3.3 NFEPA context

Data from the NFEPA programme have been presented in **Figures 9** and **10**, and indicate the following:

- Two quaternary catchments (the Koekedou and Titus sub-catchments (H10C and H10B respectively – see **Figure 9**) in the vicinity of the proposed powerline have been classified in NFEPA data as Fish Support areas, supporting at least one vulnerable or near-threatened fish species. NFEPA data indicate that this species in both cases is *Pseudobarbus burchelli* cf. Breede (Breede River redfin), which though widespread in the Breede River catchment are largely confined to tributaries without alien fish species (Garrow and Marr 2012);
- The proposed powerline itself would not however cross through any of the main tributaries in which the above species is likely to occur (**Figure 9**), stopping just south of the Koekedou River at the Ceres substation;
- The powerline would however cross two NFEPA Rivers, namely the Dwars / Breede and the Witels, with the former of these major watercourses needing to be crossed at least twice, while a new access road would cross the Dwars once;
- NFEPA data for river condition (**Figure 10**), based on modelled landuse, suggest that the Koekedou and Witels Rivers are in relatively good condition (PES Category A/B) in their reaches closest to the proposed crossing points / nearest point of the powerlines. The Dwars / Breede River itself is however much more significantly impacted in its reaches through and in the vicinity of the proposed powerline corridor, with NFEPA data showing the river as a PES Category D upstream of Ceres town, improving to Category C in its reaches through the Michell's Pass as far as the Witels confluence and then dropping to PES D downstream of this tributary. These main stem ratings are surprising, in that they do not seem to reflect known inflows of treated sewage water within Ceres town – although these may be diluted by the impact of the near-natural Witels River into the Dwars / Breede River. Ground-truthing in the present site assessment showed however that the data do reflect significant and extensive alien plant invasion along the river corridor and almost its entire floodplain, and erosion, sedimentation, shading and other impacts associated with such levels of woody invasive alien encroachment. Data from the National Rivers Programme for the Upper Breede and its tributaries (River Health Programme (RHP) 2011) also largely support these condition ratings, with the Dwars River upstream and downstream of Ceres being rated with an overall ecostatus of Fair, with Fish assemblages and Riparian vegetation both being rated as Poor downstream of Ceres. The Witels River is rated with an overall Ecostatus of Good, with all ecostatus categories other than fish and riparian vegetation being rated as Natural. Riparian vegetation was rated as Good, but fish were rated poor, reflecting the assumed presence of alien fish (sharptooth catfish and smallmouth bass) (see RHP 2011).
- NFEPA wetland data also identify a number of wetlands in the vicinity of the study area. These are mapped largely in the southern part, and comprise mainly channeled valley bottom wetlands along the Breede River itself, downstream (and south of) the Witels River confluence, as well as numerous minor channeled valley bottom wetlands that drain in a westerly direction towards the Breede River, off the hillslopes to the east of the river, again south of the Witels River confluence (**Figure 11**). Numerous artificial wetlands (mainly farm dams) have also been classified in NFEPA data, with the largest artificial system in the vicinity of the proposed powerlines being the Ceres Dam (also known as the Koekedou Dam) just west of Ceres town.

While the above data provide useful information about the context of the present study area at a national level, it must be stressed that the NFEPA datasets considerably underestimate the extent of wetlands in this area, and the Critical Biodiversity Area data developed for the Witzenberg Municipality Biodiversity Plan (from Job et al 2008 and included in WCBSP (2017) dataset) provide a far more useful spatial overview of watercourses including wetlands in the study area.

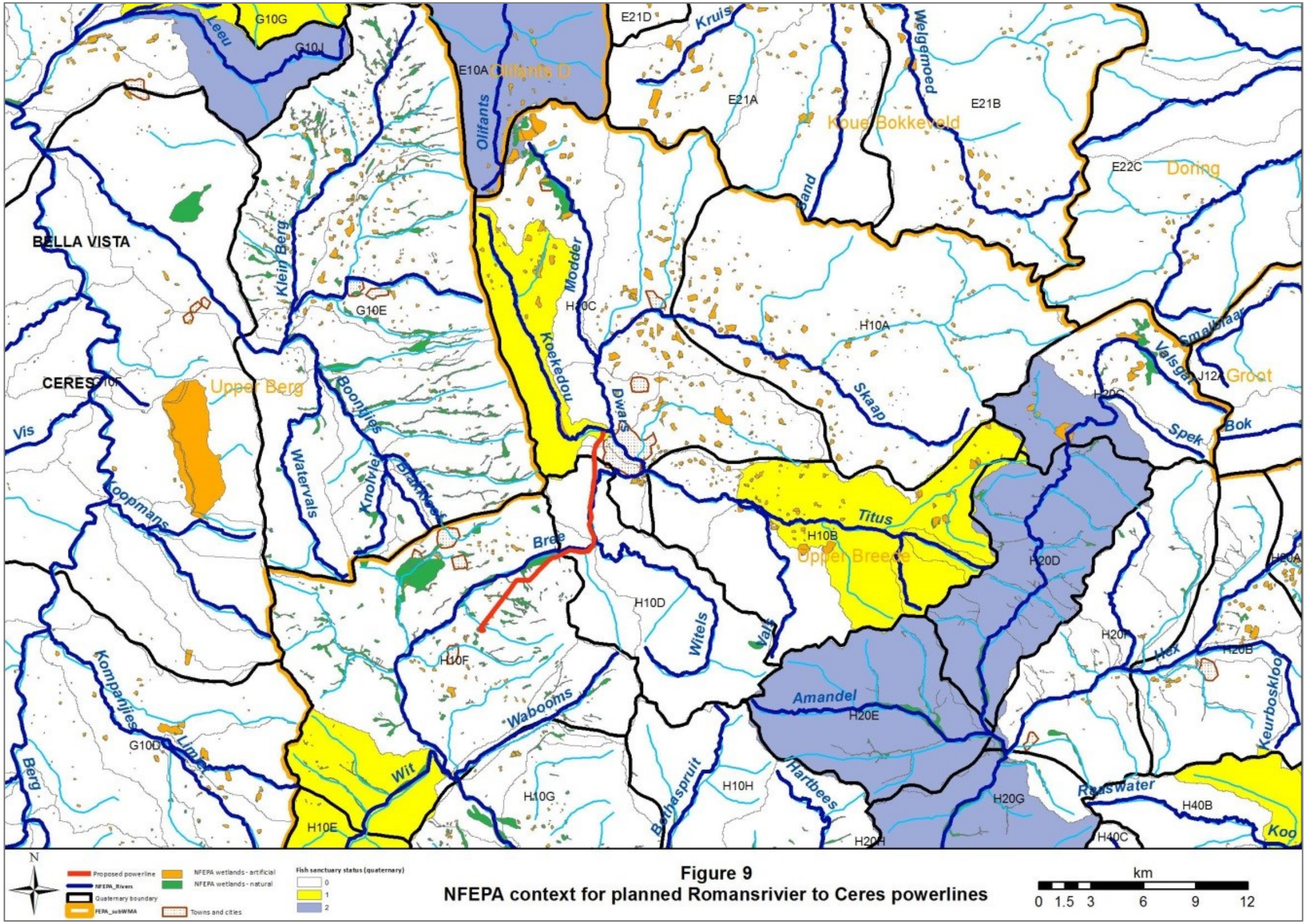


Figure 9
NFEPA context for planned Romansrivier to Ceres powerlines

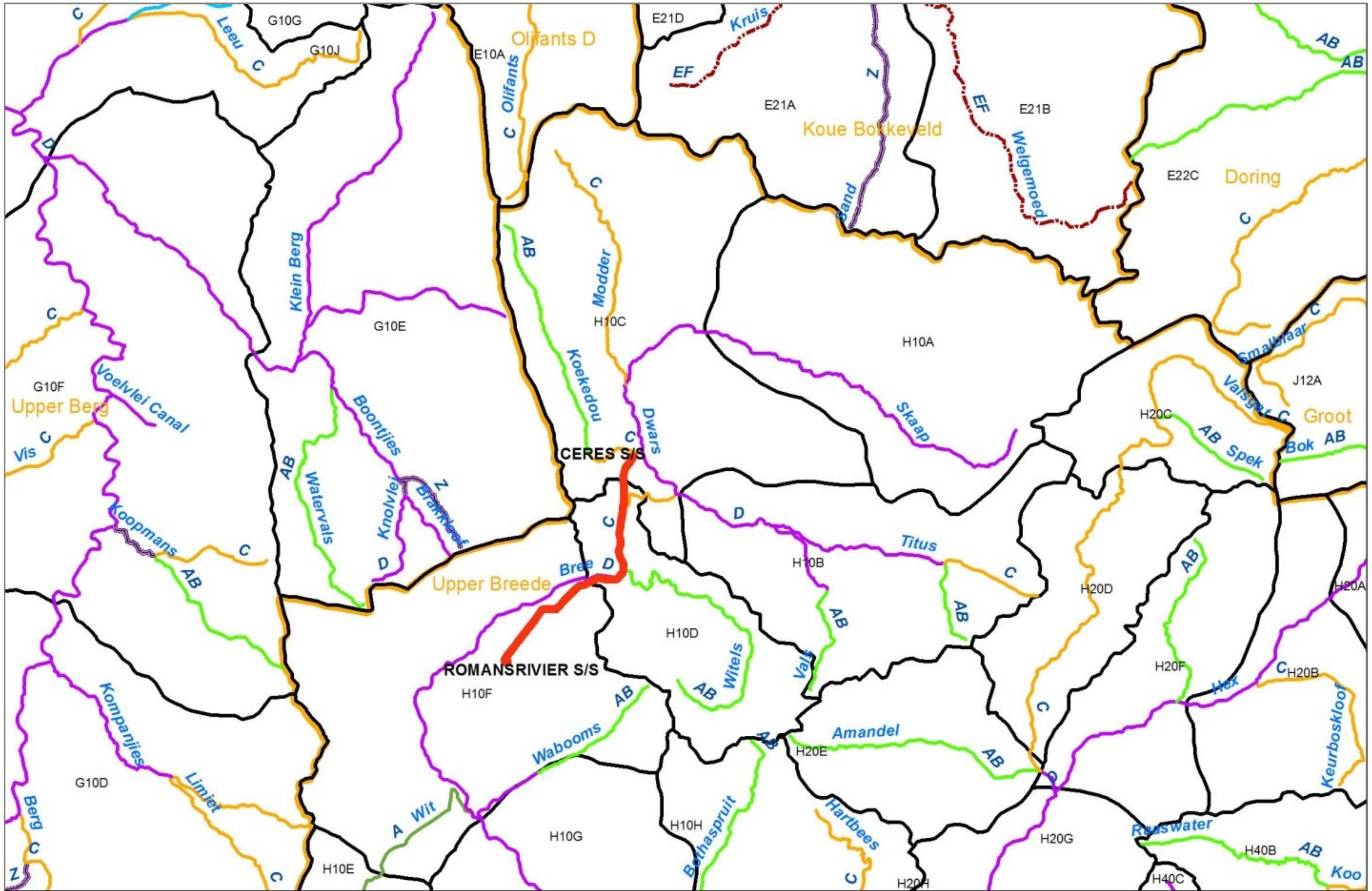


Figure 10
NFEPA context for planned Romansrivier to Ceres powerlines
Present Ecological State (PES) / Condition

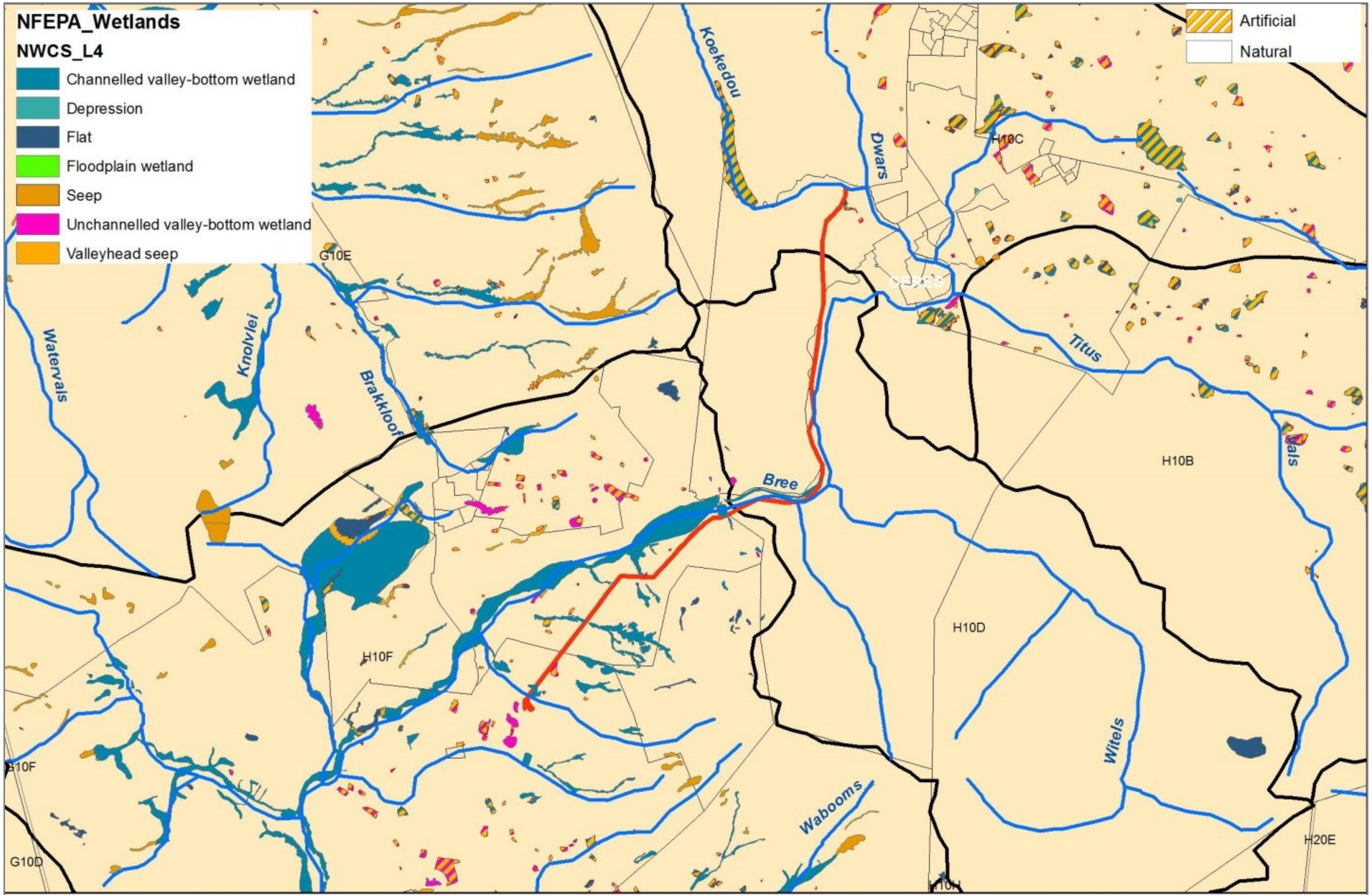


Figure 11
Wetlands as classified in the NFEPA wetland layer
Artificial wetlands classified separately

Box 1

Description of Biodiversity Priority categories (adapted from Job et al 2008)

In the Upper Breede Biodiversity Planning Domain (see Job et al 2008) biodiversity priority categories were assigned to each aquatic ecosystem and management zone, with categories being defined as follows:

- **Critical Biodiversity Areas** (CBAs): Aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning in the long term, particularly in the face of climate change. In terms of surface freshwater ecosystems, aquatic CBAs include the irreplaceable, in terms of meeting biodiversity pattern targets, and best condition wetlands, estuaries and river reaches, representative of the full set of types in the region. These also include sub-catchments, considered to be critical for achieving river or wetland type targets, or containing rivers important as fish sanctuaries. To a certain extent, CBAs also include some ecosystems required for the persistence of species, e.g. fish spawning areas.

  Wetlands were categorised as CBAs if they are:
  - Required to meet the wetland conservation threshold of 24% for all wetland types;
  - A significant wetland cluster;
  - An estuary;
  - Known habitat for Red Data Book listed hydrophytic plant species, or
  - Known habitat for focal amphibian species.

  River reaches were categorised as CBAs if they are:
  - Required to meet target of 20% of each river type;
  - Rivers of high integrity (A, AB and B classes) (i.e. considered irreplaceable), or
  - Considered to be an important fish sanctuary.

  Sub-catchments were selected as CBA or priority sub-catchments if they are:
  - Required for achieving river or wetland type conservation targets, or
  - Include rivers considered to be important fish sanctuaries.

- **Critical Ecological Support Areas** (CESAs) are supporting areas required for preventing degradation of CBAs and protected areas. These are freshwater ecosystems required in order to meet ecological process targets, or which are required in order to meet persistence objectives. Importantly, these include all buffer areas around CBAs, required for the protection of the aquatic CBAs.

  Wetlands were categorised as CESAs if they are:
  - The remaining (non-CBA) significant wetland clusters;
  - Supporting a CBA river, wetland or estuary, or
  - Good condition wetlands in CBA or CESA sub-catchments.

  River reaches were categorised as CESAs if they:
  - Are important for connectivity between CBA river reaches;
  - Are major rivers that support a CBA river segment or wetland, or
  - Are minor rivers that are situated within a CBA or priority sub-catchment.

  Sub-catchments were categorised as CESAs if they support a CBA river or wetland or contain CESA river reaches.

- **Other Ecological Support Areas** (OESAs) include all remaining (i.e. non-CBA and non-CESA) wetlands and rivers. These are essentially supporting areas required for preventing the degradation of CBAs and CESAs, or those ecosystems requiring at most moderate protection (based on its low to moderate functional importance and sensitivity).

  Also included as OESAs are sub-catchments that are:
  - Significant groundwater recharge and discharge sites;
  - Upstream management zones, or
  - Required for connecting sub-catchments for fish movement / refuge.

3.4 Fine-scale Planning context

Figure 12 illustrates the extent of freshwater ecosystems in and in the vicinity of the proposed Romansrivier to Ceres substations power line, in terms of the Witzenberg Municipality Biodiversity Plan. This plan (also shown in the more detailed maps of **Figures 2-6)** indicates the presence of multiple watercourses that would be crossed by the proposed powerline alignment. These watercourses were shown by ground-truthing of the present study area to be of a high level of accuracy at least with regard to extent. They have been classified in the Finescale Biodiversity Plan as (variously) Critical Biodiversity Areas (CBAs), Critical Ecological Support Areas (CESAs) and Other Ecological Support Areas, using the criteria outlined in **Box 1** (after Job et al. 2008).

Figure 12 shows that the proposed line in the Ceres area would pass over and in the vicinity of a number of watercourses that have been evaluated in the Witzenberg Biodiversity Plan as CESAs, and which drain into the Koekedou River to the north. Within DWS quaternary H10D, numerous OESAs have been mapped in the vicinity of the proposed powerlines, and these drain east-south-east, directly into the Dwars / Breede River, in its reaches through Michell's Pass, as well as west, off the adjacent parallel mountain range, into the Dwars / Breede River that courses as a foothill river along the valley bottom.

The Witels River also drains into the main stem of the Breede River in these reaches – although it has been classified in the CBA dataset as associated with several minor tributaries that have been mapped as OESAs, the Witels itself is not classified as a wetland system. Ground-truthing of this part of the study area confirmed this aspect. CBA wetlands have however been mapped along the main stem of the Dwars / Breede River immediately downstream of the Witels River confluence. Wetlands were observed in this area during the present study – they were however invaded by alien vegetation.

The area through which the powerline would pass south of the confluence of the Witels River with the Dwars River would include crossing over at least five watercourses that have been mapped as CBA wetlands in close proximity to the proposed power line, as far as the Romansrivier substation.

3.5 River ecological importance and sensitivity

RHP (2011) river assessments rate the EI and ES of the Dwars River upstream of Ceres and the lower Koekedou in the vicinity of the Ceres substation as Medium for both categories, with EI for the Breede River downstream of the Witels confluence (i.e. at the R43 bridge) increasing to High. The Witels River was rated as High for both EI and ES, highlighting the importance of this relatively unimpacted system, which lies largely outside of agricultural areas and is not subjected to the high levels of agricultural encroachment and abstraction that affect the Dwars River upstream of Ceres.

3.6 Description of affected aquatic ecosystems

This section provides a more detailed description of the aquatic ecosystems identified along the proposed alignment of the powerline to be constructed between Romansrivier and Ceres substations. Note that whereas the previous sections have described the study area and its associated catchment from upstream to downstream within the Breede River catchment (that is, from north to south), this section describes the affected systems from south to north. This is in response to the technical data provided by Eskom, which list the powerline support structures numerically, from the Romansrivier substation in the south, upstream through the catchment, to the Ceres substation in the north of the study area (see **Figures 2-6**).

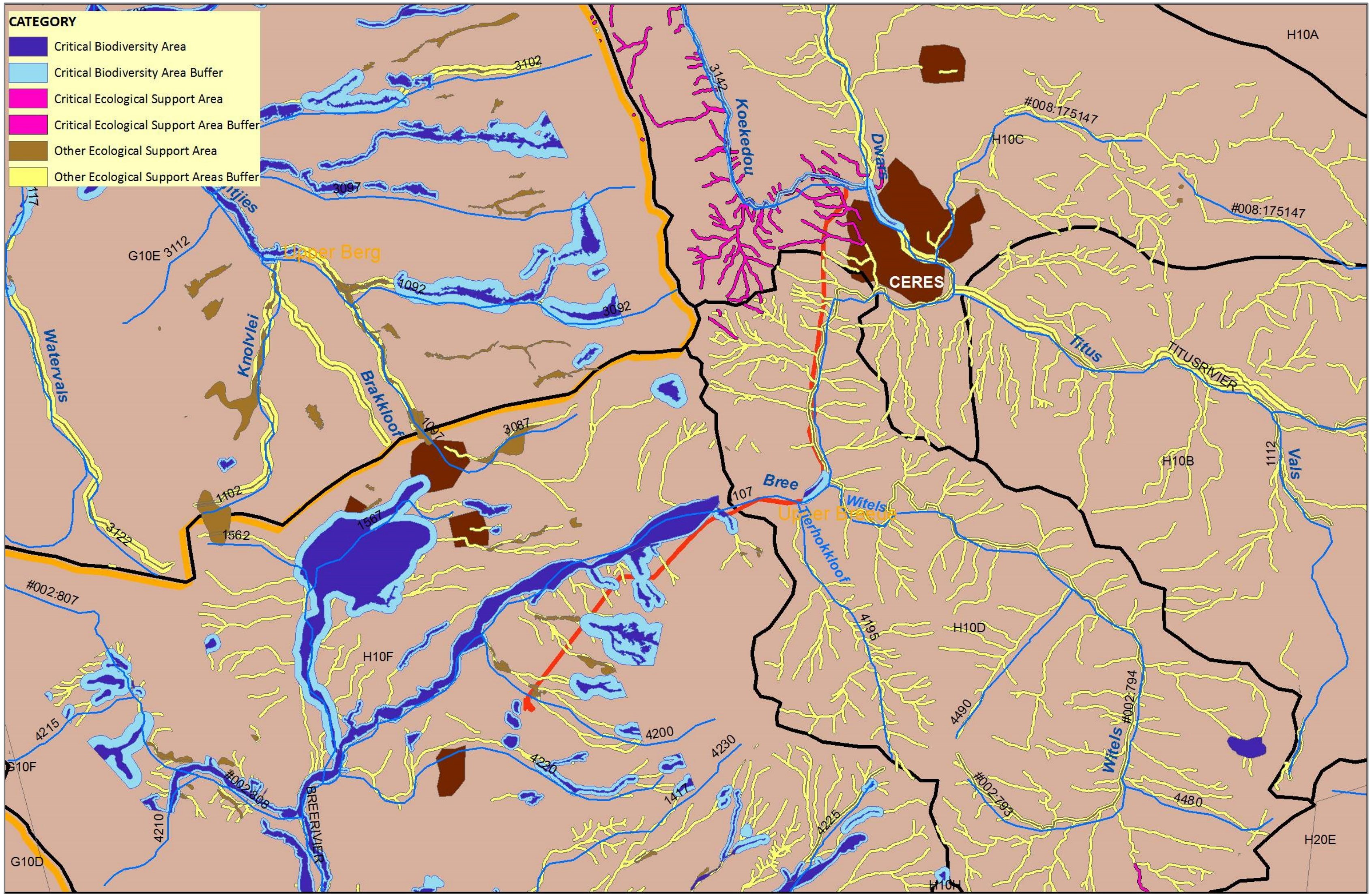


Figure 11
Context in terms of the Witzenberg Municipality Biodiversity Plans
(2014 Western Cape Biodiversity Framework (WCBF))

Table 3 provides an illustrated and annotated overview of the aquatic ecosystems and other affected areas along the length of the proposed powerline, including sections that might be impacted by related activities such as access roads. This table should be read in conjunction with **Figures 2-6**, which indicate the locations of proposed structures. The following information has however been compiled by way of a broad summary of the main aquatic ecosystems that occur along the proposed route, and their broad sensitivities and conservation importance.

On the basis of the alignments shown in **Figures 2 -6** and the project description provided in section 2, it is apparent that the proposed route would require:

- The construction of numerous access roads and electrical pylons within 100 m of watercourses and 500 m of wetlands, including
    - new access road crossings of:
        - the Dwars / Breede River at one point;
        - the Tierhokkloof River;
        - at least 3 crossings over other smaller watercourses;
    - crossing over by power lines of:
        - at least 31 minor watercourses mapped in the CBA project database;
        - the Dwars / Breede, Wabooms, Tierhokkloof and Witels Rivers.

3.6.1 *Description of different route sections*

This section refers to the alignments shown in **Figures 2 -6**. Generic PES and EIS ratings are provided for affected aquatic ecosystems in these sections in the vicinity of the proposed crossings, using the methodologies outlined in Section 1.4.3. Where individual systems have been assigned a different rating, these are specified.

3.6.1.1 Support poles 1-7 (Figure 2)

None of these support poles lie in or would be likely to affect any watercourses or other wetland areas. They would generally be located on disturbed land, which slopes down towards the R43 and the Breede River in the north west.

3.6.1.2 Support poles 8 – 13 (Figure 2)

Poles 8 and 9 would lie on either side of a broad hillslope seep, classified as a CBA wetland and comprising numerous longitudinal seepage lines that daylight off the mountain slopes and merge to form in places channeled seep lines. The actual extent of wetland extends further downslope (north west) than the mapped wetland in **Figure 2.** The channeled wet zones, shown in the two longitudinal CBA drainage lines between poles 8 and 9, were dominated by *Psoralea pinnata* and small stands of *Typha capensis* in places, and *Phragmites australis* stands along channeled sections. The seep widens out on either side of the channeled zones, with weedy elements increasing in dominance towards the outer margins. The seep as a whole was assessed as being in a Category B PES (that is, largely natural with few modifications and only minor loss of habitat) in the vicinity of the proposed poles, although the seep line closest to pole 8 has been channelised and in places diverted upstream of the electricity lines.

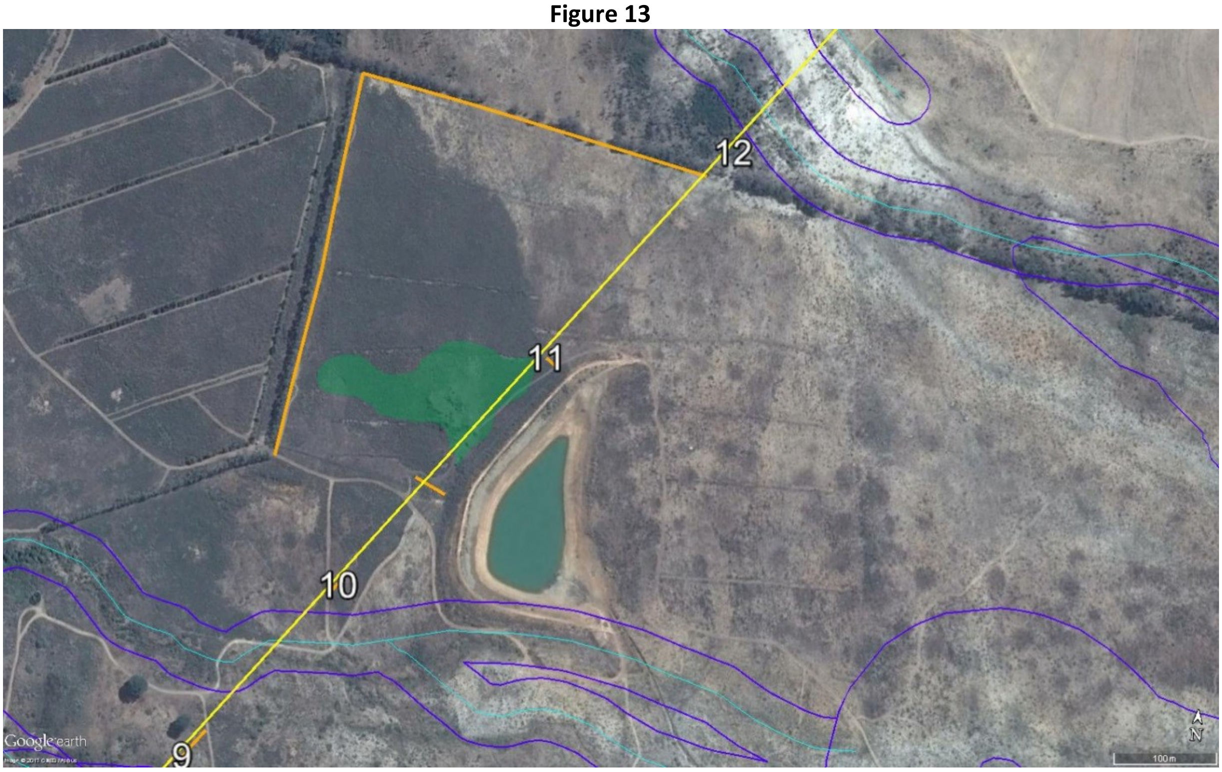
The existing 132kV Romansrivier/Witzenberg line passes through this area, and outside of the individual footprints of the towers, does not appear to have resulted in lasting impacts to this system.

A number of existing access roads, also mapped in Figure 2, occur in this area, and cross the seep lines by way of narrow informal bridges, supported with small logs.

The presence of various unidentified frog species in the wettest portions of the seep was identified during the site visit, which, it should be noted, took place in early winter, before any substantial rains, during a prolonged regional (Western Cape) drought. This highlighted the importance of seeps such as this in these otherwise relatively barren mountain areas, as a source of water to support locally indigenous small to medium fauna – this aspect will be covered in the specialist faunal study for this Basic Assessment.

A third seep line occurs between planned poles 9 and 10. Flows from this seep have been diverted into a small dam. Seepage out of the dam occurs below the dam wall. This is in part channeled downslope, but forms a wide wetland area across and just downslope of the existing access road past the downstream end of the dam, with wetter areas dominated by *Typha capensis*, *Juncus kraussii* and *Psoralea pinnata, along with mixed grasses and sedges*. The approximate extent of this additional wetland area is shown in **Figure 13**. It has been assessed as natural but transformed by changes in flows, and with a PES of Category D.

Figure 13



Mapped seepage wetland downslope of the dam between poles 10 and 11

Seeps between poles 12 and 13 have been eroded and occur within an area that has been previously invaded by pines but which was being cleared of alien invasion at the time of the assessment. Permanent incision has occurred at an existing road crossing, resulting in likely wetland shrinkage at this point. The seep does however widen out further downstream, forming a broad *Pennisetum macrourum* dominated seep, edged by ploughed agricultural field. PES of the seep line between poles 12 and 13 is assessed as Category D.

All seeps along this section of the alignment are considered of high sensitivity, and would be vulnerable to erosion and channelization of flows that would cause permanent degradation, as well as to any physical disturbance (e.g. heavy vehicles) causing compaction and (shorter term) damage to plants.

3.6.1.3 Support poles 14-26

The proposed powerline alignment would cross through eight seepage lines, as mapped in **Figures 2 and 3**.

Under natural conditions, it is assumed that these would have been similar to the least-impacted wetlands described in Section 3.6.1.2, between poles 8 and 9. However, the seep lines further north along the alignment have all been moderately to highly impacted by the close encroachment of agricultural lands and, in places, by off-channel abstraction into numerous small farm dams. Encroachment has resulted in concentration of flows along narrow channels, with the result that all of the seepage lines assessed were eroded, in places severely, and conveyed fast channelled runoff after rains, instead of flow prolonged seepage. Alien invasion along the channels (mainly black wattles (*Acacia mearnsii*) is also significant although all channels included indigenous wetland vegetation, such as *Pennisetum macrourum* and *Psoralea pinnata*.

A dam just downslope of the proposed power line between proposed support poles 22 and 25 has resulted in some changes in flow corridors down natural drainage lines, with partial diversion of flows into the dam, and extended seepage apparent in aerial maps along flow corridors, making this albeit degraded section possibly more complex in terms of watercourse crossings.

PES of the seeps along this section was generically rated as Category D, indicative of high levels of habitat degradation, with loss of indigenous vegetation, alien invasion and changes in hydrology and geomorphology as a result of channelization being the main issues.

The seeps are all however considered of high sensitivity to activities likely to promote further channelization – these would include the passage of vehicles across the channels and activities that promoted encroachment – e.g. the placement of support poles in close proximity to channelized areas.

3.6.1.4 Support poles 27-34

The proposed alignment in this area runs across steep mountain slopes, high above the R43 road. This section of the alignment was not walked, but does not include passage through or across watercourses.

Activities that promote erosion and donga formation on terrestrial areas along this section would however have impacts on the Breede River itself, which runs as a wide watercourse just north of the R43. In these reaches, the river has been highly impacted by abstraction (run of river abstraction takes place at the weir just upstream of the R43 crossing) as well as extensive invasion of its riparian area by (mainly) black wattle, and significant encroachment of farming activities across the floodplain and up to the river margins, resulting in channel shrinkage and loss of natural river secondary channels and sand bars.

The river was assessed as PES category D in these reaches.

Its ecological sensitivity has been assessed as Medium and its conservation importance is high (RHP 2011).

3.6.1.5 Support poles 34 -58

This section of the proposed alignment would run roughly parallel with the Breede / Dwars River, which flows in a wide flat valley between steep mountainsides, with the Michell's Pass road to Ceres running along the [3]right hand (mainly northern) side of the river. Numerous watercourses including major tributaries (e.g. the Witels River) as well as smaller tributaries (the Wolwekloof River) from the southern mountain slopes, entering the left hand river channel, and multiple seeps from both sides of the valley slopes, would potentially be crossed by the proposed powerline, and access roads would also be required across the Breede River and several of these watercourses.

The line between poles 34 and 35 is shown in Figure 14 as crossing a wide CBA wetland, mapped as lying within a buffered watercourse. This watercourse comprises the Wolwekloof River. Ground-

[3] By convention, the right hand side as seen when facing downstream

truthing showed however that this system in fact comprises a relatively narrow channel, which was classified as a mountain stream in the area where it would be crossed by the powerline. The river margins are densely invaded by black wattle, but retain some indigenous vegetation.

PES for this system was assessed as C/D, with moderate sensitivity.

Figure 14
Mapped OESA watercourse and seepage wetland between poles 34 and 35

Poles 35 to 39 would not cross through any seeps or other watercourses. However, they would need to be accessed, and an existing unpaved track along the (LHS) edge of the Breede River would be upgraded (widened) to allow for this (see **Figure 15**). The Breede River channel flows within these reaches as a broad channel, edged with good quality riparian and marginal vegetation including Palmiet *Prionium serratum* and various indigenous riverine sedges and restios. The active channel of the river is wide and includes secondary channels in places. Invasion by alien vegetation is however significant in sections of the river floodplain and margins, despite past clearing efforts.

The existing road closely abuts a braided secondary river channel, and the adjacent hillslope is steep and rocky.

River PES along these reaches has been assessed as PES Category C, reflecting a less impacted condition, compared to that further downstream.

River sensitivity to impacts such as sedimentation would be moderate. It would be less sensitive to limited physical disturbance or minor water quality impacts, given its size and relatively flat gradient. It would have high sensitivity to impacts that affected channel geomorphological processes – the natural patters of sedimentation and braiding are considered important to maintain in these reaches. Thus channel constriction (e.g. bridges) could have major impacts to river function.

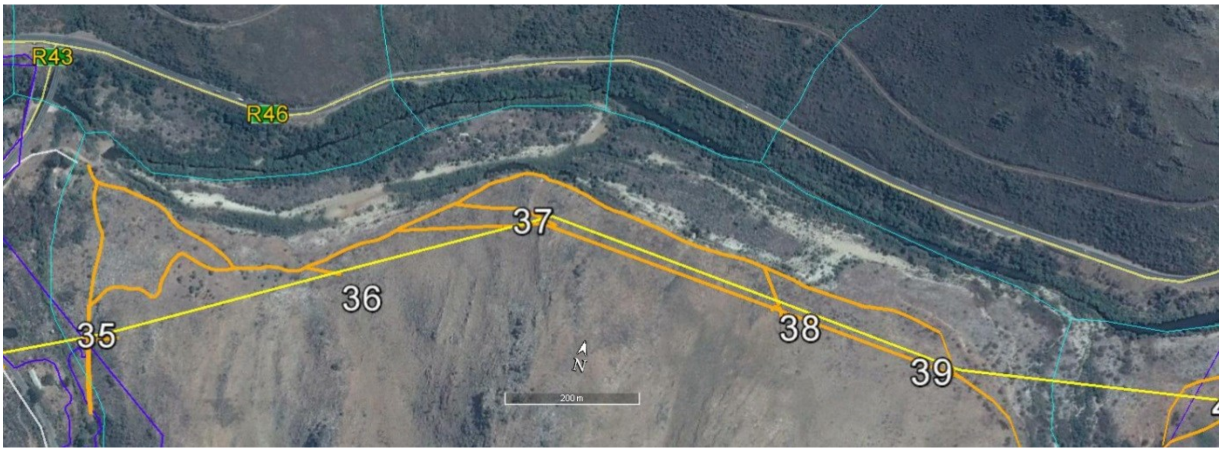


Figure 15
Mapped OESA watercourse and seepage wetland between poles 34 and 35

The river reaches between proposed poles 39 and 58 represent the most complex (but not necessarily the most sensitive) section of the proposed powerline and access road route assessed in this study, because it entails numerous crossings of sensitive seeps with steep slopes limiting options for alternative routings (see Section 4 for impact assessment).

Crossing of a significant watercourse (the Tierhokkloof River in the 1:50 000 river layer) is required between poles 39 and 40. This watercourse was groundtruthed as a foothill river that discharges onto the flat valley bottom of the Breede River, depositing sediment as it spreads out at the confluence and forming a wide braided alluvial fan type system in these reaches. This includes multiple low boulder, rock and sandy bars, with major and minor channels. There was little to no flow in the river at the time of the May 2017 site visits, but its steep gradient and rocky terrain suggests periods of high velocity flow capable of carrying large sediment loads into the Breede. Although invaded by alien vegetation along its margins, this system flows through a relatively unimpacted catchment and has been rated as a PES B/C.

The dynamic nature of the river in the reaches through which the powerline would cross means that it is likely to show low long-term sensitivity to efforts to control sediment – that is, unless major structures were put in place, it is likely that downstream sediment movement would dominate the channel and overcome minor efforts at river control.

The Breede River between poles 40 and 43 comprises a narrow single channel, closely abutted by (largely) invasive alien vegetation (mainly black wattles) which forms a dense stand along the river channel. The river is a foothill stream in these reaches, and flows in a rocky and boulder lined channel. The river banks are steep and incised in these reaches – probably reflecting encroachment by alien vegetation and effective loss of floodplain attenuation area.

The steeply graded and largely natural (PES A/B) Witels River joins the Breede River in these reaches. Unlike the tributary downstream, it is not associated with a wide alluvial fan at its point of confluence, reflecting steeper gradients.

The Skurweberg mountain slopes abutting the left hand Breede River floodplain along almost the whole of its section through Michell's Pass had recently been burned at the time of the present assessment. River channels and seeps were clearly evident in the bare landscape, and these slopes and their drainage lines, nearly devoid of vegetation and flowing down steep slopes with high sediment loads, are considered vulnerable to erosion and are thus (at least in the short term) highly sensitive to further disturbance likely to trigger erosion.

The Breede River flows as a relatively narrow single channel in its reaches between poles 43 and 53 (noting that the direction of flow is actually north to south and thus from 53 to 43). High levels of black wattle invasion occur along the river channel, but there are stands of indigenous riparian trees.

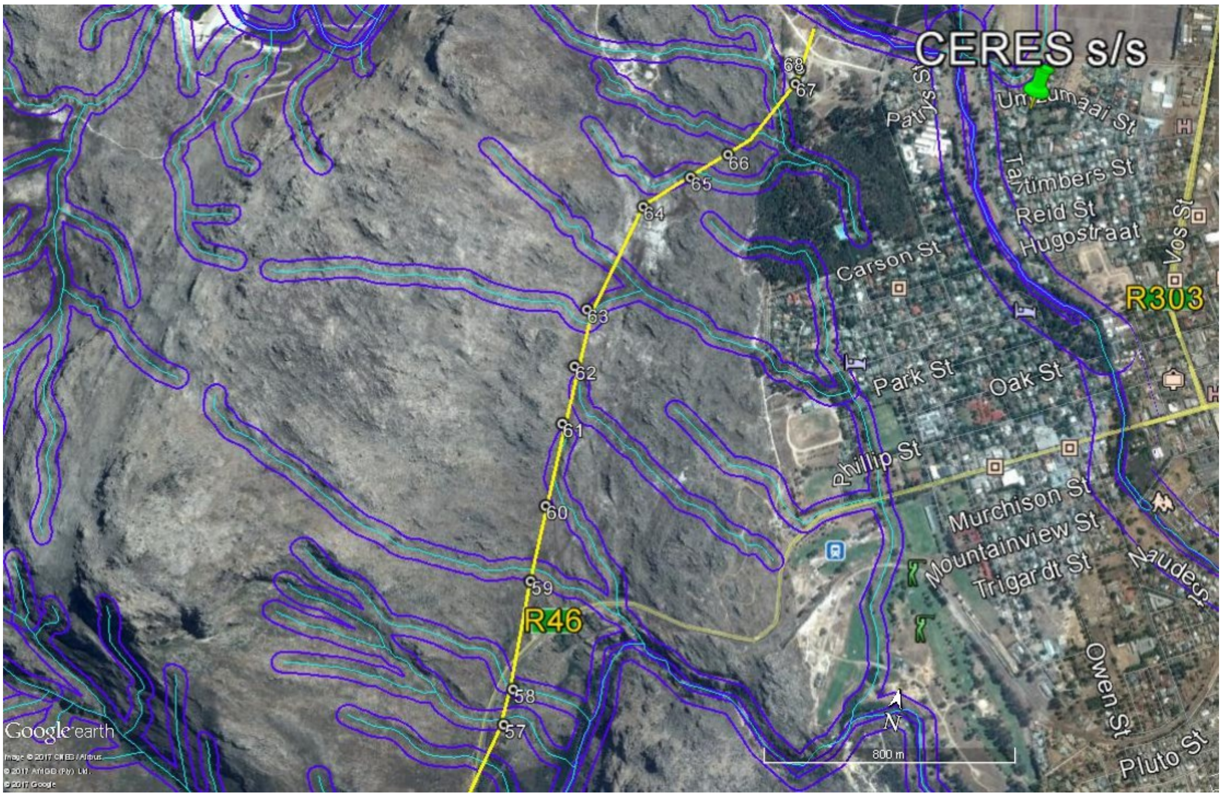
Numerous seeps, mapped in the CBA layers, open into the river channel off the lower slopes of the Witzenberg and Skurweberg mountain ranges that drop down into the western and eastern slopes of Michell's Pass, respectively. On the right hand river floodplain (western side), these seeps were usually dominated by dense stands of bracken fern (*Pteridium aquilinum*) as well as mature *Psoralea pinnata*. The left hand floodplain seeps (eastern side)were burnt and largely devoid of vegetation other than small sprouting sedges and bracken fern.

The hillslope seeps are considered in relatively natural condition (even those that have recently burned) with a generic PES of B. They would have high sensitivity to compaction, channelization and any impacts promoting concentration of flows into them, diversion of flows away from them, or sedimentation.

A single channeled seep was identified at the outlet of a road culvert just south of the Tolhuis, and south of pole 54. Vegetated with patchy *Psoralea aphylla* as well as numerous alien plants, which were being cleared at the time of the site visit, the channel is assumed to be the product of water diverted from north of the Tolhuis, on the other side of the road.

3.6.1.6 Support poles 59 -68

Figure 16 shows the proposed alignment of the powerlines between the R43 crossing after pole 58 and the existing Ceres substation at tower 68. This section of the line passes up and across the relatively flat plateau of Ceres Peak in the Witzenberg Mountain range, before descending the peak into Ceres town, where it joins Ceres substation, located just north of the Pine Forest Holiday Resort.



Figures 16
Close view of CESA watercourses between the Ceres substation and proposed pole 57. Buffered watercourses are shown here.

With the exception of poles 67 and 68 at the substation itself, this route is all located within the Ceres Mountain Fynbos Nature Reserve. **Figure 15** shows that the powerline route would cross through eight watercourses, all mapped in the CBA layer as Critical Ecological Support Areas (CESAs), and comprising mountain seeps that are considered to be in a near-reference condition, impacted only in places by footpath crossings. The seeps comprise mainly broad, shallow subsurface sheetflow across the mountain fynbos vegetated area at the top of the mountain. These sheetflow areas converge into the eight mapped watercourses shown in **Figure 15** and flows as wide, vegetated and mainly channeled seeps across the flat plateau, changing into small mountain streams and/or maintaining as mountain seeps down the steep mountain slopes to Michell's Pass to the east. Along the flatter mountain plateau, the channels include wide wetlands and sandy to organic soils, but in steeper areas where fast flows prevent accumulation of organic and other fine sedimentary material, the watercourses pass as sheetflow or fast flowing channeled flows over boulders and rocks.

The wetland seeps and their associated channels have been accorded PES ratings of Category A/B, and are considered highly sensitive to impacts likely to result in concentration of flows leading to the erosion or channelization of stream sections that do not comprise bedrock or boulders – thus watercourses between or affected by poles 62 to 59 would be less prone to erosion effects as the channels are boulder-dominated. Channels between 62 and 67 would all have some sensitivity to activities likely to promote concentration of flows, with the channel to be crossed by the access road to poles 64 and 65 and that between 64 and 63 being considered vulnerable to erosion and thus sensitive to any impacts that might promote headcut erosion. This applies particularly to the watercourse potentially crossed by the access road to poles 64 and 65.

These watercourses would all be sensitive to water quality changes, particularly those that increased turbidity, suspended solid or pH components of these naturally low-nutrient, low TDS and acidic mountain seeps.

Of relevance to the present assessment are the following management recommendations from Job et al (2008) for the management of CESA seeps with regard to maintaining ecological and hydrological connectivity, namely:

- There should be no fragmentation of the wetland buffer, e.g. through road construction (this includes tracks, e.g. for 4x4 routes) or the erection of fences or walls;
- Where the construction of fences is necessary (e.g. around reserves), this should be done to ensure that this does not fragment the wetland buffer, or lead to separation of the buffer from the wetland;
- Water flow through the wetland buffer shall not be constricted through culverts or pipes.
- There shall be no disconnection of the wetland buffer from the wetland;
- Buffer width should be consistent around the entire wetland (i.e. should not be allowed to diminish in width to accommodate other land-uses), but could be increased to attenuate additional impacts;
- Where a road or other water channeling structure runs close to a wetland buffer and / or directs water into it, such water should be discharged through multiple discharge points with energy-dispersing structures. These drains must be small, dispersed low-volume, low-velocity structures. They must preferably discharge into vegetated areas outside of the buffer, at ground level.

The proposed access road to structures 64 and 65 would require crossing through at least one CESA seep and its buffer area.

3.7 Summary of key findings of baseline study

Based on the descriptions provided in the previous section, the following main points have been distilled from the baseline study, and will be used in formulation of more detailed mitigation measures, and will be the backdrop against which impact assessments will be made.

1. Wetlands in the Romansrivier substation area (Poles 9-13) are sensitive to physical disturbance, vulnerable to erosion and compaction, and are in relatively good condition. Construction mitigation measures would be very important, and new access roads must not pass through mapped watercourses. The positions of laydown areas would need to be well

away from these areas. Where watercourses are crossed by existing roads required for maintenance or construction, attention to the design of more stable, wide culverts may be required (e.g. between poles 8 and 9). Wet season construction requiring vehicle access must not take place – for planning purposes, the wet season should be taken as between end of April and beginning of October;

2. Best practice measures must be applied during construction between poles 14 and 27, so as to minimise impacts to watercourses. Existing access routes can however be used and from an aquatic ecosystem perspective, so long as erosion and disturbance are minimized and watercourses are not deliberately disturbed, this section of line could probably be constructed during the wet season, noting however that the clay soils and steep slopes in places may hinder such activities;
3. Construction between poles 14 and 27 should include best practice measures to prevent erosion and sedimentation downslope – but aquatic issues are unlikely;
4. The reaches between poles 27 and 34 require consideration mainly from the perspective of reducing encroachment of proposed access roads onto the Breede River – impacts such as blasting rock would be important to manage. Crossing of the Tierhokkloof River would however need to take cognizance of the need to maintain the highly dynamic nature of this alluvial fan system;
5. Crossings of the Breede River itself by access roads are generally undesirable, and low-impact systems must be considered if this approach is required. Bridge designs that promote debris dams from alien or indigenous debris, or concentrate river flow would be considered highly problematic, and it is noted that no crossings are likely to be considered of low significance – this would have implications for water use license requirements by DWS, although if the crossings affected the river channel rather than wetlands, General Authorization may be applicable;
6. The section of powerline from pole 58 to the Ceres substation passes through highly sensitive wetland and terrestrial areas, and careful attention would need to be given to minimizing the construction and operational footprints of any disturbance in this area. No wet season construction should be considered along this section.

Appendix A of the Environmental Management Programme for the proposed project (SRK 2017) presents the above mitigation measures as well as those detailed in Section 4 of this report in tabulated form, for each structure, including specifications made by other EIA specialists engaged in this project.

4 IMPACT IDENTIFICATION AND ASSESSMENT

This section describes the implications of the proposed powerline alignment and substation alternatives for the freshwater ecosystems described in Section 3, using the assessment rating provided by SRK and included in Appendix A. The various alternatives are assessed formally in **Tables 3 to 13**.

Note that biodiversity importance (e.g. CBA wetlands) is reflected in the assignment of impact **intensity** rating scores.

A weakness in the assignment of various ratings is that of ratings of Extent of impact, with activities assessed in this report all affecting aquatic ecosystems at an extent of "site" as defined in Appendix A, notwithstanding the fact that the "site" extends over several sub-quaternary catchments. This means that impact magnitude tends to be slightly elevated, as the impact over a relatively small extent is assessed, with the magnitude at the most sensitive of the sites being reflected in the rating tables. This issue is however discussed further in Section 4.3, where the cumulative impact of the project as a whole on aquatic ecosystems across the full study area is assessed, and this bias is largely avoided.

The latter assessment has been taken into the overarching Environmental Impact Assessment Report (EIAR) for the project as a whole, as representing a defendable but simplified summary of overall impacts (SRK 2017).

4.1 Impacts associated with the proposed support structures / poles and stringing activities

4.1.1 *Layout and design phase impacts*

Note that the layout presented for assessment in this report already represents the result of iterative engagement between EIA specialists, the project EAPs and the design team, and layout / siting issues with regard to the support towers have already been addressed.

4.1.2 *Construction phase impacts*

Impact 1: Degradation of aquatic ecosystems

Impact description

Construction activities are likely to result in the degradation of several watercourses, with causes of degradation including compaction, erosion, sedimentation, damage to vegetation, and possible localized diversion of flows. Specific effects have been unpacked in more detail below, with the note that separation of factors individually contributing to aquatic ecosystem degradation is considered too complex for the number of sites and systems described here, and such effects are assessed cumulatively. Mitigation measures do however unpack specific actions that are required to address the contributing causes of this impact along different sections of the alignment where watercourses may have different sensitivities.

Excluding construction-associated impacts associated with access roads, which are discussed in Section 4.2.2, the main construction-phase impacts leading to the predicted (localised) degradation in watercourse condition are likely to be linked to:

- Physical disturbance at each support structure as a result of clearing, construction and the use of laydown areas - although vegetation is likely to regrow over time in such areas, evidence at existing structures suggest that recovery is not complete, with a tendency for weedy species to proliferate in disturbed areas. In the case of aquatic ecosystems, the proposed structures themselves would not be located in watercourses – however, the proximity of several structures (poles 11, 23, 63, 62 and 61) to water courses of varying sensitivity means that impacts as a result of laydown areas and general proximity are considered likely;

-

- Loss / removal of topsoil from wetland areas, resulting in areas extending at least the footprint of the structure and possibly beyond, in which only weedy and/or alien plants species are likely to establish – this impact would apply to poles in the vicinity of watercourses, with the following most likely to be affected at a significant level: 11, 23, 63, 62 and 61, all of which lie in close proximity to watercourses, with the latter two located just above the start of fast-flowing watercourses and pole 63 located on the edge of a wide seep area, vulnerable to disturbance;

- Accidental spillage of cement and other construction material (e.g. sand as well as oil and other pollutants associated with vehicle access) is possible - if not controlled, such impacts could result in localized but permanent scarring of affected areas, and where these included wetlands or other watercourses, permanent degradation would occur, with indigenous wetland vegetation unlikely to re-establish in affected areas;

- The prolonged presence and passage of numerous personnel during construction – these would increase the likelihood of watercourse degradation as a result of litter and trampling;

- Compaction of watercourses as a result of multiple or high-impact crossings by vehicles or people - this would potentially increase their vulnerability to erosion and reduce vegetation disturbance-recovery rates. Such impacts would be most likely to occur where watercourses comprise extensive, broad seeps that are difficult both to identify and to avoid and would apply particularly to seeps in the vicinity of support poles 62 -66, 23, 8 and 9 and 10 and 11 and 12 and 13. Seeps between poles 8 and 13 and 63 and 65 would be particularly vulnerable to erosion as a result of repeated passage of workers and/or vehicles in the vicinity of pole sites. In the case of poles 59 to 63, which are “helicopter-assisted” sites, it is assumed that large numbers of workers would still access the pole positions on foot from the road access to pole 64. This would entail their walking in close proximity to numerous sensitive and least-impacted watercourses, and impacts such as erosion, compaction and increased risk of accidental fires would be likely;

- Infilling of sections of watercourses with rock as a result of blasting to create founding platforms – this would result in partial diversion of flows, with possible knock-on effects on areas immediately downstream – this impact is possible in the vicinity of poles 61 and 62, although it is noted that the positions of these poles have been moved further away from the watercourses than originally proposed;

- Contamination of watercourse soils in laydown areas / areas where cement is mixed and/or where there is a likelihood of fuels or other hydrocarbon sources being leaked or spilled – such impacts would be likely to be permanent but localized and would apply to all poles in the vicinity of watercourses - 61 to 66, 23 and 8 to 13;

- Water quality impacts as a result of the accidental passage of construction-associated contaminants into flowing watercourses – contamination with cement would be likely to affect stream pH, while inflows of fuel / oil would potentially create toxic conditions in downstream reaches. Of these, localized (reach level) impacts as a result of pH changes would be most likely – given the high PES of the acid streams most likely to be affected by such impacts (watercourses between poles 59 and 67), such changes could have significant short-term ramifications for aquatic biodiversity, but recovery would be expected to be relatively rapid.

The above impacts would be primarily applicable to poles abutting watercourses and stringing that extended across watercourses. With the exception of the degraded (PES Category D) watercourse in the vicinity of structure 23, the watercourses affected by these activities comprise least-impacted CBA and OESA watercourses, between poles 8-13 and 59-66. The anticipated impacts to these watercourses would generally be irreversible in the sense that once areas were impacted by construction, it would be difficult / unlikely to restore them to a PES Category A/B once again. In the case of the watercourses /seep area immediately to the east and west of structure 23, impacts would probably be reversible, and unlikely to result in a drop on PES Category.

A formal rating of the significance of these impacts is provided in Table 3, using the impact rating methodology provided to specialists by SRK Consulting. The significance rating is elevated by the high sensitivity and ecological and biodiversity importance of many of the watercourses that would be affected (primarily between poles 8 and 12 and 59 and 66), and the extent of the proposed powerline, resulting in repeated impacts scattered over a long distance. **Impact significance without mitigation** would be **negative** and of at least **Medium significance**. Significance ratings would be higher if the extent of impact associated with the poles and laydown areas was not likely to be localized to point impacts along the alignment. Assessment of impact extent here considers multiple impacts, to aquatic ecosystems of varying sensitivity, and hence of varying magnitudes.

Essential mitigation measures have been included in Table 3, and their full implementation would reduce the assessed impact significance to Low.

Table 3
Significance of wetland trampling, compaction, erosion, water quality changes and resultant general wetland degradation during construction

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impact 1: Degradation of aquatic ecosystems and/or infilling / diversion of watercourses as a result of support tower construction							
Without Mitigation	1 Local	2 Medium	3 Long term Irreversible in some areas	6 Medium	Definite	Med. (Neg.)	Medium

Essential mitigation measures:

General mitigation measures:

i. A detailed Construction Phase Environmental Management Programme (CEMPr) must be compiled that outlines control measures to prevent impacts associated with spillage or leakage of contaminants from vehicles and machinery and contamination of watercourses with cement. Such measures, the implementation of which must be overseen by a competent Environmental Control Officer (ECO) (or similar functional designation) must include:

   a. Construction disturbance areas to be minimized and tightly controlled – laydown areas must be identified outside of any watercourses (and ideally no closer than 20m from watercourses) and their extent defined before use. Using temporary fencing that will prevent the spread of equipment and construction material into other areas – the use of plastic danger tape is not recommended for this purpose, as it is likely to tear / blow away and add to pollution of natural areas and a more effective alternative demarcation method is recommended;

   b. Routes for workers between drop-off areas / access roads and working areas must also be clearly defined and controlled to limit the spread of disturbance;

c. Litter collection and removal from each site at which construction is occurring must be allowed for on a daily basis;

d. Cement mixing / batching to be on areas with temporary removable bunding, outside of any watercourse, and managed to minimize spillage into natural areas;

e. No refueling sites / areas to be within 50m of any watercourse unless on an existing designated refueling area, with adequate bunding;

f. Site camps to be located outside of watercourses or sensitive areas and overnight accommodation areas should not be allowed for along the line, other than for security purposes, and other than at existing substations, unless sites are specifically approved as of low sensitivity by the aquatic and botanical specialists;

g. Adequate portable toilets to be provided along the route and maintained so that there is no reason for the use of open space areas for such purposes – this is generally applicable but particularly important in the least-impacted source-area seeps between poles 59 and 67;

h. Where stringing activities require the clearing of alien vegetation (noting that the existing methodology suggests that clearing will not be needed – see Section 2), such vegetation must be cut and removed using approved methods, suitable for use near watercourses – cut material must be cleared away, to at least 50m from any watercourse and outside of the 1:100 year floodline of the Dwars / Breede River. Clearing must be by hand (mechanical clearing of a wide swathe must not take place as this will increase disturbance to watercourses) and must include, where relevant, the use of appropriate herbicides to prevent re-sprouting;

i. Post-construction clear-up activities must ensure the removal of all waste and excess construction material;

j. Post-construction rehabilitation of any areas damaged / disturbed as a result of any construction-associated activity – this would include areas in which erosion has occurred, as well as areas subjected to cement spillage and other impacts, and would need to be to an aquatic ecologist's specifications.

Mitigation between support poles 1-7:

General mitigation measures (i.e. as listed above) must be implemented – no watercourses would be impacted in this zone.

Mitigation between support poles 8 – 13: see Figure 17

This section includes sensitive wetlands of high biodiversity importance (see Figure 17). Thus general mitigation measures must be implemented, as well as:

ii. Laydown areas must avoid all seeps - the seeps mapped in Figure 17 including mapped buffer areas should be used to guide implementation of this measure and a setback of at least 20m from any seep should ideally be achieved;

iii. All construction activities involving driving vehicles, excavation and the use of cement (including ready-mix concrete) are to be carried out outside of the wet season to limit disturbance and environmental risk – it should be assumed for planning purposes that this period includes the months May to September inclusive, but flexibility depending on actual conditions at the time of construction should be allowed, to accommodate wetter or drier periods;

iv. Areas from 5m upslope (east) of and north of pole 8 to be treated as absolute no-go areas and this boundary to be demarcated in the vicinity of the pole;

v. The degraded area just north of the dam, where access roads converge, should be used as a laydown area for pole 11 – see mitigation measures in Section 4.3.1 regarding the access road alignment and use;

vi. A sensitive and eroding series of watercourses lies between poles 12 and 13. These should not be crossed by any vehicle, and despite its proximity to pole 12, pole 13 should be accessed only from the north, and not from pole 12.

Mitigation between support poles 14-26

Implementation of general mitigation measures is required, with particular attention being paid to mitigation measure item i (h), regarding the stringing of lines across watercourses – these are marked in Figure 18;

vii. The development-edge of the mapped wetland adjacent to pole 13 plus a 20m setback must be fenced off as a no go area throughout construction, and no laydown areas or other sources of disturbance may be located within this area;

viii. Pole 13 should be accessed only from the north, and not from pole 12.

ix. Pole 23 should be accessed only from the existing road to the east. In the event that the adjacent (degraded) seep is further disturbed by construction, post-construction rehabilitation must ensure that the local topography is reinstated and that no additional channels likely to concentrate runoff into downstream areas are created;

x. Selection of other areas for use as construction laydown areas must ensure that these areas are outside of any watercourses, and Figure 18 should be used as a guide in this regard;

xi. This area has high vulnerability to erosion and the CEMPr must pay attention to methods to control erosion.

Mitigation between support poles 27-34

xii. No watercourses would be directly affected in this area, although the Breede River lies just downslope. The area does have high vulnerability to erosion and the CEMPr must pay attention to methods to control erosion.

Mitigation between support poles 34 -58

Figures 19 – 22 illustrate mitigation measures specific to this route which closely abuts the main stem of the Dwars / Breede River and entails several watercourse crossings. These measures apply however mainly to access roads, and pole-associated impacts are not considered material along this section, provided that the general mitigation measures outlined in (i) are applied, and stringing across marked watercourses adheres to the mitigation requirements outlined in that section in particular.

Mitigation between support poles 59 -68

Figure 23 illustrates mitigation measures specific to this section of the route which passes over highly sensitive, least-impacted watercourses, which include broad wetland seeps as well as rocky channels downs steep slopes. In addition to the general mitigation measures in i, the following apply:

xiii. Construction must not take place in the wet season, when watercourses will be more sensitive to erosion and compaction;

xiv. Helicopter landing areas and laydown areas must be strictly controlled and limited in extent. They must be selected with on-site input from the botanist and aquatic ecologist, so that likely disturbance to watercourses is minimized. These areas, and the construction footprints for each pole, to a maximum area of 15m x 15m but ideally much smaller, must be fenced with robust temporary fencing, such that the areas outside of the fenceline are regarded as no-go areas. Poles 60 – 63 all closely abut watercourses (see Figure 23 for annotations) and these watercourses must be protected from impacts;

xv. Where blasting is required to found poles (e.g. 61 and 62), particular care must be taken to remove blasted rock from the watercourse, and to prevent blasting from altering the direction or alignment of flow in the watercourses – this applies particularly to pole 62, the support poles of which should ideally straddle the watercourse;

xvi. While cutting of plant material may be necessary in laydown or landing areas, this should be minimized and no plant clearing activities may include excavation of soils or uprooting of plants, except under the actual support structure footprint itself;

xvii. Particular care must be taken to ensure that cement is not spilled onto areas other than the foundation area, as watercourses and soils in this area are highly sensitive to changes in pH;

xviii. Impacts from the repeated passage of workers across seepage areas between poles 63 and 64 must be avoided as far as possible. Since the low-growing vegetation makes it easy for pedestrians to deviate significantly from the pathway, a defined route for pedestrian passage that avoids the mapped seepage line must be identified and marked out with poles or other appropriate devices, and this route should be managed. An aquatic ecologist and botanist should inspect the demarcated route before the start of construction in this area, so that any changes in the route can be implemented;

xix. Management of fire risks must be stringent – no fires to be permitted along this section of the line at any time;

xx. After completion of construction, this section must be assessed by the botanical and wetland specialists and areas requiring rehabilitation or clearing of waste identified and addressed, with potential rehabilitation measures including manual measures to address compaction or erosion through reshaping and /or scarification;

xxi. Toilet and ablution areas must be managed so as to control and limit waste – the use of other areas (e.g. the veld / wetlands) for toilet purposes must be controlled against, through education and enforcement.

Non-essential mitigation
As a general rule, all construction should take place outside of the wet season – this is however unlikely to be practical, but it is noted that this is essential mitigation for some sections specified above.

With mitigation	1 Local	2 Medium	2 Medium-term	5 Low	Probable	Low (Neg.)	Medium

4.1.3 *Operation phase impacts*

During the operational phase, impacts to aquatic ecosystems as a result of pole and powerlines are likely to be infrequent and largely confined to individual pole positions or sections of line that require periodic repair or maintenance. It is assumed that such activities would be likely to revolve mainly around repairs to the lines and their support or insulation structures on the poles, and the need for replacement of the poles themselves would be highly infrequent, although possible. It is also assumed therefore that the number of workers required for such activities would also be lower than during the construction phase. However, the timing of repairs would potentially be less controllable, if emergency access was required, and mitigation measures such as attention to ensuring dry-season timing of interventions would not be likely.

Operational phase impacts to aquatic ecosystems would again be likely to be degradation of least-impacted wetlands and other watercourses in areas of high biodiversity importance. Such degradation would result from probable compaction and trampling of watercourses in the proximity of affected structures, and periodic impacts associated with temporary laydown or landing areas (between poles 59 and 66).

Degradation of aquatic ecosystems during the operational phase has thus been assessed at a similar level of **Significance (Medium, negative**) to that for the Construction phase, although it is recognized that this rating may over-emphasise the risk of degradation, by assuming that the whole line will require full maintenance measures at times, albeit not as a sequential process. Table 4 outlines both the significance ratings for this overall impact, and mitigation requirements.

Table 4
Assessment of the significance of aquatic ecosystem degradation as a result of Operational phase activities at poles and along powerlines

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impact 2: Degradation of aquatic ecosystems as a result of support tower and powerline maintenance activities							
Without Mitigation	1 Local	2 Medium	3 Long term Irreversible in some areas	6 Medium	Probable	Med. (Neg.)	Medium
Essential mitigation measures: i. The construction-phase mitigation measures outlined in Section 4.1.2 for each section of the line, as well as the general measures (mitigation i) must be implemented variously, depending on the affected section of line and the proposed activity; ii. Particular care must be taken when working along the line between poles 59 and 67 and 8 and 13 – operational staff likely to have to visit these areas for emergency or routine maintenance work must be familiar with the disturbance-mitigation measures for this section of the route and informed as to the sensitivity of the area. At least one person on any maintenance visit to this section must have been through such a training / information exercise; iii. An Environmental Control Officer or similar functional designation should inspect the route on an annual basis to ensure conformance to the operational EMP mitigation measures. iv. Learning from the application of mitigation measures in the Construction Phase must be carried on into the Operational phase – where mitigation measures failed, were improved upon or were unnecessary, amendments to the CEMPr must be made, at the time of construction, and this programme should be taken forward as the implementation manual for operational phase maintenance measures (i.e. the Operational Phase Environmental Management Programme (OEMPr)); v. The OEMPr should include specifications around the locations of approved areas for helicopter landing (if required) and laydown areas for each site, again based on Construction phase implementation; vi. Any watercourses that are damaged (e.g. by trampling, compaction) must be reinstated immediately after Maintenance activities have ceased, if considered necessary by an aquatic ecologist – the requirement for rehabilitation should be guided by mandatory before- and after- photographs of the affected structure and its laydown and working areas, which should be inspected by an aquatic ecologist and used as the basis on which to recommend active interventions.							
With mitigation	1 Local	2 Medium	1 Short-term	4 Low	Probable	Low (Neg.)	Medium

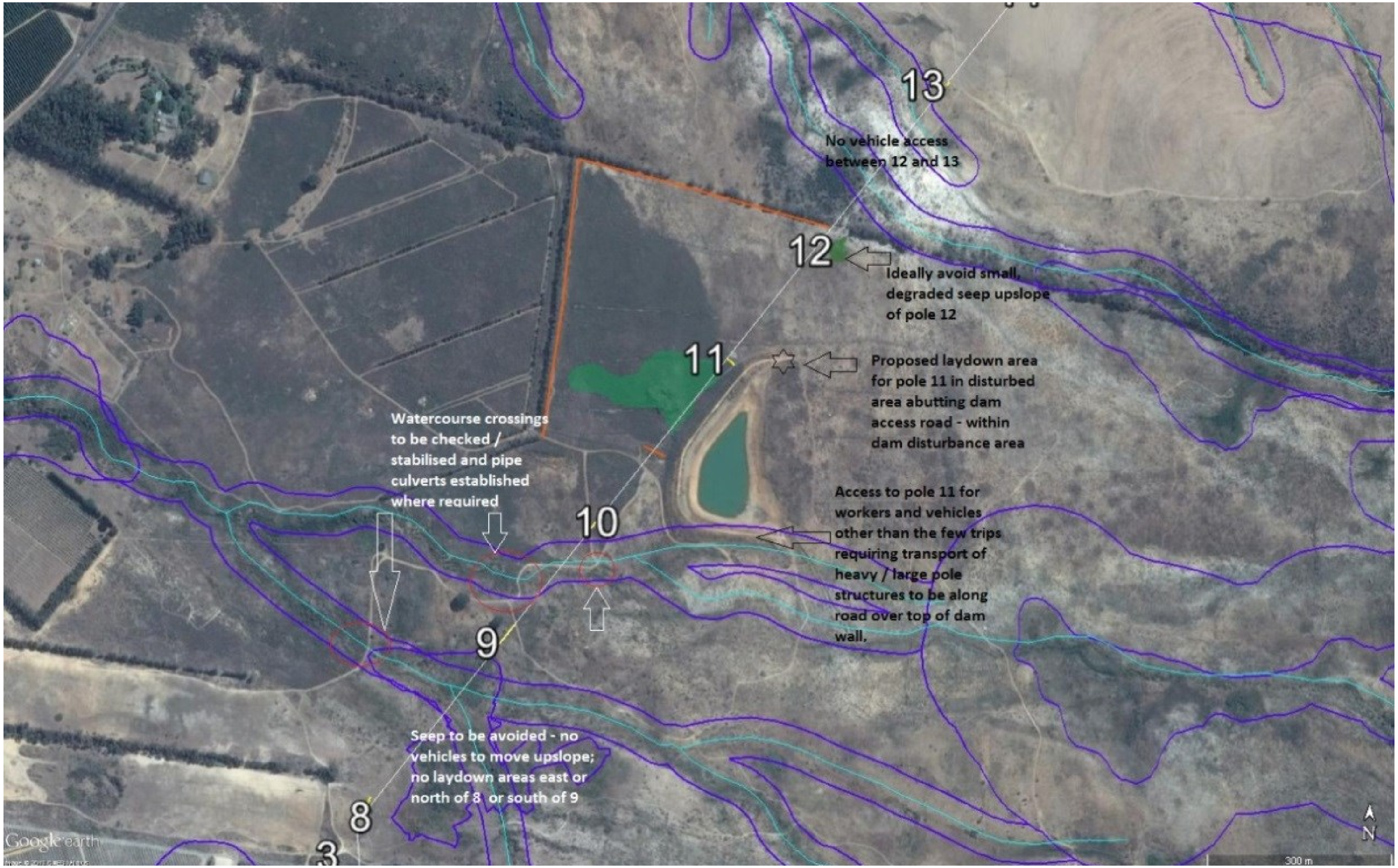


Figure 17

Mitigation recommendations for area between poles 8 and 13

To be read in conjunction with mitigation measures outlined in Section 4 for these areas. For the purposes of this assessment, the seeps in this section are defined as the full area delineated in Figure 12 by WCBF (2014) as CBA, CESA and OESA watercourses and their buffers, plus any additional areas mapped as part of this project and indicated in the maps. Thus the open purple polygons should be regarded as the edge of the watercourse.

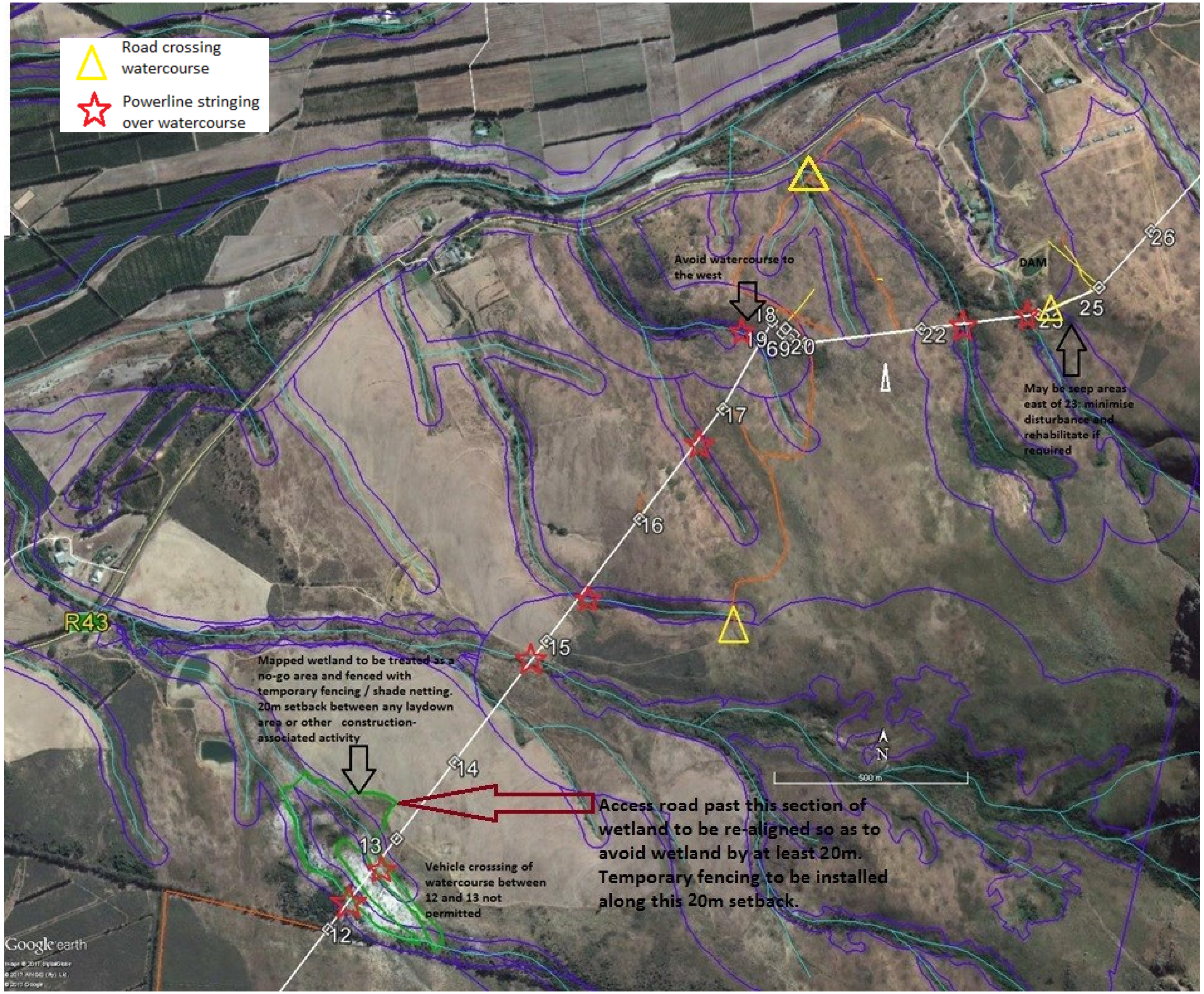


Figure 18

Mitigation recommendations for area between poles 13 and 26

To be read in conjunction with mitigation measures outlined in Section 4 for these areas. Shaded green polygon indicates seep edge of high importance and sensitivity. For the rest, the seeps are narrow and channelized and the full WCBF (2014) buffered watercourses shown in purple polygons over-represent extent

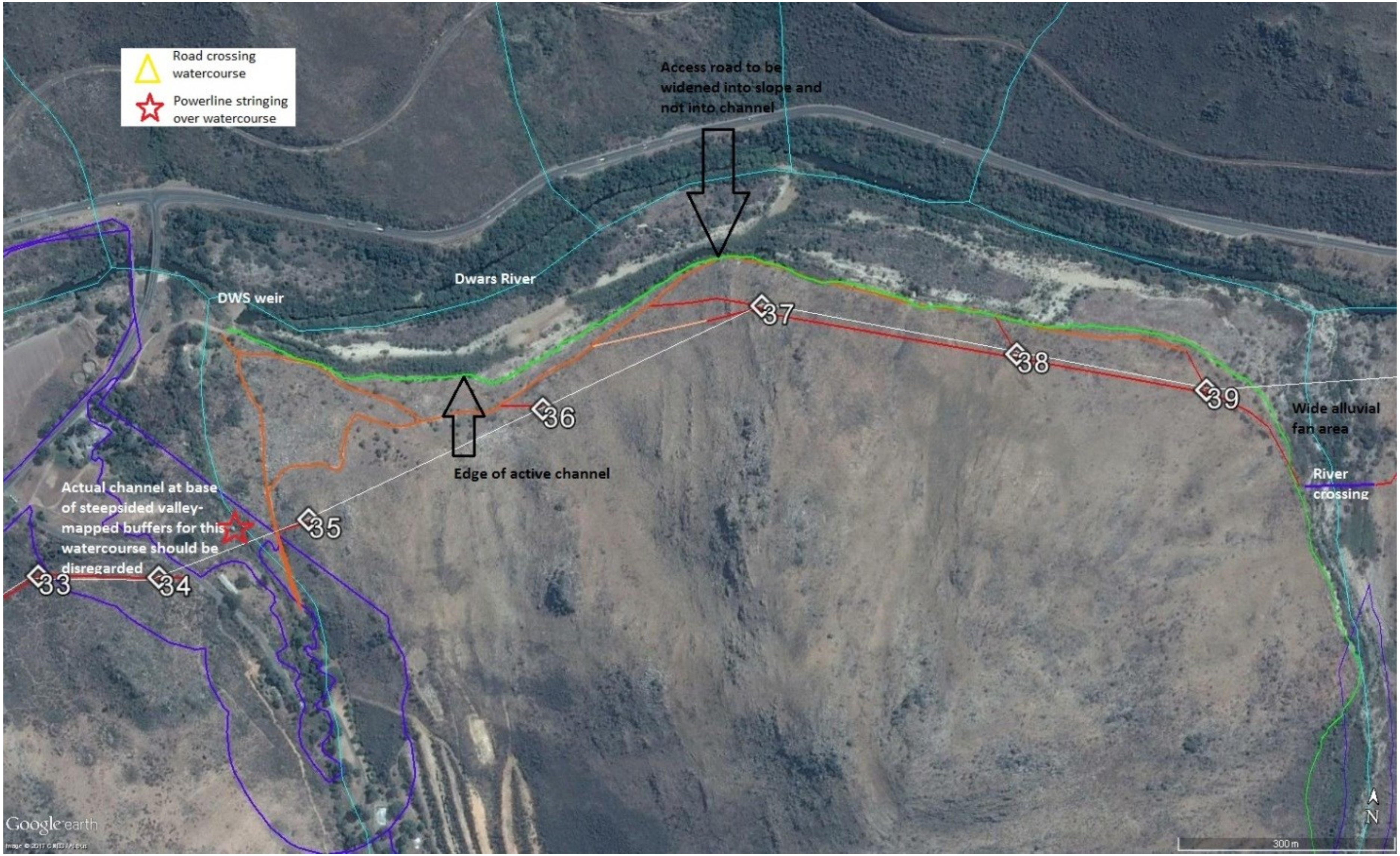


Figure 19
Mitigation recommendations for area between poles 33 and 39
To be read in conjunction with mitigation measures outlined in Section 4 for these areas. Green line indicating active channel roughly delineated.

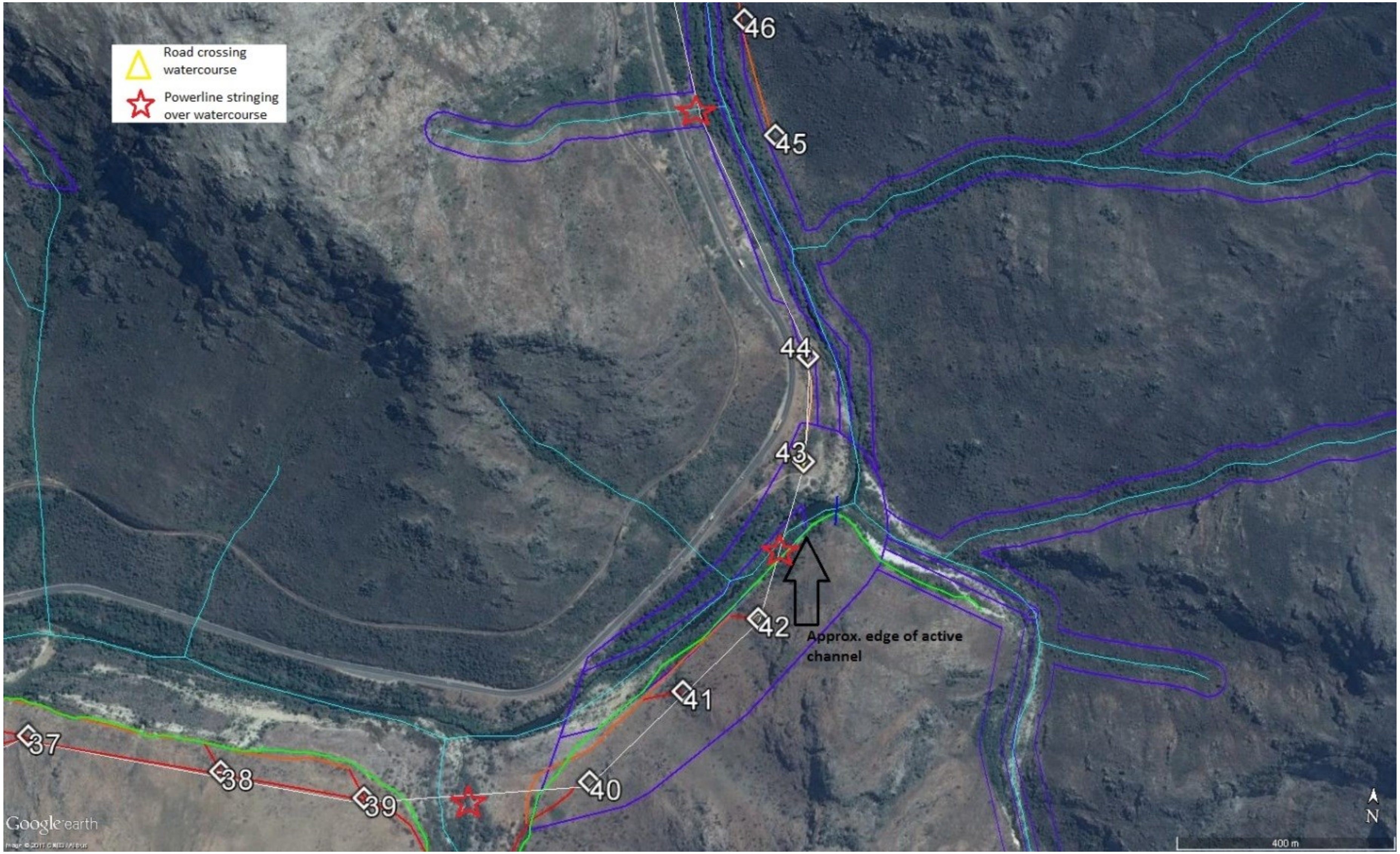


Figure 20
Mitigation recommendations for area between poles 37 and 46
To be read in conjunction with mitigation measures outlined in Section 4 for these areas. Green line indicating active channel roughly delineated.

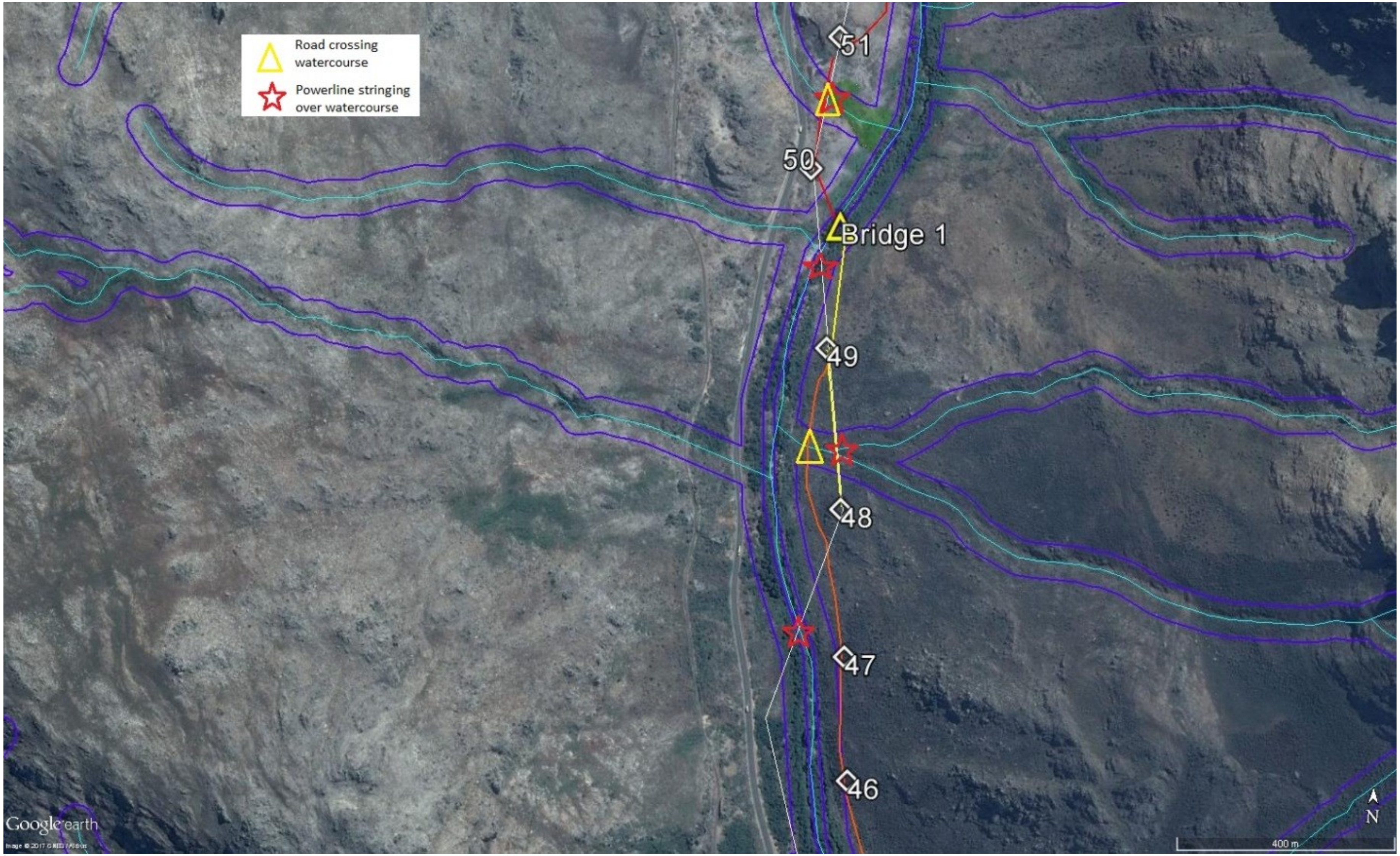


Figure 21
Mitigation recommendations for area between poles 46 and 51
To be read in conjunction with mitigation measures outlined in Section 4 for these areas

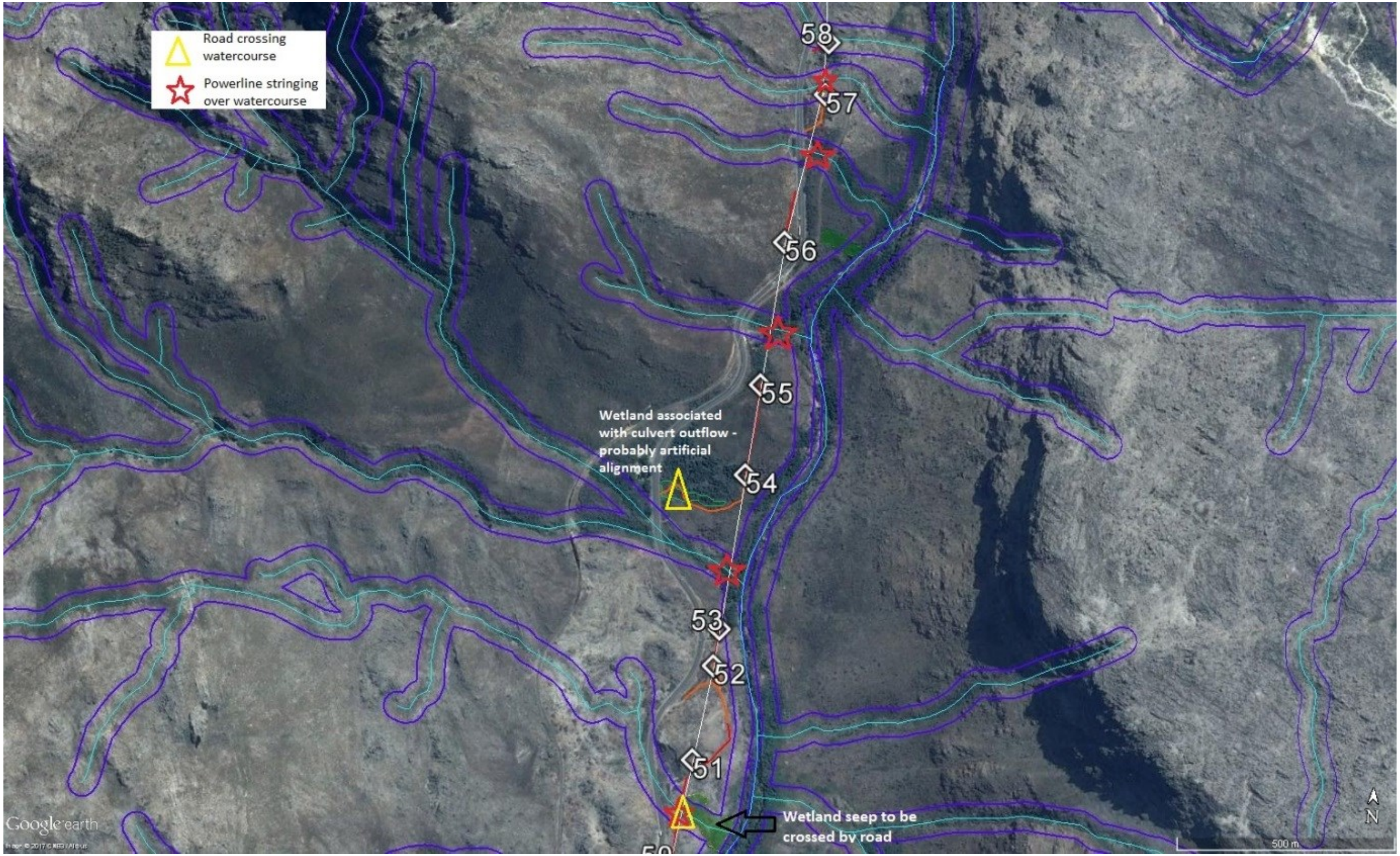


Figure 22
Mitigation recommendations for area between poles 51 and 58
To be read in conjunction with mitigation measures outlined in Section 4 for these areas

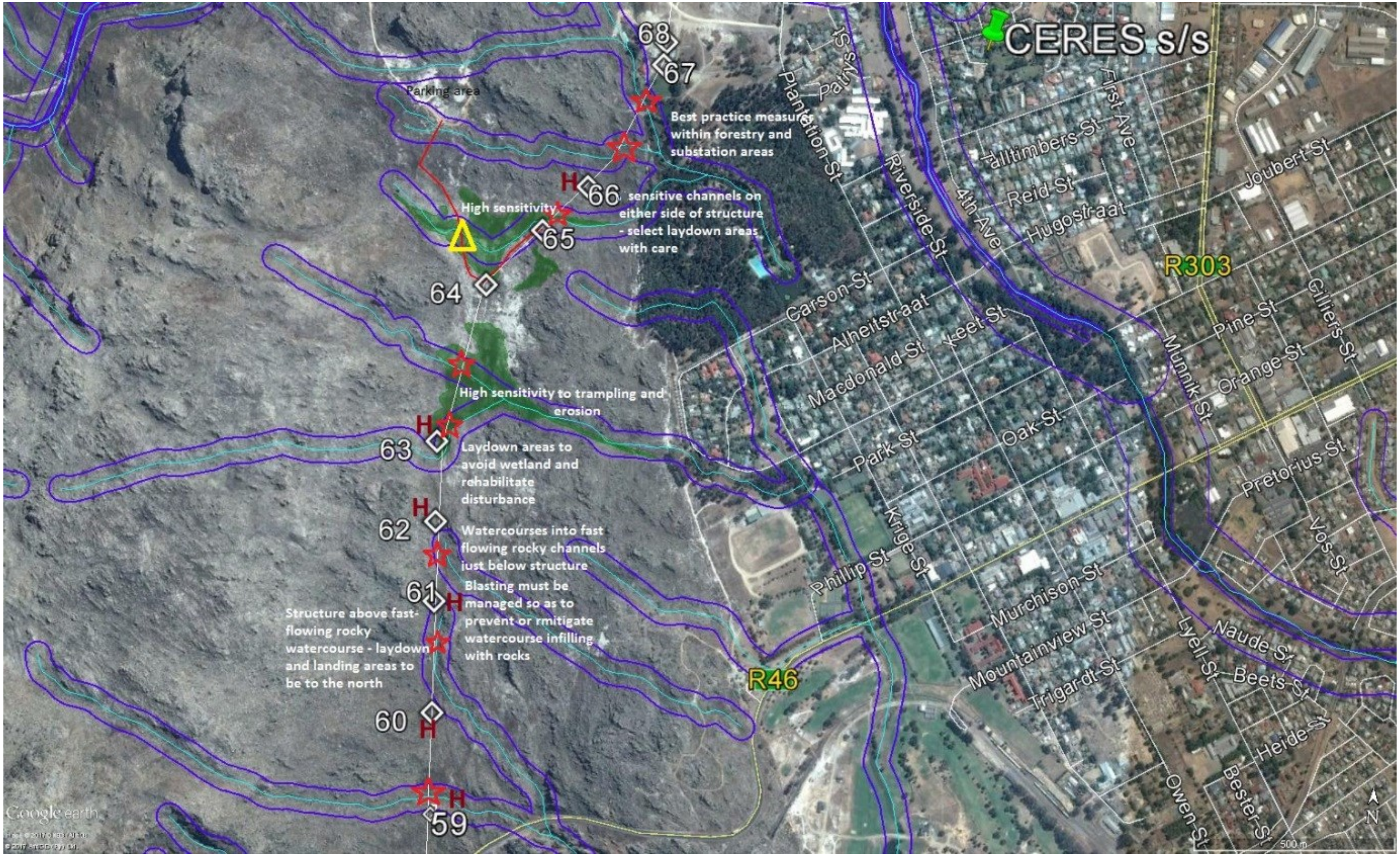


Figure 23
Mitigation recommendations for area between poles 51 and 58
To be read in conjunction with mitigation measures outlined in Section 4 for these areas
H indicates helicopter-assisted poles – all poles shown here, except 64, 65 and 67,68

4.2 Impacts associated with the proposed access routes

One of the more important indirect impacts of the selected pole positions and required new powerline as a whole is the resultant requirements for road access to most of these positions, and the need for various watercourse crossings, including the Dwars / Breede River itself. It is noted that, during the pre-assessment phases of this project, consideration was given to this ecologist's preferred approach of using helicopter access both for poles on the top of Ceres Peak (poles 59 to 66) and those requiring crossing of the Dwars River. Although such measures were included for poles 59 to 66 (excluding poles 64 and 65), their costs and maintenance requirements i.e. access were deemed prohibitive for the five poles located on the eastern bank of the Dwars River (poles 45 – 49).

The length of additional new roads that would be required to access the new pole positions is relatively short in total, with existing unpaved roads through agricultural or conservation areas being used in many cases to gain access close to the poles. However, the use of even existing roads for the construction phase of the project would be likely to incur significant impacts, and these are dealt with separately from the impacts associated with the layout, design and construction of new roads and watercourse crossings, in an assessment of the impacts associated with combined construction-phase use of access roads in general.

4.2.1 *Direct Layout and design phase impacts of new roads and watercourse crossings*

Although substantial changes in pole position were made in the pre-assessment phase, in many cases in order to allow changes in access road alignments, complete avoidance of impacts to aquatic ecosystems was not achievable, and this section unpacks the impacts likely to accrue as a result of design and layout of the proposed new access roads. The assessments in this section have been divided between those (generally larger or highly sensitive) watercourses where specific conceptual engineering design has been carried out to address ecological concerns raised at an early stage of this project (i.e. Ceres Peak seep crossed to access poles 64 and 65, Tierhokkloof crossing and Dwars/ Breede River crossing), versus those for which generic road designs have been suggested (namely, pipe culverts and/or structures comprising bidem with 3mm crush material or subbase, but where the detailed application of these measures has not been considered. For simplicity of assessment, it is assumed under assessment "without mitigation" that no allowance for such crossings has been made, and that, since the above designs were developed in response to mitigation requirements, the "with mitigation" part of the assessment considers these two approaches.

Impact 3: Degradation of minor wetland seeps as a result of new road crossings

Impact description

The proposed new access roads would cross through a number of wetland seeps. At the time of this assessment, no formal road crossings for any of these systems had been included in the engineering design, and for assessment purposes it is thus assumed that the roads will pass through the other affected seeps without consideration of the presence of aquatic systems along these alignments. It is recognized that in practice such aspects would probably have been considered in the detailed design phase. The exception to this is the proposed suspension bridge crossing over the seeps on Ceres Peak that would be crossed to access poles 64 and 65 (assessed as Impact 4) and the low level bridge crossings that have been proposed for the crossing of the Dwars River and the Tierhokkloof Rivers (assessed as Impact 5).

For the rest of the affected watercourses, the passage of the proposed unpaved new roads across seepage lines without attention to the management of flows would almost definitely result in the following effects:

- Diversion of surface and shallow subsurface flow outside of its natural course – in the case of broad seepage wetlands, such diversions would probably include damming up of flows against the upslope side of the road, impeding shallow subsurface flows and the concentration of flows at low points in the crossing, resulting in concentration of flows downstream and, unless the substrate was rocky, erosion and downstream sedimentation;
- A risk of inducing headcut erosion as a result of concentrated flows through wetland-dominated seeps – this would be a risk in most wetlands on a slope, where the substrate does not comprise bedrock or include frequent rocky sills that act as energy breaks and gradient controls.

The following impacts to aquatic ecosystems would be likely as a result:

- Wetland shrinkage as a result of blockage of flows as well as from headcut incision, which causes a localized lowering of the water table and hence a reduction in waterlogged areas that support wetlands;
- Increased velocities into downstream area as a result of changes in wetland function, with loss of attenuation capacity, reduced wetland resilience and reduced potential to absorb surface runoff and allow its slow seepage into downstream areas;
- Fragmentation of wetland corridors;
- Increased propensity for invasion of alien plants into disturbed areas;
- General deterioration in wetland condition and function as a result of the above changes in hydrology and its knock-on effects.

The above comments apply to the following watercourses, as indicated in Figures 17 – 22:

- Between structures 49 and 48: this comprises a steep seep into the left hand bank of the Dwars River, assessed in Section 3.6 as PES B and with high sensitivity to erosion and channelization effects;
- Between structures 51 and 50: this seep comprises a broad, *Pteridium aquilinum* dominated seep into the right hand floodplain of the Dwars River, which connects to wetlands along the Dwars floodplain and has also been assigned a PES of B;
- Between structures 23 and 25.

<u>Impact assessment</u>

Degradation of the above seeps, assuming erosion, wetland shrinkage, sedimentation of downstream areas and general loss of condition and natural function has been assessed in Table 5 as occurring at a **Medium intensity, in the long term**. Although the impacts have been assessed as local in extent, in fact they would definitely affect a much greater section of watercourse than that at the road crossing itself, with both downstream and upstream reaches potentially being affected. Such impacts would be potentially irreversible, at least to the pre-impact condition of these systems and without implementation of any mitigatory measures, have been assessed as impacts of Medium negative significance.

Implementation of the mitigatory measures outlined in Table 5 would reduce impact significance to **Very Low**, by a reduction in both the intensity and likelihood of impact.

Table 5
Significance of wetland seep degradation as a result of new road crossings
(new roads in sections between poles 1 – 58)

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impact 3: Degradation of wetland seeps as a result of the design and alignment of new road crossings (new roads between poles 1 and 58 – including watercourse crossings between poles 23 and 25, 50-51 and 48-49 but excluding the Dwars and Tierhokkloof River and Ceres Peak seep crossings) - see Figures 17-22							
Without Mitigation	1 Local	2 Medium	3 Long term Irreversible in some areas	6 Medium	Probable	Med. (Neg.)	Medium

Essential Mitigation measures

i. General measures

a. All road sections across watercourses must include design measures that allow for the spread of surface and subsurface flows across the full width of the watercourse, without increasing concentration of flows into downstream areas or triggering upstream headcut erosion as a result of changes in effective channel gradient;

b. Crossings through watercourses must be lined with rock (preferably, as this would facilitate the percolation of water through the structure in low flow conditions) or concrete, to prevent vehicles gouging out watercourses substrate in wet conditions and triggering erosion;

c. The crossings must be low-level crossings that are overtopped by even small floods (e.g. 1:2 year Return Interval (RI) events) and allow for the ongoing seepage of passage of subsurface and low flows through or over the structure. This means that the crossings might not be passable during and immediately after rainfall events;

d. The design of each crossing must allow for dissipation of runoff from the approach roads, to prevent erosion;

e. Long term operational phase maintenance activities must allow for the periodic (as required) removal of sediment and other debris from bridges, culverts and access roads, as well as the rehabilitation by reshaping and planting as required, of river and wetland banks that have been disturbed as a result of disturbance associated with road crossings.

The proposed generic mitigation method of using pipe culverts and/or bidem with 3mm crush material or subbase to facilitate the spread of flows across wide seeps would support the above design criteria, as would drift-type river crossings. In all cases, the designs must include measures to dissipate concentration of flows downstream of the crossing, and thus prevent the development of erosion knickponts.

ii. Measures specific to different crossings:

a. Crossing between structures 49 and 48:

General measures must be allowed for, noting that the seep is highly vulnerable to erosion and the crossing would be vulnerable to accumulation of sediment (rocks, boulders and sand) and would require maintenance to keep the road open (see Section 4.2.4);

b. Crossing of the seep between structures 51 and 50:

The road would be routed from the proposed Dwars River bridge, up and across the top of the seep (Figure 21). Attention to ensuring the dissipation of flows through the seep would be very important. The hillslope up to the road is steep here, and cutting into the slope to create a road may result in daylighting of groundwater higher up the slope than currently. Road design must allow for the conveyance and spread of any such flows that are daylighted above the road during construction, and the use of packed rocks (inserted at ground level) across the width of the seep would facilitate the spread of flows through the seep.

Best practice measures include:

iii. Water course crossings should ideally be at right angles to the position of the seep, and cross at points low down on the seeps, where they have flattened out on the floodplain, rather than on steeper portions.							
With mitigation	1 Local	1 Low	3 Long-term	5 Low	Possible	Very Low (Neg.)	Medium

Impact 4: Degradation of near-natural seeps between poles 64 and 66 as a result of the proposed suspension bridge and access road

Impact description

In the case of the seeps crossed to access poles 64 and 65, the road would cross part of a mosaic of seeps considered to be in a near-reference condition (see Section 3.6.1.6), and which flows as broad, shallow subsurface sheetflow across the mountain fynbos vegetated area at the top of the mountain. The wetland, classified as PES A/B would be highly sensitive to changes in flow and vulnerable to headcut erosion. This is the most sensitive seep that would potentially be crossed by road structures. The conceptual road design indicates crossing of the channeled portion of the seep with a suspension bridge up to 5m wide, which would comprise concrete blocks on either side of the channel, to which would be attached concrete/ steel beams, spread across the channel, with Photo C (Section 2) providing an example of the envisaged design.

The access road to the crossing, which would only be over the channeled portion of the seep and not the extended wetland, would not be levelled or lined in any way, but surface vegetation might be cut to allow the passage of vehicles along the track to the bridge.

This design would be likely to result in the following:

- Infilling of the channel margins, resulting in localized constriction of flow, likely to result in upstream erosion of banks and possible destabilization of the channeled section of the wetland;
- Compaction of the top of the bank, which comprises seasonal seepage wetland;
- A possibility that, during periodic flood events when the channel is full, the position of the beams at top of bank level would mean that water would hit the top of the bridge and cause scour on the bank on either side;
- Compaction of the wetland on either side of the channel as a result of the passage of vehicles across it;
- Disturbance in the form of tracks and scour holes as a result of the passage of heavy vehicles across the wetland on either side of the bridge during the wet season, when these areas are wet;
- Further disturbance of wetland and associated terrestrial areas as a result of damage caused by turning areas for trucks / other vehicles.

Impact assessment

The above impacts would affect near-pristine seeps, resulting in lowering of condition as a result of likely erosion, scour, compaction and trampling and cutting of vegetation. Although localized, the impact would be potentially permanent and affect wetlands within a CBA, classified as CESA wetlands. Depending on the degree of erosion-related impact over time, such impacts would not be readily reversible to restore present condition.

As such, the impact of degradation of this seep is considered of high significance (Table 6), notwithstanding the fact that significant mitigation efforts have already been included in the design for this section, with helicopter-assisted rather than vehicle-accessed poles proposed for all but two of the poles between 59 and 66, and the suspension bridge intended to address concerns around access requirements.

Implementation of the mitigatory measures outlined in **Table 6** would however reduce the impact significance to **Medium**, by decreasing the intensity and irreversibility of likely impact. The likelihood of some impact does however remain probable, even with mitigation.

Table 6
Significance of degradation of near-pristine seeps as a result of the suspension bridge

<table>
<tr><th>Nature of impact</th><th>Extent of impact</th><th>Intensity</th><th>Duration of impact</th><th>Consequence</th><th>Probability of occurrence</th><th>Signif.</th><th>Confid.</th></tr>
<tr><td colspan="8">Impact 4: Degradation of near-natural seeps between poles 64 and 66 as a result of the proposed suspension bridge and access road</td></tr>
<tr><td><u>Without Mitigation</u></td><td>1
Local</td><td>3
High</td><td>3
Long term
Irreversible</td><td>7
High</td><td>Probable</td><td>High
(Neg.)</td><td>Medium</td></tr>
<tr><td colspan="8"><u>Essential mitigation measures:</u>
i. The access route on either side of the bridge must be selected and demarcated with marker poles or similar prior to mowing/ clearing of vegetation – although this has been done conceptually already during the baseline study, final checking of the laid-out access route must take place prior to the start of construction, with input from a botanist and aquatic ecologist;
ii. Any activity requiring vehicle access over the seep may only take place during the dry season, when the seep is not flowing and impacts as a result of churning of wetland soils can be avoided – this has implications for long-term operational phase activities during the wet season (see Section 4.2.4);
iii. The design of the suspension bridge should be adjusted such that:
a. The concrete support blocks must be located on the top of the bank and not in the channel, against the bank – a distance of at least 1m should be provided on either side of the channel before the support blocks are placed. This means that the bridge would cross the whole channel, not affecting flows at all, and avoiding the likelihood of bank erosion. During large floods (unlikely at the top of this catchment), flows would also overtop into a wider area and dissipate;
b. The support blocks must be raised at least 200mm off the natural ground surface. This measure would allow water to flow over the bank during flood periods, but also means that the bridge design would need to include a slight ramp to allow vehicles onto the structure without churning the ground further;
c. Areas for the turning of trucks / vehicles must be marked out, minimized in extent, and fenced – only one access road to the two poles is permitted and no consideration should be given to providing a circular access route;
d. In the event that the bridge is found to be triggering erosion after the construction phase, it should be removed and the two pole sites should be managed thereafter as helicopter access sites.
<u>Best practice measures:</u>
Ideally, access to poles 64 and 65 should be by helicopter, as per the other poles in this area.
The access route on either side of the bridge must be aligned so as to run as far as possible over bedrock / flat rocky terrain rather than seep areas – this applies particularly to the section just south of the suspension bridge;</td></tr>
<tr><td><u>With mitigation</u></td><td>1
Local</td><td>2
Medium</td><td>3
Long term</td><td>6
Medium</td><td>Probable</td><td>Medium
(Neg.)</td><td>Medium</td></tr>
</table>

Impact 5: Degradation of larger rivers (Dwars/Breede and Tierhokkloof Rivers) as a result of new road crossings

Impact description

Low level crossings have been proposed for both of these river courses, with examples of possible designs included in Photos A and B in Section 2 and with reference also by the project engineers to the Breede River low level bridge in the Slanghoek Valley. In the present project, both rivers to be crossed are characterized by extensive upstream invasive alien tree growth and high sediment loads – the steep channel gradient of the upper Tierhokkloof River in particular, coupled with its seasonal flow regime means that the lower reaches of this river in the vicinity of where it would be crossed by the road are particularly likely to receive high sediment loads from upstream, with sediment in the form of boulders, rocks and sand. The relatively unvegetated nature of the lower reaches where the river spreads out and discharges into the Dwars/Breede River suggest a high disturbance regime that does not allow for extensive plant establishment. Against this background, the proposed bridge structures are considered likely to result in:

- Accumulation of woody debris loads and sediment on their upstream approaches which, although presumably overtopped in large floods, could still cause significant bank erosion as well as by-passing of the structures during small and large floods – it is noted however that the proposed structures do take into account large sediment roads, by including wide culverts;
- Constriction of flows as a result of the conceptual design allowing for only two 900mm diameter pipes and two 750 mm pipes – across the Tierhokkloof River, the active channel is some 127m wide at the proposed crossing point;
- Bank stabilization and earthworks requirements, to allow the access road to cross at the proposed crossing point, where the river bank is steep – the bank shallows with distance north towards the Dwars/Breede River;
- Fragmentation of the river corridor and a high likelihood of repeated disturbance of natural geomorphological processes, by causing the build-up of sediments upslope of the bridge;
- Potential bank erosion as a result of runoff from approach roads – this would be more significant where the approach road slopes are steep.

Impact assessment

The above impacts would be likely to lead to reduced habitat integrity / increased channel degradation in both the Dwars/Breede and Tierhokkloof Rivers, which although occurring at a local level and unlikely to be irreversible in either case, would nevertheless result in a node of additional disturbance in riverine corridors made less resilient to disturbance by other impacts such as alien invasion and (in the case of the Dwars/Breede River) upstream abstraction and water quality deterioration. In the case of the relatively natural Tierhokkloof River, the proposed bridge would be of significance as one of the only pieces of infrastructure to alter its natural geomorphology. These impacts have been assessed as of **Medium negative significance**, occurring at a Medium intensity at least (see Table 7). Given the absence of flow data in these rivers against which to assess the proposed structures against flood frequencies, and in the face of other uncertainties such as climate change, the impact assessment provided here is undertaken with a low level of confidence, resulting in a more conservative assessment than one that might be made with high levels of uncertainty around flood levels, flow velocities and discharge, sediment movement and climate change effects.

Table 7 includes various mitigation measures – these would reduce the level of expected impact to **Low significance** – but confidence would remain low.

Table 7
Significance of the potential degradation of larger rivers (Dwars and Tierhokkloof Rivers) as a result of new road crossings

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impact 5: Degradation of larger rivers (Dwars/Breede and Tierhokkloof Rivers) as a result of new road crossings between structures 39 and 40.							
Without Mitigation	1 Local	2 Medium	3 Long term	6 Medium	Probable	Med. (Neg.)	Low
Essential mitigation measures: i. Bridge structures must include multiple culverts or wide pipes that allow for a spread of flow across the full channel – this is particularly important in the Tierhokkloof River where sediment movement results in a dynamic channel, with low flow channels changing over time – the bridge structure must not result in permanent stabilization of any one flow pathway; ii. Bridge structures must not result in narrowing of the river channel – photos A and B (Section 2) both show such narrowing, and bridge design should avoid this outcome; iii. Bridges must be designed so that they serve as low flow structures that tend to be overtopped as a result of even minor floods: 1:2 year events or less should overtop the structures; iv. Bridge design must include measures that prevent runoff from the approach roads into the river resulting in road, bank or bed erosion – in the case of the Tierhokkloof River, it is suggested that moving the location of the crossing further downstream where the river banks are less steep may be desirable – this should be decided on site; v. Final bridge design must include input from a freshwater ecologist; vi. The access route on either side of the bridge must be selected and demarcated with marker poles or similar prior to mowing/ clearing of vegetation – a botanist and aquatic ecologist should give input into this activity.							
With mitigation	1 Local	1 Low	3 Long term	5 Low	Probable	Low (Neg.)	Low

4.2.2 *Impacts associated with the construction of new access roads and watercourse crossings*

Impact 6: Disturbance to watercourses (seeps and rivers) as a result of road and bridge construction

Impact description

Construction of bridges and roads through or in close proximity to watercourses is likely to result in disturbance to these systems as a result of compaction by vehicles, trampling, damage to vegetation, accidental spillage of construction material (e.g. cement) into watercourses and possible localized diversion of flows, as a result of churning up of wetland flow pathways by vehicle passage or other activities that cause even temporary changes in flow direction. Disturbed areas would generally be prone to invasion by weedy and/or invasive vegetation, resulting in further habitat degradation. In addition, the presence of significant numbers of vehicles and workers during construction means that there would be at least some likelihood of contamination of watercourses as a result of litter, toilet waste, spilled or leaked oils and fuels, especially if refueling is allowed along the new road sections.

The above impacts are similar to those described for the construction of support poles (see Section 4.1.2) but would affect greater areas, due to the extended nature of new roads and the fact that both proposed new roads and bridges actually extend into and over various watercourses (as described in Section 4.2.1) and as such some level of impact would be definite and unavoidable. As a result, it is possible that a degree of permanent degradation to some affected aquatic ecosystems might occur during construction, potentially resulting in a downward shift in PES score or even PES category in sensitive areas.

Of the proposed new road sections, the following are considered most likely to be associated with impacts to aquatic ecosystems during the construction phase, namely:

- The new road and proposed suspension bridge to access poles 64 and 65: this would pass through important, near-pristine, sensitive seepage wetlands within a terrestrial CBA, and construction impacts would include compaction of vegetation by vehicles, superficial (short-term) clearing of vegetation above the surface to allow vehicle access, possible destabilization of channel margins / banks and disturbance of in-channel vegetation and substrate at a very localized level - particularly if the unmitigated suspension bridge design option for this site is selected (see Section 4.2.1). All of the above impacts would be exacerbated if construction occurred in the wet season, when disturbed sediments would be more readily mobilized;
- The bridges over the Dwars/ Breede (structures 49-50) and Tierhokkloof Rivers (structures 39-40): these bridges would cross two significant rivers, of which the Tierhokkloof River in its assessed reaches is considered less sensitive to construction-associated disturbance, given the fact that it is a system naturally prone to high levels of disturbance in the form of sediment transport and associated erosion, smothering and channel migration;
- New access roads to poles 30-34: these would not cross through any watercourses but their construction ([4]involving 1.0 – 1.5m cut and fill) would be on steep, erosion-prone slopes that feed directly into the Breede River below. Erosion of these slopes would result in runoff of sediment-laden water into the Breede River, and if loads were significant, this would have resultant negative implications for this aquatic ecosystem, with impacts including sedimentation of pools and riffles, as well as increased turbidity, potentially impacting on aquatic plant growth and aquatic fauna;
- Access road across the seep between pole 50 and 51: the proposed access road would cross just above the seep – however, construction-associated impacts would include vegetation disturbance and earth compaction and, assuming required mitigation as outlined in Table 5, potentially localized excavation required for the installation of rock packing across the seep;
- Access road between poles 23 and 25 – this would run in close proximity to the disturbed seepage area leading into the dam. Construction-associated impacts would include vegetation disturbance, earth compaction and possible creation of erosion dongas as a result of concentration of flows.
- .

Impact assessment

Construction activities in all of the above areas would probably result in trampling, destruction and compaction of natural vegetation, and possible water quality impacts where cement or other pollutants including hydrocarbons and sediments are allowed to pass into

[4] Engineering design concepts provided by Element Engineering

watercourses. The implications of these impacts would be most severe in the case of near-pristine wetlands between poles 64 and 66 (high magnitude and potentially irreversible) and of lower magnitude at the other sites / sections listed.

Table 8 provides an assessment of the overall significance of these impacts, both without and assuming implementation of the mitigation measures listed in the table. Note that many of the general construction mitigation measures are standard best practice measures and have already been recommended for application to mitigation of impacts associated with pole construction. Overall impact ratings have been driven by impacts to the most sensitive systems – but essential mitigation measures break down mitigation measures into measures required for different areas / systems.

Table 8
Significance of disturbance to watercourses (seeps and rivers) as a result of road and bridge construction

Nature of impact	***Extent of impact***	***Intensity***	***Duration of impact***	***Consequence***	***Probability of occurrence***	***Signif.***	***Confid.***
Impact 6: Disturbance to watercourses (seeps and rivers) as a result of road and bridge construction							
Without Mitigation	1 Local – but along extended lengths of watercourses	2 Medium	3 Long term – potentially irreversible for seeps between poles 64 and 66	6 Medium	Probable	Med. (Neg.)	Medium

Essential mitigation measures:

General mitigation measures:

i. A detailed Construction Phase Environmental Management Programme (CEMPr) must be compiled that outlines control measures to prevent impacts associated with spillage or leakage of contaminants from vehicles and machinery and contamination of watercourses with cement. Such measures, the implementation of which must be overseen by a competent Environmental Control Officer (ECO) (or similar functional designation) must include:

   a. Construction disturbance areas to be minimized and tightly controlled where roads pass through watercourses – an additional area of 3m on either side of the proposed road may be included in the disturbance zone and this width must be fenced off before construction using temporary fencing that will prevent the spread of equipment and construction material into other areas – the use of plastic danger tape is not recommended for this purpose, as it is likely to tear / blow away and add to pollution of natural areas;

   b. Daily litter collection and removal must take place along the route through and in the vicinity of watercourses during construction in any segment;

   c. No refueling sites / areas to be within 50m of any watercourse unless on an existing designated refueling area, with adequate bunding;

   d. Workers camps and toilet facilities to be as required in Table 5;

   e. Post-construction clear-up activities must ensure the removal of all waste and excess construction material from the demarcated road alignment through watercourses and its legal disposal outside of any sensitive environmental areas;

   f. Post-construction rehabilitation of any areas damaged / disturbed as a result of any construction-associated activity – this would include areas in which erosion has occurred, as well as areas subjected to cement spillage and other impacts, and would need to be to an aquatic ecologist's specifications.

Mitigation for the new road and proposed suspension bridge to access poles 64 and 65:

Figure 23 illustrates mitigation measures specific to the section of the route which passes over highly sensitive, least-impacted watercourses, which include broad wetland seeps as well as rocky channels downs steep slopes. In addition to the general mitigation measures in i, the following apply:

ii. Construction must not take place in the wet season, when watercourses will be more sensitive to erosion and compaction;

iii. Cutting of vegetation to allow vehicle access must be carried out with manual labour rather than tractors / machinery, which is likely to increase compaction in watercourses;

iv. Areas from where plants are cleared during road construction must be minimized and no more than the area stipulated in (ia) should be allowed;

v. Plant clearing activities may not include excavation of soils or uprooting of plants;

vi. Suspension bridge concrete blocks must be pre-cast and no *in situ* cement should be used for these structures;

vii. Upon completion of construction, the access road and bridge must be assessed by the botanical and wetland specialists and areas requiring rehabilitation or clearing of waste identified and addressed;

Mitigation for the bridges over the Dwars/ Breede and Tierhokkloof Rivers:

General mitigation measures must be implemented as well as design phase measures in Table 5. In addition:

viii. Construction must not take place in the wet season;

ix. Cement mixing / batching to be on areas with temporary removable bunding, outside of any watercourse, and managed to minimize spillage into natural areas;

x. Where the river bank is destabilised / disturbed during construction, it should be reshaped and/or replanted to a freshwater ecologist's specifications – this specification is likely to be required for the Dwars/Breede River but probably not for the more robust Tierhokkloof River;

Mitigation for the new access roads to poles 30-34:

xi. The CEMPr must include measures to prevent / address erosion / wash-off of sediment rich water from the steep slopes during road construction. Such measures could include sediment traps contoured downslope of the access road.

Mitigation for the access road across the seep between pole 50 and 51:
General mitigation measures must be implemented.
Non-essential mitigation

As a general rule, all construction should take place outside of the wet season – this is however unlikely to be practical, but it is noted that this is essential mitigation for certain sections specified above.

Ideally, access to poles 64 and 65 should be by helicopter, as per the other poles in this area, thus avoiding construction phase impacts.

With mitigation	1 Local	1 Medium	3 Medium term	5 Low	Probable	Low (Neg.)	Medium

4.2.3 *Impacts associated with the construction phase use of access roads and watercourse crossings*

Section 4.2.2 described and assessed impacts to aquatic ecosystems that would be associated with the construction of new roads and watercourse crossings to secure access to the proposed powerlines and support poles. However, existing access roads through (mainly) agricultural areas would also be used during construction, and this section considers the impacts likely to accrue to aquatic ecosystems as a result of the extensive use of both new and existing roads during the construction phase for the support poles and powerlines.

Impact 7: Degradation of wetland seeps as a result of repeated passage of vehicles through them during the construction phase

Impact description

The following areas have been highlighted for particular attention in this regard, namely:

- Road crossings over watercourses between poles 8 and 11: Several of the existing crossings are light-weight, minor crossings supported by logs and are unlikely to be adequate for crossing by heavy vehicles, suggesting that their use over a prolonged construction period would result in bank collapse, churning of banks and the possible creation of erosion knickpoints. These wetland seeps are considered in a PES Category B (see Section 3.6.1.2) and their degradation as a result of multiple localized crossings would be of high significance;
- The wetland seep downstream of the dam just south of pole 11: The proposed existing route close to pole 11, from where a new road would be created (Figure 17) passes through a broad seep that has formed downstream of the dam and which, although largely an artefact of the dam, supports a relatively diverse wetland and provides useful functions in managing permanent seepage from the dam – this seepage water would naturally have passed down a broad seep just south of the dam. The prolonged use and assumed straightening and widening of the existing road between poles 10 and 11, downslope of the existing dam would result in substantial degradation of this wetland, which although artificial, performs a valuable function in preventing concentrated seepage flows, likely to cause erosion dongas (one such already occurs downstream of the dam, presumably associated with the dam spillway / outlet;
- Degraded watercourses between poles 12 and 26: Existing roads around and across agricultural fields would be used to access poles or new access roads. These cross multiple watercourses (see Figure 18) and multiple, heavy-machine crossing could trigger channelization and donga formation.
- Impacts to seeps as a result of *ad hoc* passage of vehicles across agricultural areas to reach pole positions – while the agricultural areas between poles 14 and 34 do not include important watercourses of high integrity, ad hoc passage of vehicles across these lands would be problematic if it resulted in the creation of disturbed, muddy areas that passed sediment-rich concentrated flows into watercourses, thus increasing erosion and channelization, or passed over or in the vicinity of the few least impacted seeps that have been identified - the wetland arrowed in Figure 18 just north of pole 13 is particularly vulnerable to accidental damage / compaction by vehicles;
- Near-pristine seeps between poles 64 and 66 – following construction, these seeps would remain vulnerable to ongoing impacts as a result of the passage of vehicles

over unlined sections of the seeps, and if this was carried out in the wet season, the impacts would be substantially more significant.

Impact assessment

The above impacts would potentially be of greater significance than those accruing during the construction phase of relatively limited new road sections, and would moreover continue impacts of compaction, litter, risks of pollution and other issues during pole and powerline construction activities. Table 9 assesses these impacts formally, rating them together as associated with medium to high intensity in the absence of mitigation, and potentially associated with long-term degradation that may be irreversible in some least-impacted areas.

The table includes mitigation measures, which if implemented could reduce the net significance of this impact from **Medium-High to Medium**, with the Medium rating driven by the probability despite mitigation that there will be impacts to sensitive seeps in good condition.

Table 9
Significance of impact of wetland degradation

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impact 7: Degradation of wetland seeps as a result of repeated passage of vehicles through them during the construction phase							
Without Mitigation	1 Local	2.5 Medium to high	3 Long term Irreversible in some areas	6.5 Medium to high	Probable	Med. to high (Neg.)	Medium
Essential mitigation: i. Design and Construction phase mitigation measures must be implemented for the affected areas as outlined in Sections 4.2.1 and 4.2.2; ii. No construction activities in the affected areas during the wet season; iii. All existing watercourse crossings requiring access by heavy vehicles (trucks) or repeated access by light vehicles (e.g. 4x4s) must be designed to prevent the passage of vehicles though the channel – a. Suspension type structures (e.g. as per the suspension bridge type access to poles 64 and 65) should be considered for crossings in the section between poles 8 and 12, allowing for the same design mitigation measures as outlined in Table 6; b. Pipe culverts or similar should be used for degraded crossings between poles 12 and 34; iv. The wetland arrowed in Figure 18 (north of Pole 13) should be fenced off during construction as per Table 3 measure vii, and the access road shifted in this section, to avoid the wetland and its 20m buffer; v. Post-construction rehabilitation of impacted wetlands between poles 58 and 66 must take place to a botanist's and aquatic ecologist's specifications. Best practice measures: **Ideally, access to poles 64 and 65 should be by helicopter, as per the other poles in this area.**							
With mitigation	1 Local	2 Medium	3 Long term	6 Medium	Probable	Medium (Neg.)	Medium

Impact 8: Encroachment into the riparian area of the Dwars/Breede River as a result of road widening

Impact description

The existing wagon track along the edge of the Dwars River allowing access to poles 36-39 (see Figures 19 and 20) is narrow in places and partially blocked by boulders. The track would thus require widening along sections to allow for the passage of large vehicles during construction, as far as the new track to poles 38-39. The existing track runs just above the edge of the active channel of the Dwars River, making the river bank vulnerable to impacts that would extend at least along some [5]250m of river course (the road between the access to 36 and 37) and longer if the lower existing track between 35 and 36 is used, instead of the upper track. Such impacts would include removal / damage to riparian vegetation, increased risk of bank erosion as a result of riparian disturbance, infilling with rock and/or soil as a result of earth levelling and widening activities on the edge of the river. In areas where blasting of rock is proposed, such impacts would be expected to be pronounced.

Impact assessment

Disturbance of the Dwars River riparian zone is likely to be localized and may be partially mitigated. Table 12 assigns significance ratings of **Low and Very Low** for this impact with and without mitigation – these low ratings are driven largely by the assessment of Extent as Low and limited to the site.

Table 12
Significance of encroachment into the riparian area of the Dwars River as a result of road widening

Impact Nature	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability*	*Signif.*	*Confid.*
Impact 8: Encroachment into the riparian area of the Dwars River as a result of road widening							
Without Mitigation	1 Local	2 Medium	2 Medium term	5 Low	Probable	Low (Neg.)	Low
Essential mitigation measures: i. The existing upper track between poles 35 and 36 must be used, rather than the lower track abutting the river edge – this will marginally reduce the extent of river bank abutted by the road; ii. Where track widening is required, it must be by cutting into the slope – no widening of the existing track may take place towards the river in any areas where it lies closer than 10m from the top of bank; iii. All excavated / blasted rock must be removed and disposed of at least 20 m from the river bank and into disturbed areas that are not sensitive to infilling; iv. The river bank must be treated as a no-go areas during construction and no personnel or machinery may pass down the river bank; v. The river bank must be assessed by an aquatic specialist on completion of road construction and prior to the start of pole construction, and any areas vulnerable to erosion or other degradation as a result of road construction / widening activities must be subject to rehabilitation activities that may include bank shaping and replanting; vi. The river bank must be assessed by an aquatic specialist on completion of pole installation and any areas vulnerable to erosion or other degradation as a result of project-associated activities must be subject to rehabilitation activities that may include bank shaping and replanting.							
With mitigation	1 Local	2 Medium	2 Medium term	5 Low	Possible	Very Low (Neg.)	Low

[5] Estimated from GOOGLE Earth imagery

4.2.4 *Operation phase impacts*

Impact 9: Degradation of aquatic ecosystems as a result of long-term maintenance of access roads as sources of disturbance

<u>Impact description</u>

Operational phase impacts to aquatic ecosystems as a result of the new and existing access roads are likely to be similar to those already assessed in Section 4.2.3 (impacts associated with the construction phase use of roads), but would probably take place at a lower frequency and, in the case of requirements to perform emergency repairs on sections of the line, might take place in the wet season, when aquatic ecosystems are likely to be most sensitive to impacts such as trampling, compaction by vehicles and the general disturbance of saturated areas by vehicles. Depending on the sensitivity of the affected system, such impacts, even if infrequent, could result in long-term impacts.

Other infrequent impacts to aquatic ecosystems may also occur as a result of design and layout issues (e.g. debris dam formation and sediment accumulation at watercourse crossings) – although such impacts have been considered already in Section 4.2.1 (Impacts 4 and 5) in an effort to reduce their frequency and probability, in the event that they did occur, they would result in further habitat degradation, potentially precipitating bank erosion and the passage of eroded sediments downstream.

<u>Impact assessment</u>

Table 13 outlines both the significance ratings for this overall impact, and mitigation requirements.

Table 13
Assessment of the significance of aquatic ecosystem degradation as a result of operational phase activities

Impact nature	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability*	*Signif.*	*Confid.*
Impact 9: Degradation of aquatic ecosystems as a result of long-term maintenance of access roads as sources of disturbance							
<u>Without Mitigation</u>	1 Local	2 Medium	3 Long term Irreversible in some areas	6 Medium	Probable	Med. (Neg.)	Medium

<u>Essential mitigation measures:</u>

i. The construction-phase mitigation measures outlined in Section 4.2.2 and 4.2.3 must be implemented variously, depending on the sections of road through different affected watercourses;

ii. During the wet season, access to poles 8-13 and 59-66 must be on foot from (respectively) the Romansrivier substation / the existing parking area just north of the proposed Ceres Peak crossing or by helicopter only – the use of access roads would result in a significant increase in impacts to sensitive and least-impacted to near-pristine aquatic ecosystems. In the event that Eskom cannot commit to this measure, the overall significance of this impact would remain MEDIUM;

iii. Long term operational phase maintenance activities must allow for the periodic (as required) removal of sediment and other debris from bridges, culverts and access roads, as well as the rehabilitation by reshaping and planting as required, of river and wetland banks that have been disturbed as a result of disturbance associated with road crossings;

iv. Erosion or other impacts to the wetlands in the vicinity of the suspension bridge (access to poles 64 and 65) must be assessed by an aquatic ecologist to determine whether rehabilitation measures are necessary – these, which may include bank shaping and planting, must be implemented as required.

	Such environmental inspections should take place during or within 7 days of any inspection / maintenance activity along these sections of the line, and at a minimum frequency of every five years in the absence of such activities.						
With mitigation	1 Local	2 Medium	1 Short-term	4 Low	Probable	Low (Neg.)	Medium

4.3 Cumulative project impacts

Sections 4.1 and 4.2 assessed various activities and impacts associated with different phases and sections of the proposed support towers / poles, powerlines and access roads and watercourse crossings. Arguably, the assigned impacts are skewed towards the low, because they all assume a local extent of impact, ignoring the fact that the project as a whole extends across several quaternary catchments and would affect multiple different aquatic ecosystems including major rivers such as the Dwars / Breede and the Tierhokkloof Rivers. This bias may however be counteracted by the fact that, where aquatic ecosystems of high sensitivity and high ecological importance could be affected, the magnitude of effect is elevated, to accommodate such impacts, even where they are not consistent along the whole "site".

When the cumulative impacts of the project are considered, it must however be noted that numerous systems would be impacted with high levels of probability; that some support poles (between poles 8 and 13 and between 59 and 66) closely abut least-impacted and/or near-pristine seeps that would be impacted by both proposed pole structures and, more significantly, by proposed access roads and watercourse crossings, and that other access roads would require crossings over major river systems (e.g. the Dwars and Tierhokkloof Rivers), even though the frequency of long-term use of these crossings is likely to be very low.

Tables 14, 15 and 16 provide cumulative assessments of the project in terms of impacts associated with its design and layout, construction and operational phases, respectively.

These cumulative assessments are incorporated into the Basic Assessment Report for the project as a whole (SRK 2017) as reflecting a simplified, holistic summary of the multiple impacts on multiple systems of varying importance and sensitivity, as outlined in the present report.

From this perspective, it is argued that the cumulative impact to aquatic ecosystems of the proposed project as a whole, with incorporation of all essential mitigation measures outlined in this report, is likely to be of at least medium (negative) significance, resulting in potentially extensive degradation of low to medium levels of magnitude, in all assessed phases of the project (design and layout, construction and operational phases) and including consideration of design and layout impacts associated with access road construction and /or upgrading.

Without mitigation, the ecological significance of the proposed project in all its phases would be negative and high – it is recognized that the assessments "without mitigation" to some extent under-estimate the degree to which best practice measures would in any case be incorporated at least into the layout and design of various structures.

Table 14
Degradation of freshwater ecosystems (rivers and wetlands) as a result of cumulative impacts from the proposed design and layout of the [6]access roads

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impacts: Degradation of aquatic ecosystem condition							
Without Mitigation	2 Regional	2 Medium	3 Long term Irreversible in some areas	7 **High**	Definite	**High**. (Neg.)	High
Mitigation measures	As outlined in Section 4.2.1 and reflected in the EMPr						
With Mitigation	2 Regional	1 Low	3 Long term Irreversible in some areas	Medium	Definite	**Medium** (Neg.)	Medium

Table 15
Degradation of freshwater ecosystems (rivers and wetlands) as a result of cumulative impacts from the proposed construction phase of the powerline and access roads, including both construction of the access roads, and their use during construction of the powerlines

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impacts: Degradation of aquatic ecosystem condition							
Without Mitigation	2 Regional	2 Medium	3 Long term Irreversible in some areas	7 **High**	Definite	**High**. (Neg.)	High
Mitigation measures	As outlined in Sections 4.1.2, 4.2.1 4.2.2 and reflected in the EMPr (SRK 2017)						
With Mitigation	2 Regional	1 Low	2 Medium term	5 Low	Definite	Low (Neg.)	Medium

Table 16
Degradation of freshwater ecosystems (rivers and wetlands) as a result of cumulative impacts from the proposed operational phase of the powerline and access roads

Nature of impact	*Extent of impact*	*Intensity*	*Duration of impact*	*Consequence*	*Probability of occurrence*	*Signif.*	*Confid.*
Impacts: Degradation of aquatic ecosystem condition							
Without Mitigation	2 Regional	2 Medium	3 Long-term	7 **High**	Definite	**High**. (Neg.)	High
Mitigation measures	As outlined in Sections 4.1.3 and 4.2.4 and reflected in the EMPr (SRK 2017)						
With Mitigation	2 Regional	1 Low	3 Long term	Medium	Definite	Medium (Neg.)	Medium

[6] Note: no design/layout impacts associated with the powerline alignments (see Section 4.1.1)

5 IMPLICATIONS IN TERMS OF THE NATIONAL WATER ACT

This report has focused on an assessment of the implications of the proposed Romansrivier to Ceres substation 132/66kV double-circuit powerline in terms of the NEMA. However, given the likely impacts of the proposed project for watercourses, there is also a need to consider it in terms of the National Water Act (NWA) (Act 36 of 1998), which requires licensing and/or registration of water uses through the regional or national Department of Water and Sanitation (DWS), where water "uses" are defined in Section 21 of the NWA as follows:

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.

Of the above, Section 21c and i uses would definitely be associated with the current project, entailing as it does multiple requirements for the passage of roads through various aquatic ecosystems that have been classified as watercourses in terms of the definitions of the NWA. Decisions as to whether a Section 21c or i water use would require authorization by DWS in terms of a formal water use license, or mere registration of the use, is determined largely by the Risk to the water resource as a result of the proposed use, where Risk is assessed using a Risk Assessment Matrix, as provided by the DWS (amended 2016 version).

The Risk Assessment Matrix assigns three categories of risk to activities likely to impact on water resources, namely Low, Moderate and High. Section 21c and i water uses that have been assessed as being associated with a Low Risk are considered Generally Authorised in terms of General Notice (GN) 509 of 2016. Those where Risk has been assessed as Moderate or High, even after implementation of control / mitigation measures, would be required to seek authorization through submission of an application for a water use license. The awarding of such licenses considers *inter alia* social and economic needs, environmental consequences, resource sustainability and opportunities for promoting restorative access to resources for previously disadvantaged individuals and communities.

While the terms of reference for the present study did not include allowance for detailed compilation of a Risk Assessment for each water use envisaged, on the basis of the Environmental Impact Assessment findings of this specialist, and with reference to the assessments of cumulative impact in particular (see Section 4.3), the overall risk of the activities proposed in this project would not be considered low – they would extend over a large area and would negatively affect many aquatic watercourses, some of which have high ecological importance and sensitivity and which are included in strategic regional conservation plans. The magnitude of impacts would be at least medium, in most cases.

A full water use license application is thus likely to be required by the DWS, in order for their consideration of its acceptability in terms of the NWA. Officials from the Breede-Gouritz Catchment Management Agency (BGCMA) should be approached by the project proponents for further discussion as to this issue.

6 CONCLUSIONS

This study considered the effects from an aquatic ecosystem perspective of the proposed design, placement, construction and long-term operation of a new 132/66kV double-circuit powerline between the Romansrivier and Ceres substations, including support structures / poles and requirements for the use of various existing or new roads and tracks to allow access to poles and powerlines.

The proposed powerlines and associated infrastructure would pass through and/or in the vicinity of a number of aquatic ecosystems, all of which form part of the Breede River catchment, and which include sections of the upper Breede River itself (known as the Dwars River). Of these, wetland seeps in the vicinity of the Romansrivier substation (poles 8-13) and on the Ceres Peak area (poles 59-66) are considered highly sensitive, and in near-natural condition (PES B and A/B respectively). Other watercourses including sensitive, least-impacted wetland seeps occur elsewhere along the proposed powerline and access road alignment, which would also cross the Dwars River.

Degradation of aquatic ecosystems as a result of pole and powerline installations was considered a concern in this assessment, but all impacts could be reduced to Low negative significance through avoidance and/or implementation of careful mitigation strategies.

Ironically, it is the proposed design, construction, and in particular the construction phase use of roads to access the poles that would be associated with the greatest levels of impacts to aquatic ecosystems, with road access to poles 64 and 65 on the Ceres Peak area being considered particularly problematic, and associated with Medium negative significance, even after implementation of mitigation measures including engineering designs for the crossing of the main seep channel with a small suspension bridge. Such impact significance reflects the high sensitivity of these near-pristine headwater seeps to even small changes.

One of the implications of this assignment of a Medium significance rating to access road construction in this area is that a DWS Risk Assessment would also be likely to assign a Risk rating that is at least Moderate for the same activities. This would thus probably require consideration of the Section 21c and i water uses of the project through a full water use license, although the DWS (in this case, the Breede Gouritz Catchment Management Agency) would need to provide comment on this aspect.

Mitigation measures generally focused on design and construction-phase risk reduction, with construction activities in sensitive areas being required to be undertaken outside of the wet season, and the design of all access roads through watercourses being required to include measures to prevent concentration of flows and minimize the risks of erosion.

Assuming full implementation of mitigation measures, none of the proposed support pole locations or access roads were considered fatal flaws from an aquatic ecosystem perspective, although the likely cumulative degradation of sensitive seeps in some areas was noted as a concern.

7 REFERENCES

Department of Water Affairs and Forestry. 1999. Resource Directed Measures for Protection of Water Resources. Volume 3: River Ecosystems Version 1.0, Pretoria. Resource Directed Measures for Protection of Water Resources, Pretoria, South Africa.

Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetland riparian areas. Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS-RDM: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed in March 2016.

Driver, A, Nel, J.L., Snaddon, K., Murray, K., Roux, D., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. WRC Report No. 1801/1/11. ISBN 978-1-4312-0147-1. Pretoria

Emms, P. 2017. Baseline Botanical Study for the Proposed Eskom Powerline from Romansrivier to Witzenberg Substations and the Proposed Prince Alfred's Hamlet Substation, Witzenberg Municipality, Western Cape. Paul Emms Botanical Surveys. June 2017. Draft Report for SRK for client Eskom.

Kleynhans, CJ, Thirion, C and Moolman, J. 2005. *A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland.* Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

SRK. 2017. Eskom Romansrivier – Ceres 66/132 kV double circuit powerline. Basic Assessment Report. Report prepared for Eskom Holdings SOC Limited. SRK Report Number 509264/1.

APPENDIX A

SPECIALIST IMPACT ASSESSMENT METHODOLOGY

Methodology as provided by SRK Consulting

IMPACT ASSESSMENT METHODOLOGY FOR EIAS

The significance of all potential impacts that would result from the proposed Project is determined in order to assist decision-makers. The significance rating of impacts is considered by decision-makers, as shown below.

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity.
- **HIGH**: the potential impact **will** affect a decision regarding the proposed activity.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

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[7] must be rated according to the methodology set out below:

Step 1 – Determine the **consequence** rating for the impact by determining the score for each of the three criteria (A-C) listed below and then **adding** them[8]. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

Rating	Definition of Rating	Score
A. *Extent* *– the area over which the impact will be experienced*		
Local	Confined to project or study area or part thereof (e.g. site)	1
Regional	The region, which may be defined in various ways, e.g. cadastral, catchment, topographic	2
(Inter) national	Nationally or beyond	3
B. ***Intensity*** *– the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. ***Duration*** *– the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years (i.e. reversible impact)	1
Medium-term	2 to 15 years (i.e. reversible impact)	2
Long-term	More than 15 years (state whether impact is irreversible)	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Combined Score (A+B+C)	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

[7] This does not apply to minor impacts which can be logically grouped into a single assessment.
[8] Please note that specialists are welcome to discuss the rating definitions as they apply to their study with the EIA team.

Example 1:

Extent	Intensity	Duration	**Consequence**
Regional 2	Medium 2	Long-term 3	**High** 7

Step 2 – Assess the **probability** of the impact occurring according to the following definitions:

Probability– the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Example 2:

Extent	Intensity	Duration	**Consequence**	**Probability**
Regional 2	Medium 2	Long-term 3	**High** 7	Probable

Step 3 – Determine the overall **significance** of the impact as a combination of the **consequence** and **probability** ratings, as set out below:

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Example 3:

Extent	*Intensity*	*Duration*	***Consequence***	***Probability***	***Significance***
Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**

Step 4 – Note the **status** of the impact (i.e. will the effect of the impact be negative or positive?)

Example 4:

Extent	*Intensity*	*Duration*	***Consequence***	***Probability***	***Significance***	***Status***
Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**	**– ve**

Step 5 – State level of **confidence** in the assessment of the impact (high, medium or low).

Depending on the data available, you may feel more confident in the assessment of some impact than others. For example, if you are basing your assessment on extrapolated data, you may reduce the confidence level to low, noting that further ground-truthing is required to improve this.

Example 5:

Extent	*Intensity*	*Duration*	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**	**– ve**	High

Step 6 – Identify and describe practical **mitigation** and **optimisation** measures that can be implemented effectively to reduce or enhance the significance of the impact. Mitigation and optimisation measures must be described as either:

- **Essential**: best practice measures which must be implemented and are non-negotiable; and.
- **Best Practice**: recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Essential mitigation and optimisation measures must be inserted into the completed impact assessment table. The impact should be re-assessed with mitigation, by following Steps 1-5 again to demonstrate how the extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures. *Best practice* measures must also be inserted into the impact assessment table, but not considered in the "with mitigation" impact significance rating.

Example 6: A completed impact assessment table

	Extent	*Intensity*	*Duration*	*Conseq.*	*Prob.*	*Signif*	*Status*	*Confid*
Without mitigation	Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**	**– ve**	High
Essential mitigation measures: • Xxx1 • Xxx2 • Xxx3 **Best practice mitigation measures:** • Yyy1 • Yyy2								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Improbable	**VERY LOW**	**– ve**	High

Step 7 – Summarise all impact significance ratings as follows in executive summary:

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Impact 1: XXXX	Medium	Improbable	**LOW**	–ve	High
With Mitigation	Low	Improbable	**VERY LOW**		High
Impact 2: XXXX	Very Low	Definite	**VERY LOW**	–ve	Medium
With Mitigation:	*Not applicable*				