the region will be of **low** significance.
- Potential visual impacts on tourist routes, tourist destinations and tourism potential within the region will be of **moderate** significance.
- Potential visual impact on the declared and tentatively listed World Heritage Sites within the region will be of **low** significance.
- Lastly, the visual impact on sensitive topographic features within the region will be of **moderate** significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) are not considered to be fatal flaws from a visual perspective, especially considering the very low occurrence of visual receptors along alignment Alternative 4.

Furthermore, it is the opinion of the author that the anticipated visual impact is not likely to detract from the regional tourism appeal, numbers of tourists travelling along the N7, N14 or R355, and it is unlikely that the infrastructure will be visible from many tourist and heritage destinations.

It is therefore recommended that the development of the power line as proposed (i.e. Alternative 4) be supported, subject to the implementation of the recommended mitigation measures (section 5.9) and management actions (Chapter 9).

## 9. MANAGEMENT PLAN

The management plan tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts.

**Table 13:** Management plan – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed Aggeneis-Oranjemond 400kV Power Line.

<b>Project component/s</b>	The power line and access roads.	
<b>Potential Impact</b>	Primary visual impact of the infrastructure due to the presence of the power line and the access roads in the landscape.	
<b>Activity/risk source</b>	The viewing of the above mentioned by observers on or near the site as well as within the region.	
<b>Mitigation: Target/Objective</b>	Optimal planning of infrastructure so as to minimise visual impact.	
<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Implement an environmentally responsive planning approach to roads and infrastructure to limit cut and fill requirements. Plan with due cognisance of the topography.	Eskom Holdings Ltd / design consultant	Planning.
Implement power line alignment Alternative 4.	Eskom Holdings Ltd / design consultant	Planning.
<b>Performance Indicator</b>	No internal access roads are visible from surrounding areas.	
<b>Monitoring</b>	Not applicable.	

**Table 14:** Management plan – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed Aggeneis-Oranjemond 400kV Power Line.

<b>Project component/s</b>	Construction activities related to the power line and associated infrastructure	
<b>Potential Impact</b>	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing.	
<b>Activity/risk source</b>	The viewing of the above mentioned by observers on or near the site.	
<b>Mitigation: Target/Objective</b>	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.	
<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Reduce the construction period through careful planning and productive implementation of resources.	Eskom Holdings Ltd / contractor	Construction
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing.	Eskom Holdings Ltd / contractor	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Eskom Holdings Ltd / contractor	Construction
Ensure that rubble, litter and disused construction materials are managed and removed regularly.	Eskom Holdings Ltd / contractor	Construction
Ensure that all infrastructure and the sites and general surrounds are maintained in a neat and appealing way	Eskom Holdings Ltd / contractor	Construction
Reduce and control construction dust through the use of approved dust suppression techniques.	Eskom Holdings Ltd / contractor	Construction
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Eskom Holdings Ltd / contractor	Construction
Rehabilitate all disturbed areas, construction areas, road servitudes and cut and fill slopes to acceptable visual standards.	Eskom Holdings Ltd / contractor	Construction
<b>Performance Indicator</b>	Vegetation cover on and in the vicinity of the site is intact with no evidence of degradation or erosion.	
<b>Monitoring</b>	Monitoring of vegetation clearing during construction. Monitoring of rehabilitated areas post construction.	

**Table 15:** Management plan – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed Aggeneis-Oranjemond 400kV Power Line.

<b>Project component/s</b>	The power line servitude and access roads.	
<b>Potential Impact</b>	Visual impact of vegetation rehabilitation failure.	
<b>Activity/risk source</b>	The viewing of the above mentioned by observers on or near the site.	
<b>Mitigation: Target/Objective</b>	Well rehabilitated and maintained alignment.	
<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Monitor rehabilitated areas, and implement remedial action as and when required.	Eskom Holdings Ltd / operator	Operation.
<b>Performance Indicator</b>	Intact vegetation on and in the vicinity of the alignment.	
<b>Monitoring</b>	Monitoring of rehabilitated areas.	

**Table 16:** Management plan – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed Aggeneis-Oranjemond 400kV Power Line.

<b>Project component/s</b>	The power line and access roads.	
<b>Potential Impact</b>	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
<b>Activity/risk source</b>	The viewing of the above mentioned by observers on or near the site.	
<b>Mitigation: Target/Objective</b>	Rehabilitated vegetation in all disturbed areas.	
<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Remove infrastructure.	Eskom Holdings Ltd / operator	Decommissioning.
Rip and rehabilitate access roads not required for the post-decommissioning use of the site.	Eskom Holdings Ltd / operator	Decommissioning.
Monitor rehabilitated areas, and implement remedial action as and when required.	Eskom Holdings Ltd / operator	Decommissioning.
<b>Performance Indicator</b>	Intact vegetation on and in the vicinity of the alignment.	
<b>Monitoring</b>	Monitoring of rehabilitated areas.	

## 10. REFERENCES/DATA SOURCES

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