PROPOSED CONSTRUCTION OF A NEW ESKOM POWER LINE, SUBSTATION AND SWITCHING STATION FOR ZANDKOPSDRIFT MINE (NORTHERN & WESTERN CAPE):

FRESHWATER ECOSYSTEMS IMPACT ASSESSMENT REPORT

--- DRAFT FINAL REPORT ---

The Freshwater Consulting Group

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1. INTRODUCTION

1.1. Background
The construction of a new Eskom power line, substation and switching station is proposed for the Zandkopsdrift Mine in the southern portion of the Northern Cape and the northern portion of the Western Cape. A Basic Assessment process must be undertaken in terms of the Environmental Impact Assessment (EIA) Regulations of the National Environmental Management Act (Act No. 107 of 1998) (NEMA), and GIBB (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioner to undertake this environmental assessment process. The Freshwater Consulting Group (FCG) was, in turn, appointed to provide freshwater ecological input into the Basic Assessment.

The proposed project entails the construction of a ~80 km long, 132 kV power line from Zandkopsdrift (in the Northern Cape) to Hoekklip (in the Western Cape), a new substation at each end of the line and a switching station at Landplaas (see locality map in Figure 1). Two alternative routes have been proposed for the power line, with a middle section of approximately 40 km in length being the same for both routes. Both alternatives have been considered during the Basic Assessment process. The two route alternatives that have been assessed were refined after initial input was obtained from all the specialists working on the project (including FCG). A third alternative, further to the west, was also considered during the initial stages of the environmental assessment, but this option was discarded in the final assessment due to a number of fatal flaws that were identified.

1.2. Terms of reference
The terms of reference for the freshwater ecological input into this project were understood by FCG to be as follows:

- Identify and map the freshwater ecosystems (rivers and wetlands) along the proposed power line routes that could be affected by the proposed activities;
- Assess the ecological condition and importance of potentially impacted freshwater ecosystems;
- Assess the significance of the identified potential impacts on freshwater ecosystems that could result from the proposed activities;
- Provide recommendations to mitigate the potentially negative impacts to freshwater ecosystems that could result from the proposed activities;
- Identify the legal requirements in terms of the National Water Act (Act No. 36 of 1998) that could be triggered by the proposed activities; and
- Provide a summary of the findings in a Freshwater Ecosystems Impact Assessment Report.
Eskom Power Line for Zandkopsdrift Mine: Freshwater Ecosystems Impact Assessment

Figure 1: Map of proposed routes for the Hoekklip-Zandkopsdrift power line [from GIBB (Pty) Ltd]
2. APPROACH TO AND LIMITATIONS OF THE STUDY

2.1. Approach

The approach taken to meeting the above-mentioned terms of reference was to complete the following tasks:

- Review of available background information and documentation, including the maps and layout diagrams for the proposed routes for the transmission line.
- Examination of relevant existing maps and GIS covers (including the applicable 1:50 000 scale topographical maps and component layers available from the Chief Directorate: National Geospatial Information) to ascertain where major rivers, wetlands and open waterbodies have already been mapped in relation to the proposed transmission line routes.
- Examination of electronic GIS versions of the maps generated by the National Freshwater Ecosystem Priority Areas (NFEPA) project (Driver et al. 2011, Nel et al., 2011), to ascertain whether there are any freshwater ecosystems along or in close proximity to the proposed routes that have been identified as Freshwater Ecosystem Priority Areas (FEPAs).
- Examination of relevant biodiversity conservation plans to ascertain whether any freshwater ecosystems have been mapped by such plans along the proposed routes, and to note what conservation importance category has been assigned to any freshwater ecosystems that have been mapped along the routes.
- Examination and interpretation of recent colour aerial photographs (obtained from the Chief Directorate: National Geospatial Information) and Google Earth imagery of the study area, to identify additional freshwater ecosystems along the proposed routes that were not captured by existing maps.
- Compilation of a desktop-based map of freshwater ecosystems likely to be present along the proposed transmission line routes, mapped within a 100 m wide corridor on each side of the centreline of the proposed power line (i.e. a total corridor width of 200 m). An electronic version of this map, which was compiled to guide the site assessment by FCG and to inform the planning of the power line route, was provided to GIBB (Pty) Ltd in KML format.
- Completion of a three-day field trip in mid-June 2013 to ground-truth, as far as possible, the desktop-based map of freshwater ecosystems along the initially proposed routes (on foot and by vehicle). Sufficient information was collected during this field trip to assess the ecological condition and importance of the identified freshwater ecosystems.
- Categorisation of the present ecological condition of each freshwater ecosystem mapped within a 200 m corridor along the proposed routes (as “good”, “fair” or “poor”), based on professional judgement and a rapid visual assessment of the present state of the hydrology, geomorphology, water quality and vegetation associated with each ecosystem.
Categorisation of ecological/conservation importance of each freshwater ecosystem mapped within a 200 m corridor along the proposed routes (as “high” / “moderate” / “low” importance), based on a list of criteria developed by FCG as outlined in Table 1 (see below).

Formulation of recommended buffer areas for the freshwater ecosystems mapped within a 200 m corridor along the proposed routes, taking into account the categorisation of the ecological condition and importance of each ecosystem (see Table 2, below).

 Updating of the desktop-based map of freshwater ecosystems, to produce a ground-truthed map of freshwater ecosystems along the proposed transmission line routes. The ground-truthed map included the categorisation of the ecological condition and importance of the mapped freshwater ecosystems that could be affected by the proposed power line, together with the recommended buffer areas. An electronic version of this map was provided to GIBB (Pty) Ltd in KML format.

Completion of a two-day follow-up field trip in late September 2013 to map and assess the freshwater ecosystems along the revised alternative routes for the proposed power line (considering a 200 m corridor along the routes, as done previously).

Categorisation of the present ecological condition and ecological importance of the freshwater ecosystems that were mapped along the revised alternative routes, and assignment of recommended buffer areas (based on the ecological condition and importance), using the same methods as before.

Evaluation of the encroachment of the proposed power line routes into freshwater ecosystems or the recommended buffer areas around the mapped ecosystems.

Assessment of the significance of potential impacts on freshwater ecosystems that could be associated with the proposed development (considering the two revised alternative routes), using the method prescribed by GIBB (Pty) Ltd (see Appendix 1).

Preparation of a Freshwater Ecosystems Report (i.e. the current report), which includes recommended mitigation measures to minimise potential impacts on freshwater ecosystems during the design (pre-construction), construction, operational and decommissioning phases of the proposed power line project. It is our understanding that this specialist report will form an integral component of the Basic Assessment Report required in terms of NEMA for the proposed transmission line.
### Table 1: Criteria used to assign low, moderate or high ecological/conservation importance to potentially affected freshwater ecosystems (note that the highest category applicable to any freshwater ecosystem, based on any one criteria, is the one accorded the ecosystem as a whole) [modified from Ewart-Smith & Ractliffe (2002)]

<table>
<thead>
<tr>
<th>Importance</th>
<th>Low importance</th>
<th>Moderate importance</th>
<th>High importance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>does not provide ecologically or functionally significant aquatic habitat because of extremely small size or relatively high degree of degradation; and/or</td>
<td>provides ecologically significant aquatic habitat (e.g. locally important aquatic ecosystem habitat types); and/or</td>
<td>supports a high diversity of indigenous plant / animal species; and/or</td>
</tr>
<tr>
<td></td>
<td>of extremely limited importance as a corridor between systems that are themselves of low conservation importance.</td>
<td>fulfils some functional roles within the catchment; and/or supports (or is likely to support) fauna or flora that are characteristic of the region and/or provides habitat to indigenous flora and fauna; and/or is degraded but threatened habitat type (e.g. seasonal wetlands); and/or is degraded but has high potential for rehabilitation; and/or has been identified as a Freshwater Ecosystem Priority Area (FEPA) in terms of the National Freshwater Ecosystem Priority Areas (NFEPA) project or as an aquatic Critical Biodiversity Area (CBA) in terms of a regional biodiversity conservation plan, but is in relatively poor present ecological condition; and/or has been identified as an aquatic Critical Ecosystem Support Area (CESA) in terms of a regional biodiversity conservation plan; and/or functions as a buffer area between terrestrial systems and more ecologically important aquatic ecosystems; and/or is upstream of aquatic ecosystems that are of high conservation importance.</td>
<td>supports relatively undisturbed aquatic communities; and/or forms an integral part of the habitat mosaic within a landscape; and/or is representative of a regionally threatened / restricted habitat type; and/or has been identified as a FEPA in terms of the NFEPA project or as an aquatic CBA in terms of a regional biodiversity conservation plan, and is in fair to good present ecological condition; and/or has a high functional importance (e.g. nutrient filtration; flood attenuation) in the catchment; and/or is of a significant size (and therefore provides significant aquatic habitat, albeit degraded or of low diversity).</td>
</tr>
</tbody>
</table>

### Table 2: Recommended buffer areas, as formulated by FCG, for natural freshwater ecosystems (i.e. rivers and wetlands) within which no electricity towers or other ‘hard’ infrastructure associated with the proposed Zandkopsdrift-Hoekklip power line should be established

<table>
<thead>
<tr>
<th>Importance</th>
<th>Present ecological condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>High</td>
<td>50 m</td>
</tr>
<tr>
<td>Moderate</td>
<td>40 m</td>
</tr>
<tr>
<td>Low</td>
<td>20 m</td>
</tr>
</tbody>
</table>
2.2. Assumptions and limitations

The following assumptions have been made in conducting the specialist study of freshwater ecosystems for the proposed Zandkopsdrift-Hoekklip power line development:

- That construction activities associated with the establishment of the power line will be restricted to a corridor 60 m or less in width along the centreline of the proposed routes;
- That pylon structures of some sort would need to be erected every few hundred metres along the power line route that is selected, to support the transmission cables;
- That a continuous access road would be established along the centreline of the proposed route between towers, unless alternative existing access roads are identified or there are areas where it is not possible to establish such an access road;
- That all significant freshwater ecosystems were captured by the desktop mapping for those sections of the proposed power line route that were not traversed during the fieldwork (see list of limitations below), and that the application of the recommended buffer areas to these freshwater ecosystems does compensate for inaccuracies in the delineation of these features; and
- That there will be further opportunity for freshwater ecological input into the selection of specific positions for pylon structures before they are erected and the final routing of access roads to and between pylons.

The following limitations apply to the specialist study of freshwater ecosystems:

- Due to access constraints, certain sections of the proposed power line routes were not traversed (on foot or by vehicle) during the 5 days of fieldwork undertaken for this investigation. The presence and approximate extent of freshwater ecosystems along these portions of the proposed line was thus not ground-truthed.
- Due to the large number of freshwater ecosystems that had to be assessed, the categorisation of the present ecological condition was limited to a very rapid, visually-based assessment of the hydrology, geomorphology, water quality and vegetation associated with each system (there was insufficient time available to collect soil, vegetation, water quality, or any invertebrate or other faunal data for each system).
- The categorisation of the ecological/conservation importance of freshwater ecosystems was limited, to some degree, by the lack of detailed information on the species of fauna and/or flora within each system, and the lack of detailed functional assessments. The collection of such information would have increased the degree of confidence in the categorisation of the importance of potentially affected freshwater ecosystems, but is not feasible for such a broad-scale project that involves numerous freshwater ecosystems that need to be assessed.
- Regional conservation plans with a freshwater ecosystem component were only available for certain portions of the study area. The strategic perspective provided by such plans would have assisted in the categorisation of the conservation importance of potentially affected freshwater ecosystems.
The proposed locations of the pylons for the proposed power line and the proposed routing of the access roads to/between pylons had not yet been determined when this study was undertaken.

No development footprint was specified for the Zandkopsdrift and Hoekklip substations or for the Landplaas switching station. The exact proposed locations and areal cover of these structures would be required for more accurate assessment of their potential impact on surrounding freshwater ecosystems. Furthermore, no specifications were provided as to the proposed routing of the electrical connection/s from the Zandkopsdrift substation to the mine infrastructure or about the proposed infrastructure required for this (e.g. underground cabling versus overhead cabling with electricity poles).

3. BIOPHYSICAL OVERVIEW OF STUDY AREA

The proposed Zandkopsdrift-Hoekklip power line is situated relatively close to the west coast in the northernmost reach of the Western Cape province. A small portion of the line at the northern end occurs within the Northern Cape province, including the substation at Zandkopsdrift Mine. The proposed power line would be located between the coast and the N7 highway, running roughly parallel to these two features. The nearest town of any significance is Lutzville, approximately 8.5 km to the south-east of the proposed Hoekklip substation. The land across which the power lines traverse is, for the most part, private farmland. The terrain is undulating, with some areas being relatively flat and others being dominated by rocky ridges and relatively shallow valleys.

The area through which the middle and southern sections of the proposed power line would traverse (for both route alternatives) falls within the Western Coastal Belt aquatic ecoregion, as delineated by the Department of Water Affairs (Kleynhans et al. 2005). This ecoregion is characterised by plains of low and moderate relief. Vegetation types consist predominantly of Succulent Karoo types. The Olifants, Doring, Sout, Groen and Buffalo Rivers traverse this region. The northern portion of the proposed line, incorporating approximately 30 km of both route alternatives, is located within the Namaqua Highlands aquatic ecoregion (following Kleynhans et al. 2005). Closed hills and mountains with moderate to high relief are distinctive in this region. Dominant vegetation types consist of Succulent Karoo types and Renosterveld. The Buffalo and Groen Rivers have their sources in the region. Both of the ecoregions described above are characterised as being arid, with a mean annual precipitation of less than 200 mm (Kleynhans et al. 2005), mostly occurring during the winter months. The study area is mostly relatively low-lying, with altitudes varying from less than 200 m.a.s.l. up to approximately 450 m.a.s.l. All rivers in the immediate vicinity of the power line routes are non-perennial and any wetlands are non-permanent in terms of their inundation and saturation period. Most natural aquatic
ecosystems in the study area are highly ephemeral due to the extremely low and inconsistent rainfall in this arid region.

The proposed power line falls within the Olifants/Doorn Water Management Area (WMA) of DWA, for both alternative routes. Most of the proposed project lies within DWA Secondary Catchment F6, with a small part of the northern portion in Secondary Catchment F5 and part of the southern portion in Secondary Catchment E3.

According to the 1:1,000,000 scale geology map of Vegter (1995), most of the proposed power line (with the exception of the extreme southern portion of the line near the proposed Hoekklip substation) falls within the Namaqua Metamorphic Complex lithostratigraphic unit, which is characterised by metamorphic rock types (e.g. granite, gneiss and volcaniclastic rocks). Approximately 1 km of the proposed line, near the proposed Hoekklip power station end, falls within a lithostratigraphic unit made up of coastal deposits of some sort (consisting, for example, of sandstone, aeolianite and/or sand).

Most of the study area falls within the Succulent Karoo Biome (after Mucina & Rutherford), although there is a small section of the proposed Alternative 2 route that goes through the Fynbos Biome (approximately 4 km of the line going north-west from the proposed Hoekklip substation). The proposed routes both pass primarily through the Namaqualand Hardeveld and Namaqualand Sandveld Bioregions (after Mucina & Rutherford 2006), with a short (<5 km long) section of the southern extremity going through the Knersvlekste Bioregion in the case of Alternative 1 and through the Northwest Fynbos Bioregion in the case of Alternative 2. The two proposed alternative power line routes cross a diversity of terrestrial vegetation types. According to Mucina and Rutherford (2006), the natural vegetation types along the proposed routes are the following (none of which are included on the national list of threatened ecosystems1):

- Namaqualand Riviere;
- Namaqualand Strandveld;
- Namaqualand Sand Fynbos;
- Knersvlakte Quartz Vygieveld;
- Namaqualand Klipkoppe Shrubland; and
- Namaqualand Heuweltjieveld.

Although several rivers and wetlands in the area have been delineated by the NFEPA project, none that cross the proposed routes for the power line have been classified as Freshwater Ecosystem Priority Areas (FEPAs).

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1 As published in Government Notice No. 1002 of December 2011, issued in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).
According to the information on SANBI’s Biodiversity GIS website (http://www.bgis.sanbi.org), the following regional biodiversity conservation planning initiatives are of relevance to the study area for the proposed power line:

- Biodiversity Sector Plan for the Saldanha Bay, Bergrivier, Cederberg and Matzikama Municipalities (Maree & Vromans 2010), which incorporates aquatic Critical Biodiversity Areas (CBAs) identified within the Sandveld-Saldanha Planning Domain of the C.A.P.E. Fine-Scale Planning Project (Job et al. 2008). Only the southern extremity of the proposed power line route is covered by this Conservation Plan.

- Namakwa District Biodiversity Sector Plan (Northern Cape Province, Conservation International South Africa & Botanical Society of South Africa 2008), which includes the identification of aquatic CBAs within the planning area. Only the northern extremities of the proposed power line routes are covered by this Conservation Plan.

- Succulent Karoo Ecosystem Plan (SKEP) (Driver et al. 2003), which identified important “river corridors” within the Succulent Karoo planning domain. This Plan covers the entire study area, but was one of the earlier regional conservation plans developed in South Africa and did not specifically incorporate aquatic ecosystems (for example, wetlands were not considered) or identify aquatic CBAs.

4. DESCRIPTION OF PROPOSED PROJECT

The proposed project entails the construction of a 132 kV overhead power line, approximately 80 km in total length, from a new substation station at Hoekklip (in the Western Cape) to a new substation at Zandkopsdrift Mine (in the Northern Cape) via a switching station at Landplaas (see locality map in Figure 1). Two route alternatives have been proposed for the power line, with approximately half the route (~40 km of the middle portion) being similar for both alternatives. Alternative 2 is the proponent’s preferred alternative.

The establishment of the proposed power line would involve the construction of at least two new substations, one new switching station, and a series of pylons along the proposed route to support the overhead transmission cable (spaced up to a few hundred metres apart). No details have been provided at this stage about the proposed pylon positions, or about the type of pylons that are proposed and what the size of their associated footprint would be. In addition to the substations, switching station and power line pylons, access roads would need to be established for the erection of the pylons and installation of the transmission line, and for ongoing access to the pylons and the servitude below the power lines themselves. The ideal situation for Eskom would be to create a continuous access road along the centreline of the power line, running from pylon to pylon, so that easy access can be gained to the pylons, the transmission cable and the portions of land within the power line servitude. The standard maintenance regime is to regularly clear or trim the vegetation...
within the power line servitude in areas where the vegetation grows too tall to comply with minimum height clearances for the reduction of fire risks associated with electrical short-circuiting. No details have been provided at this stage about the routing of access roads.

If the proposed power line were to be decommissioned at the end of its operational life span, it is presumed that the transmission cables and pylons would be taken down and removed, and the substations and switching station associated with the power line would probably be demolished.

5. DESCRIPTION OF POTENTIALLY AFFECTED FRESHWATER ECOSYSTEMS

Maps of the freshwater ecosystems identified within a 200 m wide corridor along the proposed power line routes, overlaid on the 1:500 000 scale national map of rivers and the river networks captured on the relevant 1:50 000 scale topographical maps for the study area\(^2\), are presented in Appendix 2. Electronic versions of some of the component “layers” that were used to make these maps have also been provided with this report, in KML format that can be viewed in Google Earth or used in GIS software programs. The specific component layers that have been provided electronically are “drainage lines”, “wetlands”, “dams”, and “buffers”.

The maps in Appendix 2 show that there is only one major river system in the study area that could be directly affected by the proposed power line development, as captured on the national 1:500 000 scale map of rivers in the country. This is the Sout River (see photo in Figure 2), and two of its major tributaries (the Groot-Goerap and Klein-Goerap Rivers) that also cross the proposed power line routes. This river system and all its tributaries have a non-perennial flow regime. For all three of the major rivers that could be directly affected by the proposed infrastructure development (i.e. the Sout, Groot-Goerap and Klein-Goerap Rivers), the river reaches that flow across the proposed power line routes are within the Upper or Lower Foothills (or near the transition between these two zones) in terms of their longitudinal zonation (after Rowntree & Wadeson 2000).

The Sout River and the Groot- and Klein-Goerap tributaries were all identified as important “river corridors” in terms of the SKEP project. Both of the proposed alternative routes for the power line cross all three of these important river corridors.

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\(^2\) The 1:500 000 scale national river map was obtained from the Department of Water Affairs (Resource Quality Services website) and the vector layers of the 1:50 000 scale topographical maps for the study area were obtained from the Chief Directorate: National Geospatial Information, all in electronic GIS ‘shapefile’ format.
The northern extremity of the proposed power line (in the vicinity of the proposed Zandkopsdrift substation) is within the catchment area of the Swart-Doring River (a tributary of the Groen River) that was identified as a riverine aquatic CBA in terms of the Namakwa District Biodiversity Sector Plan. The southern extremity of the line (in the vicinity of the proposed Hoekklip substation) falls within the catchment area of the Jaagleegte River, which was identified as an aquatic CBA by the C.A.P.E. Fine-Scale Planning project (as incorporated into the Biodiversity Sector Plan for the Saldanha Bay, Bergrivier, Cederberg and Matzikama Municipalities).

Although there is only one major river system (the Sout River and its tributaries) that could be directly affected by the proposed power line, and two major river systems immediately to the north and south of the proposed substations at either end of the power line (the Swart-Doring and Jaagleegte Rivers, respectively), there are numerous non-perennial drainage lines (as captured on 1:50 000 scale topographical maps) that could be directly affected. Most of these drainage lines are very ephemeral systems (often well vegetated), almost being terrestrial in certain cases, and could be considered as wetlands associated with a drainage network as opposed to clearly channelised river ecosystems (e.g. see photo in Figure 3). To avoid the confusion of trying to distinguish between highly ephemeral rivers and possible wetlands associated with the drainage network, all these systems were simply classified as “drainage lines” for the purposes of the current study.
The Alternative 1 routing for the proposed power line crosses a total of approximately 70 “drainage lines”, while the Alternative 2 routing crosses a total of approximately 50 “drainage lines”, with 11 of these “drainage lines” being common to both routes (see maps in Appendix 2). This represents an average density of approximately 0.9 drainage line crossings per kilometre (or an average of one crossing every 1.1 km) in the case of Alternative 1, and an average of approximately 0.6 crossings per kilometre (or an average of one crossing every 1.7 km) for Alternative 2.

The present ecological condition and the ecological importance of the drainage lines that would be crossed by the alternative routes was broadly similar. Overall, of all the drainage lines that could be crossed by the proposed power line (considering both alternative routes together), approximately 25% were rated to be in poor condition, approximately 30% in fair condition, and approximately 45% (the majority) in good condition. In terms of their ecological/conservation importance (categorised according to the guidelines in Table 1), approximately 28% of the drainage lines were rated to be of low importance and approximately 2% of high importance, with the majority by far (approximately 70%) of the drainage lines rated to be of moderate importance. The only drainage lines rated to be of high importance were the Sout River and its main tributaries (the Groot-Goerap and Klein-Goerap Rivers).
The systems classified as “wetlands” in this study were clearly recognisable as wetland ecosystems, often associated with a river channel (i.e. floodplain or channelled valley-bottom wetlands, after Ollis et al. 2013) (e.g. see photos in Figure 4). Very few of these were identified along either of the proposed power line routes (see maps in Appendix 2), with only three wetlands mapped along the proposed Alternative 1 route and six mapped along the Alternative 2 route. It is not surprising that very few wetlands were identified that could be affected by the proposed power line project, due to the very low rainfall of the arid region and the predominance of relatively deep, granite-derived sandy soils over much of the study area.

Figure 4: Photographs of a wetland crossing an existing road along the proposed power line route (note distinctive vegetation and wet soils within the wetland area)
Most of the wetlands were rated to be in good condition, or fair to good condition, and almost all of them were rated to be of moderate importance. None of the mapped wetlands were rated to be of high importance.

A total of three dams were identified and mapped along the proposed Alternative 1 route and a total of two dams along the proposed Alternative 2 route, with one of these dams being along the common portion of the route (see maps in Appendix 2). These artificial features were not categorised in terms of their ecological condition and importance, but their presence should be taken into account when determining the pylon positions of the proposed power line.

The maps in Appendix 2 also show the recommended buffer areas for naturally occurring freshwater ecosystems (drainage lines and wetlands) along the proposed power line routes, assigned in each case on the basis of the present ecological condition and the importance of a freshwater ecosystem (using the buffer widths presented in Table 2). To protect freshwater ecosystems from many of the impacts potentially associated with the proposed power line development, no transmission line pylons should be established within these recommended buffer areas. Furthermore, the establishment of new access roads and the ongoing clearing or trimming of vegetation should be avoided within these recommended buffer areas.

6. ASSESSMENT OF POTENTIAL IMPACTS ON FRESHWATER ECOSYSTEMS ASSOCIATED WITH THE PROPOSED DEVELOPMENT

The current status quo of the proposed power line routes and of the potentially affected freshwater ecosystems, as presented in previous sections of this report, is the baseline against which the significance of potential impacts on freshwater ecosystems was assessed (below). In other words, the significance of potential impacts associated with the proposed power line routes has been determined by comparison with the “no-go alternative” of not undertaking the proposed activities (as recommended in terms of DEA&DP’s 2010 Guideline on Alternatives), as opposed to comparison against the presumed pristine state of the study area in the absence of existing impacts.

The potential impacts of the proposed Hoekklip-Zandkopsdrift transmission line and associated infrastructure on freshwater ecosystems were assessed separately for design-phase impacts (section 6.1), construction-phase impacts (section 6.2), operational-phase impacts (section 6.3) and decommissioning-phase impacts (section 6.4), using the significance rating method prescribed by GIBB (see Appendix 1) and taking the criteria for non-reversibility and irreplaceable resources into account when assigning impact intensity.
ratings. A discussion of the water use authorisations that may be required in terms of the National Water Act (Act No. 36 of 1998) is also included (section 6.5).

6.1. Footprint-related (design phase) impacts

No freshwater ecosystems have been identified within at least 200 m of the proposed substation or switching station sites for the proposed Hoekklip-Zandkopsdrift power line. A number of drainage lines and wetlands have, however, been identified within a 200 m corridor along the proposed power line routes. As such, one of the main potential impacts of the proposed power line on freshwater ecosystems is the placement of power line pylons within or in close proximity to freshwater ecosystems. Another, related, potentially negative impact is the construction of new access roads through freshwater ecosystems located between pylons. Both of these footprint-related issues, which can only be addressed during the design phase, could potentially result in the infilling of wetlands and other freshwater ecosystems, the loss of vegetation (and subsequent erosion) in or adjacent to freshwater ecosystems, and the possible fragmentation of habitats associated with freshwater ecosystems. These impacts would also result in the need for a “water use” authorisation to be obtained from the Department of Water Affairs in terms of Sections 21 and 22 of the National Water Act (Act No. 36 of 1998) for all pylons and access roads that encroach into any freshwater ecosystems (see section 6.5 of this report).

The potential footprint-related impacts on freshwater ecosystems associated with the proposed power line were assessed separately for the Alternative 1 and Alternative 2 routes that have been proposed (see Table 3). Without mitigation, the footprint-related impacts on freshwater ecosystems potentially associated with both of the proposed route alternatives were rated to be of medium to high significance. The impact would be of slightly higher significance in the case of Alternative 1, due to the higher density of drainage lines along this route that would need to be crossed, but the difference is not considered enough to elevate the impact significance rating to a higher category.

The recommended mitigation measure for the negative footprint-related impacts potentially associated with the Hoekklip-Zandkopsdrift power line would be to avoid the impacts by ensuring that no infrastructure (such as pylon structures and new access roads) is established within the recommended buffer areas for the freshwater ecosystems mapped along the proposed routes. If this mitigation measure was to be effectively implemented in the final design stages of the power line project, it is predicted that the potential footprint-related impacts on freshwater ecosystems could be reduced to a low level of significance (as shown in Table 3). This would, obviously, be more difficult for Alternative 1 than for Alternative 2, due to the higher density of drainage lines that the power line would have to cross over for this route option (e.g. see maps in Appendix 2). Therefore, unless it is possible to avoid the establishment of transmission line pylons and new access roads in freshwater ecosystems along this route or within the recommended buffer areas for the freshwater
ecosystems, Alternative 2 is marginally preferable to Alternative 1 from a freshwater ecosystem perspective.

Besides the lower drainage density along the Alternative 2 route option, the desktop analysis and fieldwork observations undertaken for the current investigation showed that there appear to be more opportunities to use existing access roads along this route, compared to the situation for the Alternative 1 routing.

No potential cumulative impacts of major significance to freshwater ecosystems were identified that could be addressed during the design phase of the proposed project.
Table 3: Summary of assessment of potential design-phase (footprint-related) impacts on freshwater ecosystems

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Intensity</th>
<th>Extent</th>
<th>Duration</th>
<th>Consequence</th>
<th>Probability</th>
<th>Significance</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1A: Encroachment of infrastructure into freshwater ecosystems (Alternative 1)</td>
<td>Negative</td>
<td>Medium-High</td>
<td>Local</td>
<td>Long-term</td>
<td>Medium-High</td>
<td>Highly probable</td>
<td>MEDIUM-HIGH</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low</td>
<td>Local</td>
<td>Long-term</td>
<td>Low</td>
<td>Probable*</td>
<td>LOW</td>
<td>Medium</td>
</tr>
<tr>
<td>Impact 1B: Encroachment of infrastructure into freshwater ecosystems (Alternative 2)</td>
<td>Negative</td>
<td>Medium-High</td>
<td>Local</td>
<td>Long-term</td>
<td>Medium-High</td>
<td>Highly probable</td>
<td>MEDIUM-HIGH</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low</td>
<td>Local</td>
<td>Long-term</td>
<td>Low</td>
<td>Probable*</td>
<td>LOW</td>
<td>Medium</td>
</tr>
</tbody>
</table>

* Avoidance of the impact (which would be the most effective mitigation) would require that no power line pylons or new access roads are established within the recommended buffer areas of the freshwater ecosystems identified along the proposed route, which would probably be impossible for the establishment of new access roads.
6.2. Construction-phase impacts
Due to the proximity of the proposed power line routes to numerous drainage lines and some wetlands, potential impacts on freshwater ecosystems associated with the construction of the proposed power line and associated infrastructure could include:

(1) Physical destruction or damage of freshwater ecosystems by workers and machinery operating within or in close proximity to wetlands or drainage lines, and through the establishment of construction camps or temporary laydown areas within or in close proximity to wetlands or drainage lines.

(2) Pollution of freshwater ecosystems through the runoff of contaminants such as fuel, oil, concrete, wash-water, sediment and sewage into these ecosystems.

(3) Increased disturbance of aquatic and semi-aquatic fauna, as a result of the noise from construction teams and their machinery working within or in close proximity to wetlands and rivers.

A summary of the assessment of the potential construction-phase impacts associated with the proposed power line on freshwater ecosystems is presented in Table 4 (below). Note that these impact ratings apply to both the power line route options assessed in this report (i.e. Alternatives 1 and 2). All the potential construction-phase impacts identified were rated to be of medium intensity and low significance without mitigation.

The following mitigation measures, which should be included in the Environmental Management Programme (EMP) for the project, are recommended to reduce the severity of the above-mentioned construction-phase impacts:

- All wetlands and drainage lines should generally be treated as “no-go” areas and appropriately demarcated as such. No vehicles, machinery, personnel, construction materials, cement, fuel, oil or waste should be allowed into these areas without the express permission of and supervision by the ECO.

- Construction activities associated with the establishment access roads through wetlands or drainage lines (if unavoidable) should be restricted to a working area 10 m in width either side of the road, and these working areas should be clearly demarcated. No vehicles, machinery, personnel, construction material, cement, fuel, oil or waste should be allowed outside of the demarcated working areas.

- There should be as little disturbance to surrounding vegetation as possible when construction activities are undertaken, as intact vegetation adjacent to construction areas will assist in the control of sediment dispersal from exposed areas.

- Construction camps, toilets and temporary laydown areas should be located at least 30 m from the edge of any wetlands and drainage lines.

- No fuel storage, refuelling, vehicle maintenance or vehicle depots should be allowed within 30 m of the edge of any wetlands or drainage lines.

- Refuelling and fuel storage areas, and areas used for the servicing or parking of vehicles and machinery, should be located on impervious bases and should have bunds around
them. Bunds should be sufficiently high to ensure that all the fuel kept in the area will be captured in the event of a major spillage.

- Vehicles and machinery should not be washed within 30 m of the edge of any wetland or drainage line.
- No effluents or polluted water should be allowed to discharge into any drainage lines or wetland areas.
- If construction areas are to be pumped of water (e.g. after rains), this water should be pumped into an appropriate settlement area, and not allowed to flow straight into any drainage lines or wetland areas.
- No spoil material, including stripped topsoil, should be temporarily stockpiled within 30 m of the edge of any wetland or drainage line.
- Freshwater ecosystems located in close proximity to construction areas (i.e. within ~30 m) should be inspected on a regular basis by the ECO for signs of disturbance from construction activities, and for signs of sedimentation or pollution. If signs of disturbance, sedimentation or pollution are noted, immediate action should be taken to remedy the situation and, if necessary, a freshwater ecologist should be consulted for advice on the most suitable remediation measures.
- Workers should be made aware of the importance of not destroying or damaging the vegetation along drainage lines and in wetland areas, of not undertaking activities that could result in the pollution of drainage lines or wetlands, and of not killing or harming any animals that they encounter. This awareness should be promoted throughout the construction phase (and decommissioning phase, if this takes place).

If the above-mentioned mitigation measures were to be effectively implemented, it is predicted that all the potential construction-phase impacts on freshwater ecosystems would be of low intensity and very low significance (see Table 4).

No potential cumulative impacts of major significance to freshwater ecosystems were identified for the construction phase of the proposed project.
### Table 4: Summary of assessment of potential construction-phase (and decommissioning-phase) impacts on freshwater ecosystems (applicable to Alternatives 1 and 2)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Intensity</th>
<th>Extent</th>
<th>Duration</th>
<th>Consequence</th>
<th>Probability</th>
<th>Significance</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 2: Physical destruction or damage of wetlands and drainage lines</td>
<td>Negative</td>
<td>Medium</td>
<td>Local</td>
<td>Short-term</td>
<td>Low</td>
<td>Highly probable</td>
<td>LOW</td>
<td>Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low</td>
<td>Local</td>
<td>Short-term</td>
<td>Very low</td>
<td>Probable</td>
<td>VERY LOW</td>
<td>Medium</td>
</tr>
<tr>
<td>Impact 3: Pollution of freshwater ecosystems</td>
<td>Negative</td>
<td>Medium</td>
<td>Local</td>
<td>Short-term</td>
<td>Low</td>
<td>Highly probable</td>
<td>LOW</td>
<td>Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low</td>
<td>Local</td>
<td>Short-term</td>
<td>Very low</td>
<td>Probable</td>
<td>VERY LOW</td>
<td>Medium</td>
</tr>
<tr>
<td>Impact 4: Disturbance to aquatic and semi-aquatic fauna</td>
<td>Negative</td>
<td>Medium</td>
<td>Local</td>
<td>Short-term</td>
<td>Low</td>
<td>Highly probable</td>
<td>LOW</td>
<td>Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low</td>
<td>Local</td>
<td>Short-term</td>
<td>Very low</td>
<td>Probable</td>
<td>VERY LOW</td>
<td>Medium</td>
</tr>
</tbody>
</table>

* Assessment of potential impacts with mitigation assumes that ALL the recommended construction-phase mitigation measures are effectively implemented, and that the potential footprint-related impacts have been addressed during the design phase.
6.3. Operational-phase impacts

The main potential impacts to freshwater ecosystems that have been identified for the operational phase of the proposed Hoekklip-Zandkopsdrift power line development are as follows:

1. Increased erosion and alteration of the hydrology of drainage lines and wetlands, as a result of the establishment of transmission line towers within or immediately adjacent to these freshwater ecosystems.

2. Increased erosion and alteration of the hydrology of drainage lines and wetlands, as a result of the establishment of access roads through these freshwater ecosystems.

3. Clearing or trimming of natural vegetation in and around wetlands and drainage lines located within the servitude of the power line, as part of the routine maintenance operations.

4. Disturbance to aquatic and semi-aquatic fauna associated with freshwater ecosystems located below or in close proximity to the power line, through the noise and electromagnetic field (EMF) that would result from the operation of the high-voltage transmission line. There is also the possibility of noise- and lighting-related disturbance to aquatic and semi-aquatic fauna associated with freshwater ecosystems located in close proximity to the proposed substation/s and switching station/s.

With the exception of the impact relating to the disturbance of aquatic and semi-aquatic fauna, all of the above-listed potential operational phase impacts on freshwater ecosystems were rated to be of medium or medium-to-high significance without mitigation (see Table 5). Note that these impact ratings apply to both the power line route options assessed in this report (i.e. Alternatives 1 and 2).

The only way to effectively mitigate the first of the potential operational-phase impacts listed above would be to ensure that none of the pylons for the transmission line are located within any drainage lines or wetlands, and preferably that no pylons are located within the recommended buffer areas for these freshwater ecosystems (as recommended in section 6.1, above). As indicated previously, this is likely to be more difficult to achieve for Alternative 1 due to the higher density of drainage lines along the route compared to Alternative 2.

For the second potential operational-phase impact, relating to the construction of access roads across wetlands and drainage lines, the best way to mitigate this impact would also be to avoid it by, for example, using existing access roads wherever possible. In situations where the impact is unavoidable, it can be mitigated to some degree by formalising road crossings over drainage lines and using properly designed structures that minimise the

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3 Note that the potential impacts of the proposed power line on avifauna (e.g. collision and electrocution risk), including water birds, have not been considered in the current study because this has been addressed in the avifauna specialist study by Jenkins (2013).
alteration of flows. For wetlands, the impact can be mitigated to some extent by installing adequate sub-surface drainage under any access roads for which the crossing of wetland areas is unavoidable. The input of a freshwater ecologist should be obtained during the design phase for any unavoidable road crossings over drainage lines or wetlands that are required for the proposed power line. As indicated above, there appear to be better opportunities to use existing access roads along the proposed Alternative 2 route option than there are along the Alternative 1 route option.

The clearing or trimming of natural vegetation in and around wetlands and drainage lines located within the servitude of the proposed power line is a potentially negative operational-phase impact rated to be of medium to high intensity, local to regional extent and medium to high significance without mitigation. The regional extent of this impact, in certain cases, is due to the relatively high number of threatened or near threatened plant species that could occur in natural habitats in the study area (as highlighted by Hoare 2013), including vegetated wetlands and drainage lines. It is strongly recommended that the vegetation maintenance protocol generally followed by Eskom should be re-evaluated for the sections of the proposed power line that traverse natural areas, including wetlands and drainage lines, in consultation with relevant conservation agencies for the region (e.g. CapeNature and the Northern Cape Department of Tourism, Environment and Conservation. One of the options that could be explored to mitigate against the potential vegetation clearing/trimming impacts would be to consider constructing taller pylons in certain areas that are high enough to allow for the growth of relatively tall vegetation. In addition, as recommended by Hoare (2013), where the proposed power line traverses areas of natural vegetation (including wetlands and vegetated drainage lines), a detailed threatened plant species assessment should be undertaken by a suitably qualified botanical specialist during an appropriate season and possibly at different times of the year. This specialist assessment should be used to guide the final positioning of the infrastructure (including pylons and access roads) associated with the proposed power line, so as to avoid disturbance of plant species of conservation importance.

During the operational phase, it is also recommended that there should be regular (e.g. annually or twice a year) monitoring of the condition of the vegetation within untransformed areas along the power line servitude by a botanical specialist with knowledge of wetland and riparian vegetation, and this monitoring should include an evaluation of the vegetation associated with wetlands and drainage lines along the route. The effects of the maintenance operations within the power line servitude, including any vegetation clearing or trimming, should be carefully evaluated when the monitoring is undertaken. The findings of the monitoring should be used to guide the ongoing development of an ecologically sound protocol for vegetation maintenance activities within freshwater ecosystems and the surrounding terrestrial areas along the power line servitude. The detailed specifications of the vegetation monitoring programme should be developed
by a botanical specialist, with input from CapeNature and the Northern Cape Department of Tourism, Environment and Conservation.

It is predicted that, with the effective implementation of the above-mentioned mitigation measures, the potential operational-phase impacts 5, 6 and 7 (as listed in Table 5) would be reduced to low levels of significance. In the case of impacts 5 and 6 (relating to increased erosion and alteration of hydrology associated with the placement of power line pylons and access roads within freshwater ecosystems), it is important to note that the assessment of impact significance after mitigation is based on the assumption that the encroachment of pylons and access roads into the recommended buffer areas of the freshwater ecosystems identified along the proposed routes is avoided as far as possible. As indicated previously, this is likely to be more difficult to achieve for the Alternative 1 routing, compared to Alternative 2, due to the higher density of drainage lines along this route.

There is no way to mitigate against the noise- and EMF-related disturbance to aquatic and semi-aquatic fauna potentially associated with the operation of the proposed power line and associated substations and switching stations, and it is difficult to predict how significant this potential impact could be (although it was rated to be a potential impact of low significance, this rating was assigned with a low level of confidence – see Table 5). The light-related disturbance from the substations and switching station could be mitigated to some degree by minimising the amount of lighting at these facilities and by using low-intensity lights that are directed exclusively to the areas where night-time lighting is required.

No potential cumulative impacts of major significance to freshwater ecosystems were identified for the operational phase of the proposed project.
### Table 5: Summary of assessment of potential operational-phase impacts on freshwater ecosystems (applicable to Alternatives 1 and 2)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Intensity</th>
<th>Extent</th>
<th>Duration</th>
<th>Consequence</th>
<th>Probability</th>
<th>Significance</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 5: Increased erosion and alteration of hydrology of freshwater ecosystems due to the placement of pylons</td>
<td>Negative</td>
<td>Medium</td>
<td>Local</td>
<td>Long-term</td>
<td>Medium</td>
<td>Highly probable</td>
<td>MEDIUM</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low#</td>
<td>Local</td>
<td>Long-term</td>
<td>Low#</td>
<td>Probable</td>
<td>LOW#</td>
<td>Medium</td>
</tr>
<tr>
<td>Impact 6: Increased erosion and alteration of hydrology of freshwater ecosystems due to the placement of access roads</td>
<td>Negative</td>
<td>Medium</td>
<td>Local</td>
<td>Long-term</td>
<td>Medium</td>
<td>Highly probable</td>
<td>MEDIUM</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low#</td>
<td>Local</td>
<td>Long-term</td>
<td>Low#</td>
<td>Probable</td>
<td>LOW#</td>
<td>Medium</td>
</tr>
<tr>
<td>Impact 7: Clearing and/or trimming of natural vegetation in and around freshwater ecosystems within servitude</td>
<td>Negative</td>
<td>Medium-High</td>
<td>Local-Regional</td>
<td>Long-term</td>
<td>Medium-High</td>
<td>Highly probable</td>
<td>MEDIUM-HIGH</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>With Mitigation*</td>
<td>Negative</td>
<td>Low</td>
<td>Local-Regional</td>
<td>Long-term</td>
<td>Low</td>
<td>Probable</td>
<td>LOW</td>
<td>Medium</td>
</tr>
<tr>
<td>Impact 8: Ongoing disturbance to aquatic and semi-aquatic fauna</td>
<td>Negative</td>
<td>Low</td>
<td>Local</td>
<td>Long-term</td>
<td>Low</td>
<td>Probable</td>
<td>LOW</td>
<td>Low</td>
</tr>
<tr>
<td>With Mitigation</td>
<td>n/a**</td>
<td>n/a**</td>
<td>n/a**</td>
<td>n/a**</td>
<td>n/a**</td>
<td>n/a**</td>
<td>n/a**</td>
<td>n/a**</td>
</tr>
</tbody>
</table>

* Assessment of potential impacts with mitigation assumes that ALL the recommended operational-phase mitigation measures are effectively implemented, and that the potential footprint-related impacts have been addressed during the design phase

# Assessment of Impacts 5 and 6 “with mitigation” is based on the assumption that the encroachment of transmission line pylons and access roads into freshwater ecosystems will be avoided as far as possible, in addition to the proper design of unavoidable road crossings through/over wetlands and drainage lines

** No mitigation of Impact 8 is possible
6.4. Decommissioning-phase impacts
The potential impacts on freshwater ecosystems that are likely to be associated with the decommissioning the proposed power line would be very similar to the construction-phase impacts. The recommended mitigation measures for the decommissioning phase are, therefore, the same as those for the construction phase (see section 6.2, above) and the significance of the potential impacts on freshwater ecosystems is likely to be similar (see Table 4).

No potential cumulative impacts of major significance to freshwater ecosystems were identified for the decommissioning phase of the proposed project.

6.5. “Water use” authorisations
According to Section 22(1) of the National Water Act (Act No. 36 of 1998), a Water Use Licence is required for all “water uses” listed in Section 21 of the Act, unless the water use is permissible under Schedule 1 of the Act, or as a continuation of an existing lawful use, or in terms of a General Authorisation issued under Section 39 of the Act (Thompson 2006). Section 21 of the National Water Act lists the activities that are considered to be a “water use” as follows:

“For the purposes of this Act, water use includes
(a) taking water from a water resource;
(b) storing water;
(c) impeding or diverting the flow of water in a watercourse;
(d) engaging in a stream flow reduction activity contemplated in section 36;
(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
(g) disposing of waste in a manner which may detrimentally impact on a water resource;
(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
(i) altering the bed, banks, course or characteristics of a watercourse;
(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
(k) using water for recreational purposes.”

The most likely “water uses” in terms of the National Water Act that could be triggered by the proposed establishment of the Hoekklip-Zandkopsdrift power line would be those listed in section 21(c) (“impeding or diverting the flow of water in a watercourse”) and section 21(i) (“altering the bed, banks, course or characteristics of a watercourse”), and a specific
General Authorisation has been promulgated for these water uses\textsuperscript{4}. If the encroachment of power line pylons and access roads into freshwater ecosystems is avoided altogether, as recommended in this specialist study (see section 6.1 of the current report), then it is unlikely that either of these “water uses” would be triggered and no authorisation would be required from the Department of Water Affairs.

It should be possible to avoid the encroachment of power line pylons into freshwater ecosystems, but the establishment of new access roads through/over freshwater ecosystems (especially drainage lines) may be unavoidable. Before a proper evaluation of the “water use” authorisation requirements associated with the proposed power line project can be made and before any applications for such authorisation can be prepared, detailed information is going to be required about the proposed positions of the pylons for the power line and the exact proposed routing of all the access roads that are going to be required.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions
A number of freshwater ecosystems were identified along the two alternative routes proposed for the Hoekklip-Zandkopsdrift power line, mostly in the form of highly ephemeral drainage lines that are, in many cases, transitional between river and wetland ecosystems. Many of the drainage lines were assessed to be in good condition and most were rated to be of moderate conservation importance. The highest density of drainage lines occurs along the Alternative 1 route option (with the average density of drainage line crossings estimated to be just under one crossing per kilometre, versus an average of approximately 0.6 crossings per kilometre in the case of Alternative 2). As such, the potential for the encroachment of infrastructure associated with the proposed power line (especially pylons and access roads) into freshwater ecosystems is slightly higher for Alternative 1 than it is for Alternative 2. Therefore, the route alignment of Alternative 2 is marginally preferable to that of Alternative 1 from a freshwater ecology perspective.

The significance of most of the potentially negative construction-, operational- and decommissioning-phase impacts is dependent on the degree to which the encroachment into freshwater ecosystems can be avoided during the design phase. Due to the higher density of drainage lines along the Alternative 1 route alignment, the extent to which encroachment into freshwater ecosystems can be avoided is likely to be slightly less than it would be for the Alternative 2 route alignment. At the same time, there are a number of

moderate to highly important wetlands and drainage lines along both the proposed route alignments that could result in highly significant negative construction- and operational-phase impacts if infrastructure for the proposed power line was to encroach into these ecosystems.

If the encroachment of power line pylons and access roads into freshwater ecosystems can be avoided, then it is predicted that most of the potential negative impacts to freshwater ecosystems would be reduced to low levels of significance for both route alternatives, assuming that all the other mitigation measures recommended in the current report are also properly implemented. The avoidance of encroachment into freshwater ecosystems would also reduce the likelihood that a water use authorisation would be required from DWA in terms of the National Water Act (Act No. 36 of 1998). As indicated above, it is going to be slightly more difficult to avoid encroachment into drainage lines in the case of the Alternative 1 route alignment option that has been proposed, compared with the Alternative 2 route alignment option.

### 7.2. Recommendations

The maps of freshwater ecosystems along the proposed power line routes that have been compiled as part of this specialist study (as presented in Appendix 2 of the current report and provided in electronic KML format), and of the recommended buffer areas for the freshwater ecosystems, should be used to guide the further planning of the proposed infrastructure development. In particular, transmission line pylons should be positioned outside of the recommended buffer areas for freshwater ecosystems and access roads should be routed in such a way as to avoid the crossing of freshwater ecosystems or encroachment into the recommended buffer areas for freshwater ecosystems.

Assuming that the encroachment of infrastructure associated with the proposed power line into freshwater ecosystems can be avoided or reduced to very low levels during the final design stages of the project, then the recommended mitigation measures for the protection of freshwater ecosystems during the construction and operational phases provided in the current report (in sections 6.2 and 6.3) should be written into the EMP and implemented under the guidance of a suitably experienced ECO.
8. REFERENCES


APPENDIX 1:
Prescribed impact significance assessment method
**IMPACT ASSESSMENT METHODOLOGY**

Impact Assessment Methodology - Instructions to Specialists

To ensure consistency in the assessment of impacts, all specialists are required to make use of the impact assessment methodology described in this Appendix. Deviations from this methodology must be discussed and agreed with ARCUS GIBB prior to the commencement of the specialist study.

**Step 1: Identify all possible impacts**

The specialists are required to identify all the possible impacts associated with the proposed development. Through the Public Participation Process, additional impacts may be identified, which may require specialist consideration and therefore must be addressed by the relevant specialist. The impacts identified must be applicable to all phases of the proposed development, i.e. construction and operation.

**Step 2: Prediction of impacts**

Identified impacts must be assessed in terms of the following criteria and rating scales:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating Scales</th>
</tr>
</thead>
</table>
| Cumulative impacts (incremental impacts of the activity and other past, present and future activities on a common resource) | - Low (there is still significant capacity of the environmental resources within the geographic area to respond to change and withstand further stress)  
- Medium (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress is reduced)  
- High (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress has been or is close to being exceeded) |
| Nature | - Positive  
- Negative  
- Neutral |
| Extent (the spatial limit of the impact) | - Local (site-specific and/or immediate surrounding areas)  
- Regional (Gauteng)  
- National |
| Intensity (the severity of the impact) | - Low - where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected  
- Medium - where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected  
- High - where natural, cultural or social functions and processes are altered to the extent that it will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected |
| Duration (the predicted lifetime of the impact) | - Short-term (0 to 5 years)  
- Medium term (6 to 15 years)  
- Long term (16 to 30 years) - where the impact will cease after the operational life of the activity either because of natural processes or by human intervention |
| Probability (the likelihood of the impact occurring) | - Improbable – where the possibility of the impact occurring is very low  
- Probable – where there is a good possibility (<50 % chance) that the impact will occur  
- Highly probable – where it is most likely (50-90 % chance) that the impact will occur  
- Definite – where the impact will occur regardless of any
**Criteria**

<table>
<thead>
<tr>
<th>Rating Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>prevention measures (&gt;90 % chance of occurring)</td>
</tr>
</tbody>
</table>

**Reversibility** (ability of the impacted environment to return to its pre-impacted state once the cause of the impact has been removed)
- Low (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the short-term)
- Medium (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the medium to long term)
- High (impacted natural, cultural or social functions and processes will never return to their pre-impacted state).

**Impact on irreplaceable resources** (is an irreplaceable resource impacted upon)
- Yes
- No

**Confidence level** (the specialist's degree of confidence in the predictions and/or the information on which it is based)
- Low
- Medium
- High

The result of the impact prediction must be summarised in a table as per Example 1. The criteria for cumulative impacts, non-reversibility and irreplaceable resources must be considered as part of the impact **Intensity** criterion.

**Example 1: Prediction of Impacts (before mitigation)**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Intensity</th>
<th>Extent</th>
<th>Duration</th>
<th>Probability</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion</td>
<td>-</td>
<td>Low</td>
<td>Local</td>
<td>Short-term</td>
<td>Probable</td>
<td>High</td>
</tr>
</tbody>
</table>

**Step 3: Identify mitigation measures and predict the residual impact**

Identify and describe practical mitigation measures that can be implemented effectively to reduce the significance of the impact. The impact should be re-assessed following mitigation, by following Step 2 again to demonstrate how the impact criteria change after implementation of the proposed mitigation measures. The results of this assessment must be summarised as per the table in Example 2.

**Example 2: Prediction of Impacts (after mitigation)**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Intensity</th>
<th>Extent</th>
<th>Duration</th>
<th>Probability</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion With Mitigation</td>
<td>-</td>
<td>Negligible</td>
<td>Local</td>
<td>Short-term</td>
<td>Improbable</td>
<td>High</td>
</tr>
</tbody>
</table>

**Step 4: Assign a consequence rating**

The consequence of the potential impacts will be determined according to the main criteria for determining the consequence of impacts, namely the extent, duration and intensity of the impacts.

Using the consequence rating below, assign a consequence to the impacts for both the pre-mitigation and post-mitigation scenario (Example 3):

---

1 A resource for which no reasonable substitute exists, such as Red Data species and their habitat requirements
<table>
<thead>
<tr>
<th>Consequence Rating</th>
<th>Intensity, Extent and Duration Rating</th>
</tr>
</thead>
</table>
| **HIGH** Consequence | - High intensity at a regional level and endure in the long term  
- High intensity at a national level and endure in the medium term  
- Medium intensity at a national level and endure in the long term  
- High intensity at a regional level and endure in the medium term  
- High intensity at a national level and endure in the short term  
- Medium intensity at a national level and endure in the medium term  
- Low intensity at a national level and endure in the long term  
- High intensity at a local level and endure in the long term  
- Medium intensity at a regional level and endure in the long term |
| **MEDIUM** Consequence | - High intensity at a local level and endure in the medium term  
- Medium intensity at a regional level and endure in the medium term  
- High intensity at a regional level and endure in the short term  
- Medium intensity at a national level and endure in the short term  
- Medium intensity at a local level and endure in the long term  
- Low intensity at a national level and endure in the medium term  
- Low intensity at a local level and endure in the medium term  
- Low intensity at a regional level and endure in the long term  
- Low intensity at a regional level and endure in the long term |
| **LOW** Consequence | - Low intensity at a regional level and endure in the medium term  
- Low intensity at a national level and endure in the short term  
- High intensity at a local level and endure in the short term  
- Medium intensity at a regional level and endure in the short term  
- Low intensity at a local level and endure in the long term  
- Low intensity at a local level and endure in the medium term  
- Low intensity at a regional level and endure in the short term  
- Low to medium intensity at a local level and endure in the short term |

Example 3: Assign a consequence rating

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Consequence</th>
<th>Probability</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion</td>
<td>-</td>
<td>Low</td>
<td>Probable</td>
<td>High</td>
</tr>
<tr>
<td>With Mitigation</td>
<td>-</td>
<td>Low</td>
<td>Improbable</td>
<td>High</td>
</tr>
</tbody>
</table>
Step 5: Assign a significance rating

The **significance** of an impact is defined as a combination of the consequence of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact must be rated according to the methodology set out below:

- **LOW** – will not have an influence on the decision to proceed with the proposed project, provided that recommended mitigation measures to mitigate impacts are implemented;
- **MEDIUM** – should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented; and
- **HIGH** – would strongly influence the decision to proceed with the proposed project.

<table>
<thead>
<tr>
<th>Consequence Rating</th>
<th>Consequence x Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH Significance</td>
<td>• High x Definite</td>
</tr>
<tr>
<td></td>
<td>• High x Highly Probable</td>
</tr>
<tr>
<td></td>
<td>• High x Probable</td>
</tr>
<tr>
<td></td>
<td>• High x Improbable</td>
</tr>
<tr>
<td></td>
<td>• Medium x Definite</td>
</tr>
<tr>
<td>MEDIUM Significance</td>
<td>• Medium x Highly Probable</td>
</tr>
<tr>
<td></td>
<td>• Medium x Probable</td>
</tr>
<tr>
<td>LOW Significance</td>
<td>• Medium x Improbable</td>
</tr>
<tr>
<td></td>
<td>• Low x Definite</td>
</tr>
<tr>
<td></td>
<td>• Low x Highly Probable</td>
</tr>
<tr>
<td></td>
<td>• Low x Probable</td>
</tr>
<tr>
<td></td>
<td>• Low x Improbable</td>
</tr>
</tbody>
</table>

**Example 4: Assigning a significance rating**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Consequence</th>
<th>Probability</th>
<th>Significance</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion</td>
<td>Low</td>
<td>Probable</td>
<td>LOW</td>
<td>High</td>
</tr>
<tr>
<td>With Mitigation</td>
<td>Low</td>
<td>Improbable</td>
<td>LOW</td>
<td>High</td>
</tr>
</tbody>
</table>

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2 This does not apply to minor impacts which can be logically grouped into a single assessment.
APPENDIX 2:
Maps of freshwater ecosystems identified along the proposed power line routes and of the recommended buffer areas

NOTE:
Maps 1 to 10 are presented from north to south (i.e. from Zandkopsdrift Mine substation on Map 1 to Hoekklip substation on Map 10)