FRESHWATER ASSESSMENT FOR THE PROPOSED LONGYUAN MULILO DE AAR WIND ENERGY FACILITY AT MAANHAARBERG, NORTHERN CAPE

JANUARY 2014

Prepared for:

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EXECUTIVE SUMMARY

Longyuan Mulilo De Aar Wind Power (Pty) Ltd proposes to place wind turbines on the farms Smauspoort 130 and Zwartkopjes Portion 2 of 131 near De Aar, in order to establish a 100.5 MW wind farm. The proposed development includes 67 wind turbines, a substation and control building, three temporary construction camp/laydown areas, internal access roads and an internal electricity distribution network. The site is located on the Swartkoppies and Kasarmberge mountains to the south west of De Aar. This freshwater impact assessment report is intended to inform the decision making process regarding any freshwater features on the site.

The main aquatic features within the study area are associated with the Elandsfontein tributary of the Brak River, a seasonal tributary within the Orange River System. The Elandsfontein River and its larger tributaries have well defined channels while the smaller ephemeral streams and drainage channels generally flow within wide flat valleys with poorly defined channels and little clearly associated vegetation. Small to moderate sized, shallow instream dams have been constructed within the Elandsfontein River and many of its tributaries. A wetland area exists within a steep-sided valley of a larger tributary of the Elandsfontein River as it exits the Kasarmberge in the north of the site.

Land use in the study area currently consists of primarily of livestock and game farming. Due to the arid nature of the area, the carrying capacity of the land is low and livestock numbers in general are low. The land and climate are also not conducive to the cultivation of crops and pastures. Current land and water use impacts on the ephemeral streams are thus low. Due to the seasonal to ephemeral character of these surface water systems, they are also slow to recover from any impacts such as over-grazing.

Within the study area, the habitat of the Elandsfontein River is considered to be largely modified while the tributaries area still in a largely natural condition. The riparian habitat of the streams tends to be slightly more impacted as a result of surrounding farming activities. The Elandsfontein River and its larger tributaries are considered to be of a moderate to low ecological importance and sensitivity while the minor tributaries are of a low to marginal ecological importance and sensitivity. The wetland area on the site is located within in steep sided valley and is still in a largely natural state. It is fed by two fountains, this together with the current water management practices within the plateau area, have ensured that the flow to the wetland area is still largely unimpacted.

The nature of the renewable energy projects allows them to have minimal impact on the surface water features with the correct mitigation measures. Erosion and sedimentation resulting from project activities, together with the potential for invasive alien plant growth and the possible modification of surface water runoff and water quality, may lead to additional impacts on the freshwater habitats within the study area. Most of the proposed activities for this project are outside of the identified freshwater features or along existing roads and provided the construction and operation activities of the projects remain contained within the allocated areas and any disturbed areas within the freshwater features rehabilitated, the overall impact should be limited and of a low significance.

In terms of project alternatives, the main difference between the preferred access route and the alternative is the main access to the site. The alternative route access is via a relatively steep valley where the road is located adjacent to and crosses the stream twice. This stream is seen as a large stream that is deemed to be more ecologically important than the minor streams crossed by the entry road for the preferred access route. One can therefore expect the alternative access route to have a more significant impact and thus be least preferred from an aquatic point of view.

In terms of the sensitivity of the site, the larger streams and the wetland area are deemed to be the most sensitive and should be treated as 'no-go' areas. The remainder of the site tends to consist of small drainage features that are considered to be less ecologically significant. Due to the sensitivity of the plateau area as a whole (as a recharge area for the wider Elandsfontein Catchment), it would be essential that water sources for the project should be obtained from, and sewage and solid waste or disposed of, outside of the plateau area.

Proposed mitigation measures are as follows:

- *Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facilities and the identified access routes. No turbine (including its area of disturbance) should be located within 100m of drainage lines within the Elandsfontein River (measured from the centre of the channel). The small wetland area in the centre of the site as well as the larger stream channels should be considered as 'no-go' portions of the site. It is important that any of the cleared areas are rehabilitated after construction is completed.*

- *Existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded.*

- *Road infrastructure and transmission lines should coincide as much as possible to minimize the road network and impact of these activities. Where new access routes need to be constructed through the drainage channels, disturbance of the channels should be limited and the crossing should preferably be perpendicular to the channel. Transmission lines and roads created parallel to the channels should be located at least 20m away from the stream channel. Any disturbed areas within the stream or drainage channels should be rehabilitated*

- *Temporary roads created during the construction phase should also comply with the requisite 20m buffer and be rehabilitated once construction activities are complete.*

- *Monopoles for transmission lines should be placed outside of the recommended buffer for the streams/drainage lines (20m). After construction is complete and the areas monitored for growth of invasive alien plants.*

- *With regards to the proposed substation, consider either to divert the drainage channel(s) that currently pass through the site around the proposed substation and/or to do some minor adjustment to the location of the facility. Ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete.*

- *Activities at the construction camps should as far as possible be limited to the identified footprint for construction camp sites. Cleared areas are rehabilitated after construction is completed. Ensure that on-site storm water management at the construction camps should be such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete. Monitoring of these sites post-construction will need to take place to ensure that they have been adequately rehabilitated and do not provide opportunity of growth of invasive alien plants.*

- *Water for the construction phase of the project should be obtained for sources outside of the plateau areas. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the drainage lines/ephemeral streams and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Programme for the construction phase.*

- *Operational activities should as far as possible be limited to the wind turbine sites, the substation/control building and the identified access routes. Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants. Any storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities sites. Should any erosion features develop, they should be stabilised as soon as possible. Water sources for the operational phase of the project should be obtained from, and sewage and solid waste or disposed of, outside of the plateau areas for the operation phase.*

A water use authorization application may need to be submitted to the Department of Water Affairs Free State Regional Office for approval of the water use aspects of the proposed activities. It is likely that the proposed activity can be authorised by means of the General Authorisation.

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1. BACKGROUND

Longyuan Mulilo De Aar Wind Power (Pty) Ltd proposes to place wind turbines on the farms Smauspoort 130 and Zwartkopjes Portion 2 of 131 near De Aar, in order to establish a 100.5 MW wind farm. The proposed development includes 67 wind turbines, a substation and control building, four temporary construction camp/laydown areas, internal access roads and the internal distribution network. The site is located on the Swartkoppies and Kasarmberge mountains to the south west of De Aar (Figure 1). The site is drained by the Elandsfontein River and some of its tributaries. The Elandsfontein River is a tributary in the middle reaches of the Orange River system. This freshwater impact assessment report is thus intended to inform the decision making process regarding any freshwater features on the site.

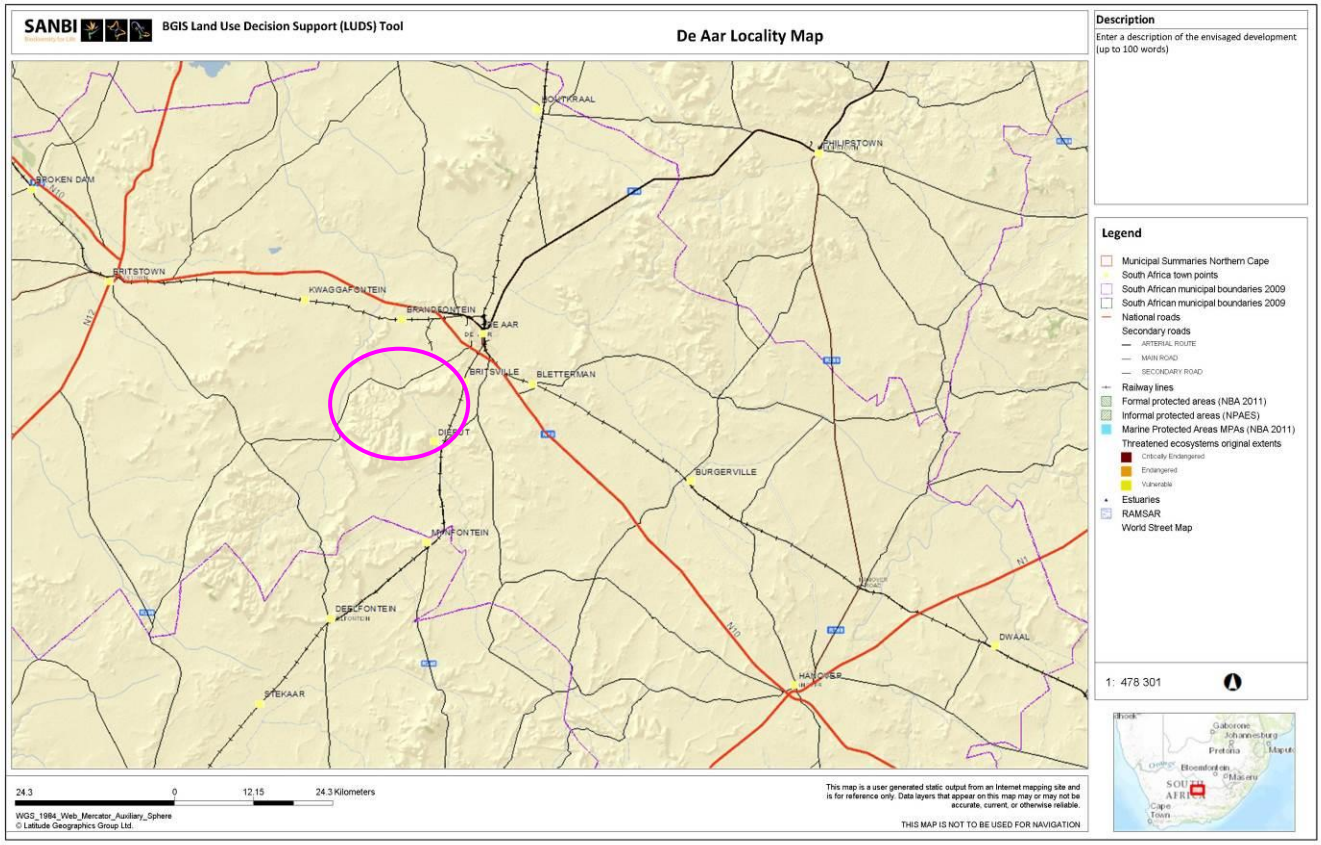


Figure 1. Locality map of the proposed wind energy facilities site (SANBI Biodiversity GIS, 2014)

2. TERMS OF REFERENCE

The agreed upon scope of work for the freshwater impact assessment is as follows:

Task 1.1: Literature Review and initialisation

Task 1.2: Site Assessments of freshwater systems on the site

Task 1.3: Freshwater assessments and refinement of impact assessment based on layout plans and infrastructure designs. The impact of the proposed development on the freshwater features and recommended mitigation measures will be included in the report.

Task 1.4: Review of reports and integration into EMP and EA processes, liaison with client; and

Task 1.5: Liaison with DWA to determine the needs for water use authorisation.

3. APPROACH TO THE STUDY, STUDY LIMITATIONS AND ASSUMPTIONS

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and catchment, as well as by a more detailed assessment of the freshwater features at the proposed site. Aquatic Ecosystem Health assessments were carried out to provide information on the ecological condition and ecological importance and sensitivity of the river and wetland systems within the study area. The river health and wetland health assessments were carried out using South African Department of Water Affairs developed methodologies.

The site was visited in December 2012 and again in January 2014. During the second field visit, the characterisation, mapping and integrity assessments of the freshwater features were undertaken. This information/data was used to inform the potential impact of the proposed activities as well as the recommended mitigation measures.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. Analysis of the freshwater ecosystems was undertaken according to nationally developed methodologies and was undertaken at a rapid level which was considered a suitable level of evaluation for this freshwater impact assessment.

4. USE OF THIS REPORT

This report reflects the professional judgment of its authors. The full and unedited content of this should be presented to the client. Any summary of these findings should only be produced in consultation with the authors.

5. OVERVIEW OF THE PROPOSAL AND STUDY AREA

5.1. OVERVIEW OF THE STUDY AREA

The study area is located approximately 6 km south of De Aar in the Northern Cape Province, within the boundaries of the Emthanjeni Local Municipality. The broader landscape consists of predominantly flat-topped hills, interspersed with drainage lines and small streams (Figure 2). The main water feature in the area is the Elandsfontein River and some of its smaller tributaries, within the Orange River System. Most of the land surrounding De Aar is undeveloped and only utilised for grazing of sheep, cattle, goats or game.

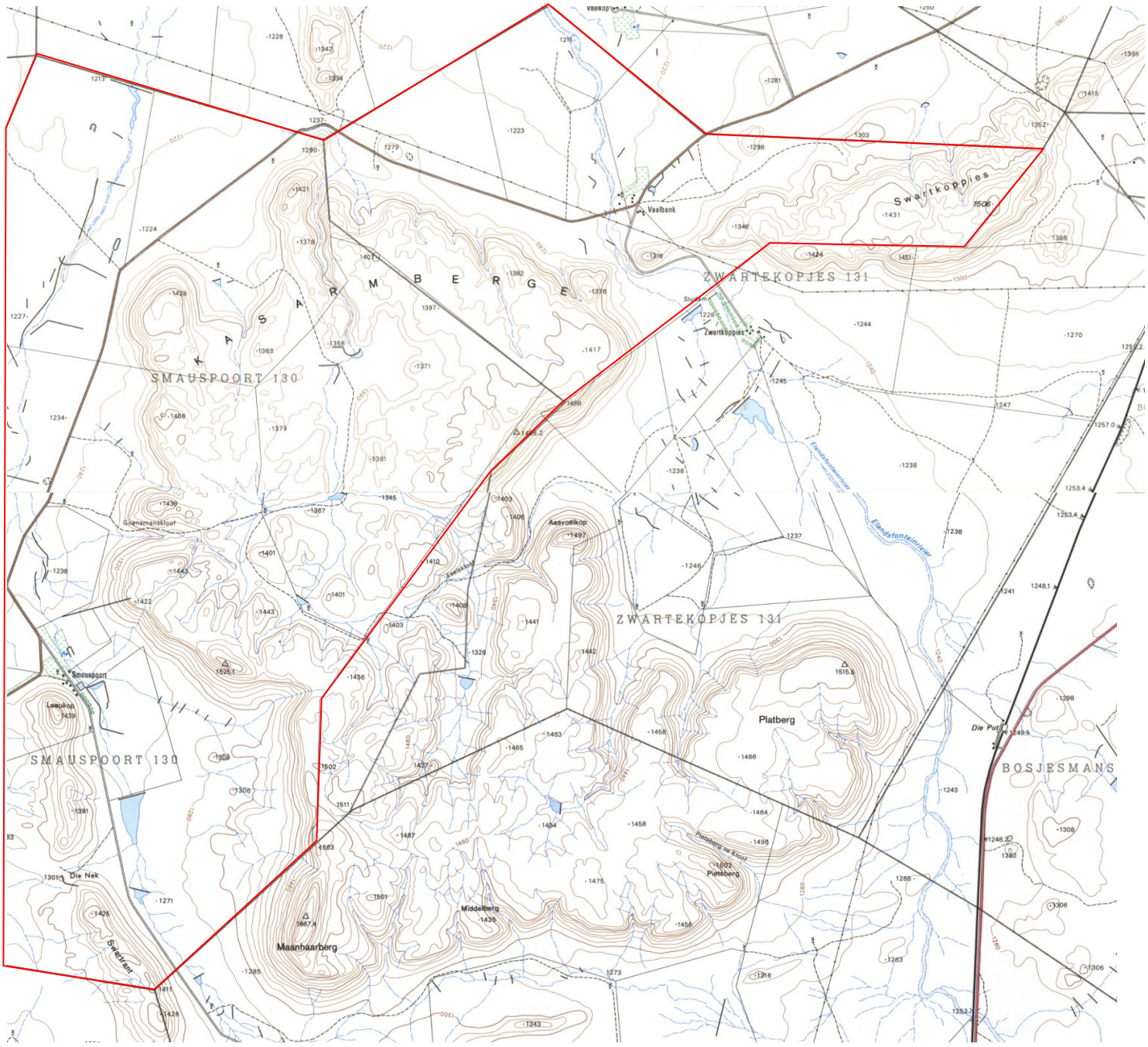


Figure 2. Topographical map (3023DB and 3023DD) for the site

5.2. ACTIVITY DESCRIPTION

The proposed De Aar wind farm consists of 67 turbines (Figure 3), each with a generation capacity of 1.5 MW. The total wind farm footprint (67 ha) is spread over an area of 11 766 hectares (ha) accounting for 0.6% of the total area, with the required spacing between turbines of 200 to 600 metres, depending on terrain topography and main wind direction. The turbines are mounted on cylindrical steel towers 80 meters high and 4 meters in diameter at the base. Each turbine rotor has three blades, each 40 meters long and manufactured from a composite material. Foundations to support turbine towers will consist of circular concrete foundations with a diameter of 16 m (201 m^2) per turbine. Hard standing areas to support cranes will be 50 x 50 m per turbine.

Internal 33kV overhead transmission lines will need to be constructed that would connect the turbines to the onsite substation. Internal transmission lines would follow the route of the access roads as far as possible. The area required for the onsite substation / control building will be 100 x 200 m in extent. This area includes a temporary construction yard that will be used to house equipment and materials related to the construction of the on-site substation and control building. The wind turbines will generate electricity at a voltage of 33 kV which will stepped up with a transformer to 132kV which will lead over a 22km distance to Hydra substation where the electricity will be fed into the national grid.

To provide access to the site, existing gravel roads will be upgraded and will have a width of less than 4 metres. Access roads will be constructed in advance of any components being delivered to site and will remain in place after completion for access. Existing roads to the site will be utilised where possible and will be upgraded where required. Temporary construction roads may be required that would consist of either a cleared strip (i.e. subsoil stripped of topsoil) or two track on top of vegetation and topsoil. Temporary turning circles of approximately 15m would also need to be established where hardstands / platforms cannot be used for turning of large construction vehicles and at sharp corners.

Apart from the gravel access road, no services are required for the operation of the wind turbines. The turbines operate automatically and no on-site personnel are required. Portable toilets will be used across the site during the construction phase and waste will be collected at regular intervals and transported to the Municipal Waste Water Treatment Works. One or two 5,000ℓ header tanks will be used to provide potable water as required. Storm water control measures would likely be limited to occasional cross drain / berms. On longer sections of road, additional storm water control measures may be required and these will be designed together with the road.

Three temporary construction yards (400 x 200 m) would be required. Two construction yards would be located close to the main access gates and the third construction yard would be located on the plateau. For the operational phase there would be basic operation and maintenance buildings including a storage facility will be constructed on site, adjacent to the substation. No municipal services would be required for the control building. During this phase the site will remain available to the farmers as grazing or retained as wilderness area.

The construction phase is anticipated to last 20 months while the estimated life of the project after construction is 20 years.

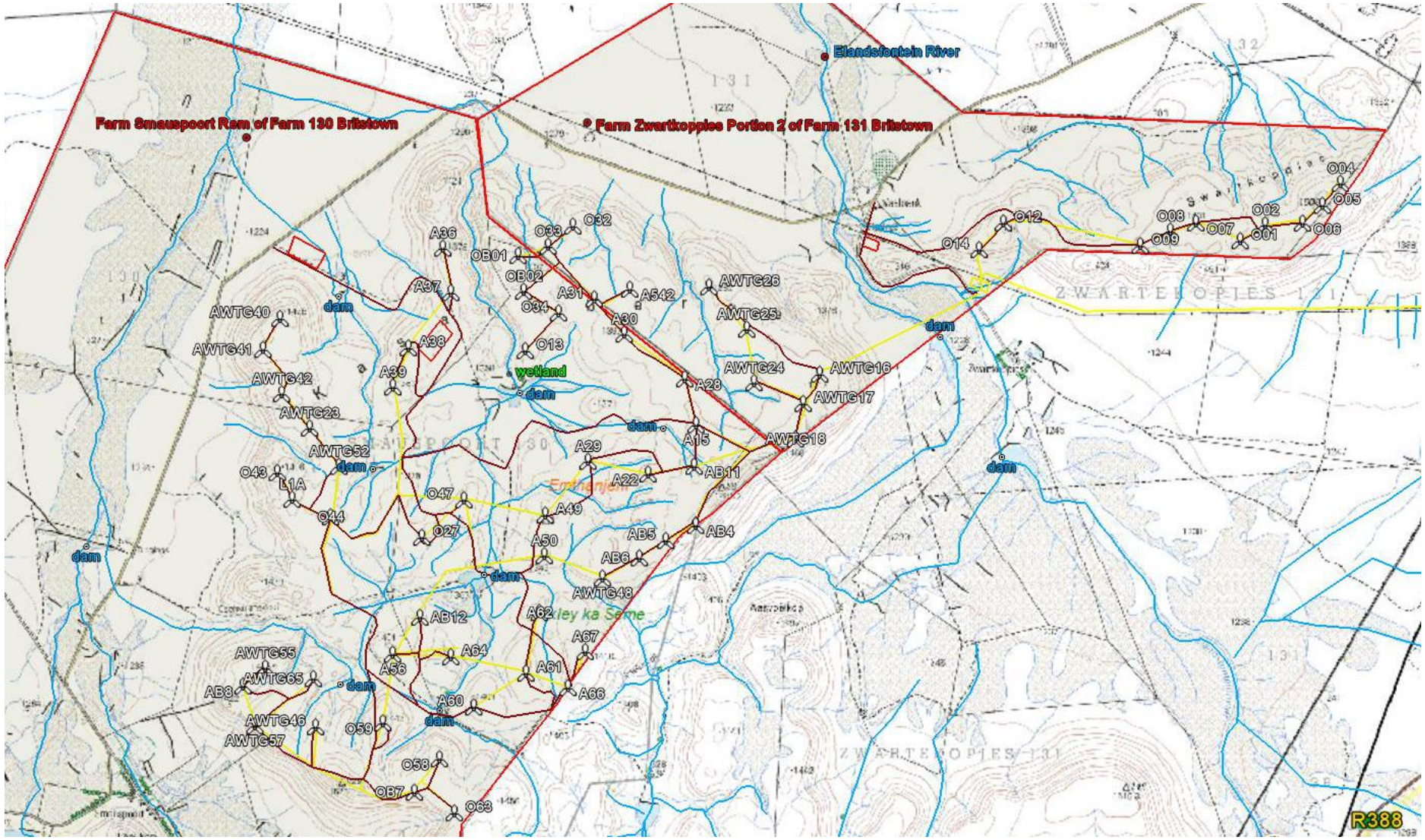


Figure 3. Proposed Layout plan for De Aar 1, where the maroon lines depict the road network and the yellow lines the electricity network, wind turbines are represented by the diamond shaped symbols

5.3. LEGAL REQUIREMENTS

The following Acts, regulations and ordinances are applicable to the development:

5.3.1. THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

Chapter Seven of the NEMA states that:

"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".

The Act also clearly states that the landowner, or the person using or controlling the land, is responsible for taking measures to control and rectify any degradation. These may include measures to:

"(a) investigate, assess and evaluate the impact on the environment;

(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment:

(c) cease, modify or control any act, activity or process causing the pollution or degradation:

(d) contain or prevent the movement of pollutants or degradation: or

(e) eliminate any source of pollution or degradation: or

(f) remedy the effects of the pollution or degradation."

NEMA BASIC ASSESSMENT REGULATIONS, GN R543 OF 2010

Activities listed in terms of Chapter 5 of NEMA in Government Notice No. R. 544, 5 and 6 trigger a mandatory Basic Assessment, or even a full scoping EIA process, prior to development.

The National Environmental Management Second Amendment Act (Act No.8 of 2004) provided for formal procedures for offenders in terms of Section 24G to apply for rectification of the unlawful commencement of listed activities.

Due to the fact that many of the activities, and in particular the access roads, will need to be constructed within 32m of watercourse within the proposed development site, the need for a Basic Assessment is triggered.

5.3.2. NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The purpose of the National Water Act is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorisation and register as users. The National Water Act also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources.

REGULATIONS REQUIRING THAT A WATER USER BE REGISTERED, GN R.1352 (1999)

Regulations requiring the registration of water users were promulgated by the Minister of the Department of Water Affairs (DWA) in terms of provision made in section 26(1)(c), read together with section 69 of the National Water Act, 1998. Section 26(1)(c) of the Act allows for registration of all water uses including existing lawful water use in terms of section 34(2). Section 29(1)(b)(vi) also states that in the case of a general authorisation, the responsible authority may attach a condition requiring the registration of such water use. The Regulations (Art. 3) oblige any water user as defined under section 21 of the Act to register such use with the responsible authority and effectively to apply for a Registration Certificate as contemplated under Art.7(1) of the Regulations.

GENERAL AUTHORISATION IN TERMS OF S. 39 OF THE NATIONAL WATER ACT, GN R 1199 OF 2009

Government Notice R1199 was issued as a revision of the General Authorisations (No. 1191 of 1999) for Section 21 (c) and (i) water uses as defined under the National Water Act (Act 36 of 1998). The revision was published and came into effect on 2009/12/18. According to the preamble to Part 6 of the National Water Act, "*This Part establishes a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette...*"

"The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary…"

The all of the freshwater features identified within the site that may be impacted on by the proposed activities consist of minor ephemeral streams and drainage lines. The authorisation of water use activities for Sections 21 (c) - change to the bed, banks and characteristics of a water course and 21 (i)- impeding and diverting the flow, will however need to be applied for. It is likely that the proposed activities such as the access road crossings will fall within the listed activities that can be Generally Authorised at the Free State Regional Office of the Department of Water Affairs, however an application for authorisation of the proposed activities will need to be submitted to them for confirmation that this is the case.

6. AQUATIC SYSTEMS IN THE STUDY AREA

6.1. DESCRIPTION OF THE STUDY SITE

6.1.1. PHYSICAL CHARACTERISTICS

The proposed project is located approximately 6km south of the town of De Aar and extends for approximately 25 km to the south-west of the town. De Aar was established in 1903 and derives its name refers from the water-bearing arteries that occur underground. The surrounding area is characterised by wide open plains and low hills, with sparse settlements and predominately wide open spaces. The vegetated cover consists largely of sparse dwarf karroid scrub and tufted grass with bare patches of sand.

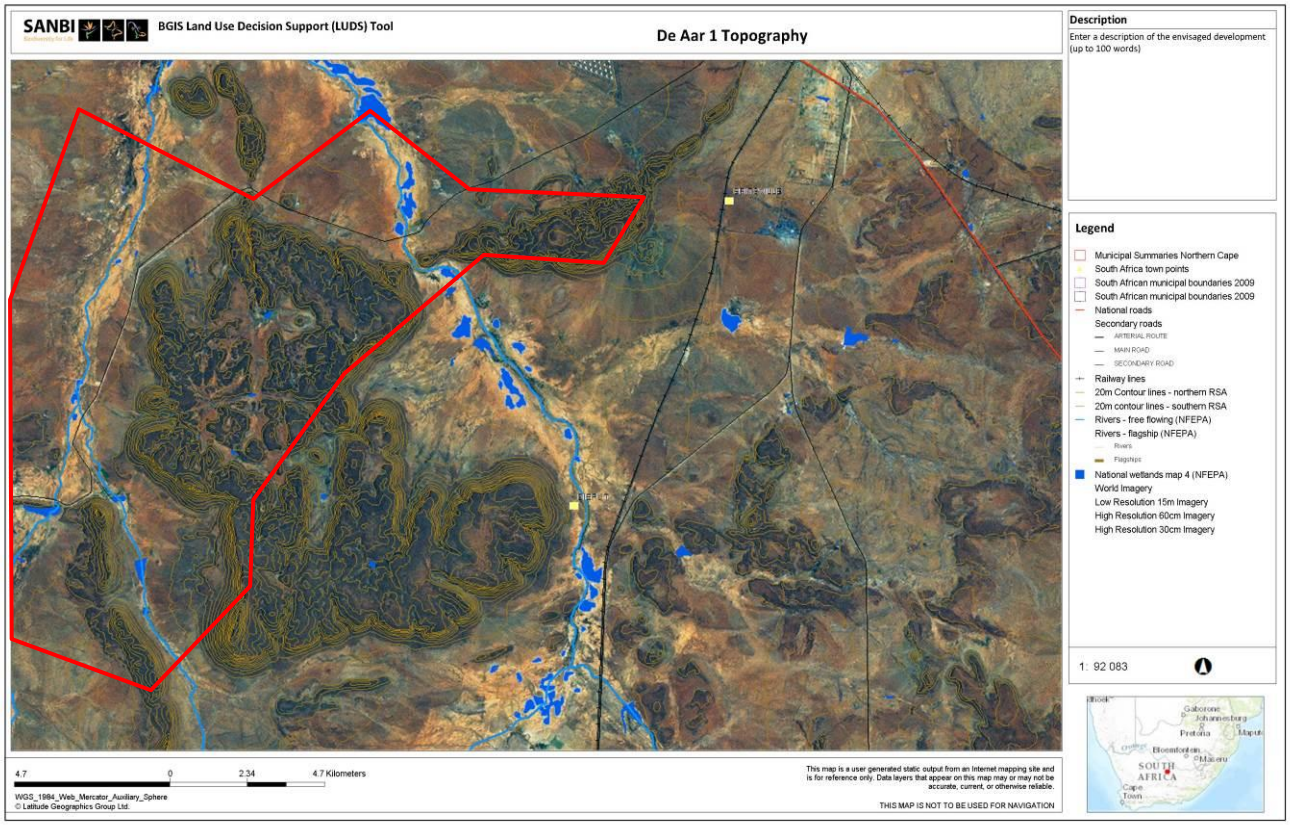


Figure 4. A satellite image of the proposed site showing the topography and freshwater features (SANBI Biodiversity GIS, 2014)

6.1.2. CLIMATE

De Aar normally receives about 196mm of rain per year, mostly during autumn. The lowest rainfall (1mm) usually occurs in August and the highest (45mm) in March. The average midday temperatures for De Aar range from 16°C in June to 30.3°C in January. The region is the coldest during July when the mercury drops to 0.3°C on average during the night.

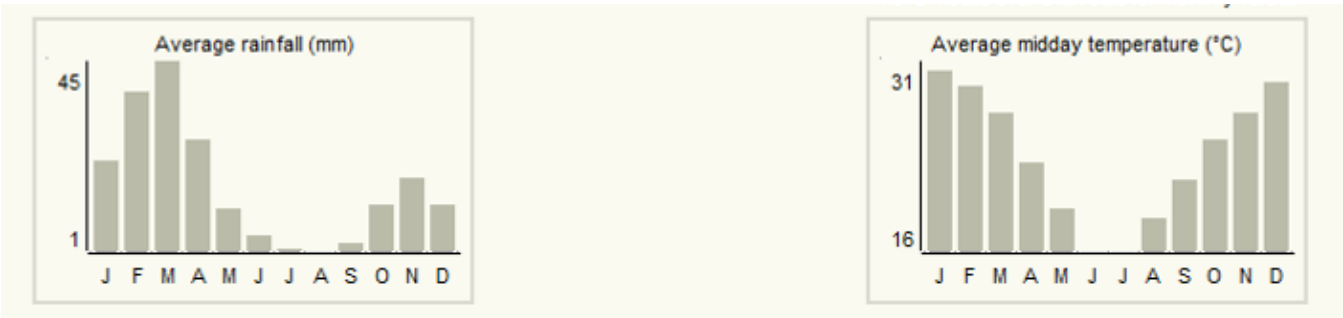


Figure 5. Average monthly rainfall for the area (SA Explorer, 2008)

6.1.3. GEOLOGY AND SOIL

The geology of the study area can be described as being underlain by flat-lying sedimentary rocks of the Karoo Supergroup, which have been intruded by innumerable sills and dykes of dolerite. The overlying soils for much of the area surrounding De Aar are primarily red soils of a restricted soil depth, excessive drainage, high erodibility and low fertility. The higher lying areas consist of shallow soils overlying rock. These areas are water recharge areas. Along the Elandsfontein River channel the soils have a marked clay accumulation.

6.1.4. FLORA

The study area lies near the eastern edge of the Nama Karoo biome, and is mapped according to the national vegetation types (2006) as being predominantly of the vegetation type Northern Upper Karoo (NKu3 - Pink areas in Figure 6) for the lower lying areas, while the higher lying areas of the Swartkoppies and Kasarmberge are covered by Upper Karoo Hardeveld (NKu2 - Darker brown areas in Figure 6). Both vegetation types are considered to be least threatened. At the foot of the higher lying areas, Eastern Upper Karoo (NKu4 – dusky pink areas in Figure 6) occurs (Least Threatened).

The vegetation cover is generally dominated by sparse dwarf karroid scrub and tufted grass with bare patches of sand in between. The lower lying areas tend to be in a disturbed condition, mostly as a result of livestock grazing. There is however little presence of invasive alien plants. Along the smaller tributaries and streams of the Elandsfontein River system within the site there is very little to no discernible riparian vegetation.

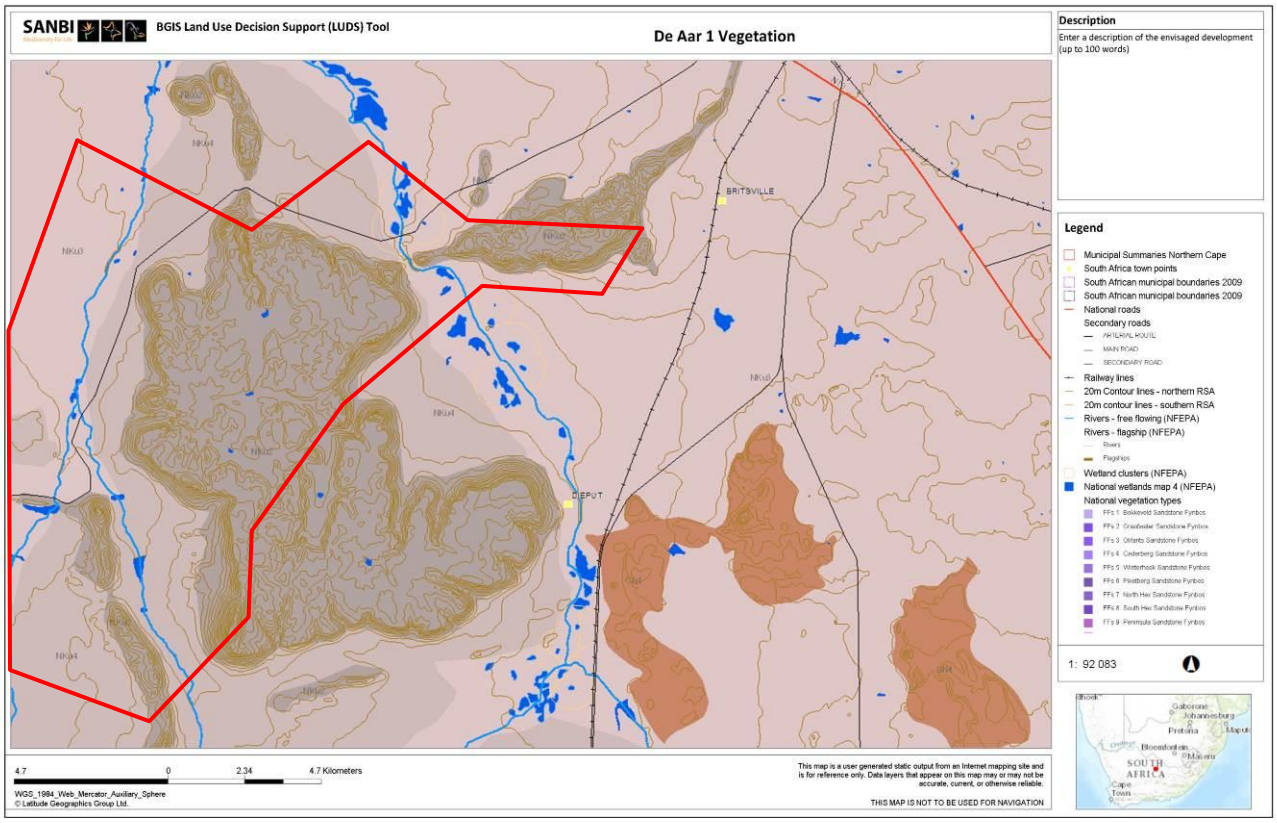


Figure 6. Vegetation map for the area (SANBI Biodiversity GIS, 2014)

6.1.5. AQUATIC FEATURES AND FAUNA

The main aquatic features within the study area are associated with the Elandsfontein tributary of the Brak River (Figure 7), a seasonal tributary within the Orange River System that joins the Orange River east of Prieska.

Figure 7. Elandsfontein River on the Farm Zwartekopjes

The larger tributaries of the Elandsfontein River have well defined channels (Figure 8) while the smaller ephemeral streams and drainage channels generally flow within wide flat valleys with poorly defined channels (Figure 9). Most of the smaller tributaries have little clear associated vegetation.

Figure 8. Larger tributary of the Elandsfontein River that drains the higher lying areas of the Farm Smauspoort

Figure 9. Characteristic minor drainage channel/tributary of the Elandsfontein River on the Farm Smauspoort

Small to moderate sized, shallow instream dams have been constructed within many of the Elandsfontein River drainage channels (Figure 10). A wetland area (Figure 11) exists within a steep-sided valley of a larger tributary of the Elandsfontein River as it exits the Kasarmberge in the north of the site. The wetland is fed by two fountains at the entrance to the valley and is dominated by the common reed *Phragmites australis* but also contains a number of sedges (Cyperaceae) species such as *Scirpoides dioecus* within its marginal zone.

Figure 10. Small dam within a tributary of the Elandsfontein River

Figure 11. Wetland area within a tributary of the Elandsfontein River

6.1.6. LAND USE

Much of the study area is undeveloped and utilised mainly for dryland agriculture (Figure 12) and consists of some homesteads with the veld being used for grazing of sheep and cattle as well as game. The closest urban area is De Aar, with the township of Nonzwakazi located east of the town. Smaller towns of Britstown, Philipstown, Hanover and Richmond occur within a 65km radius of De Aar.

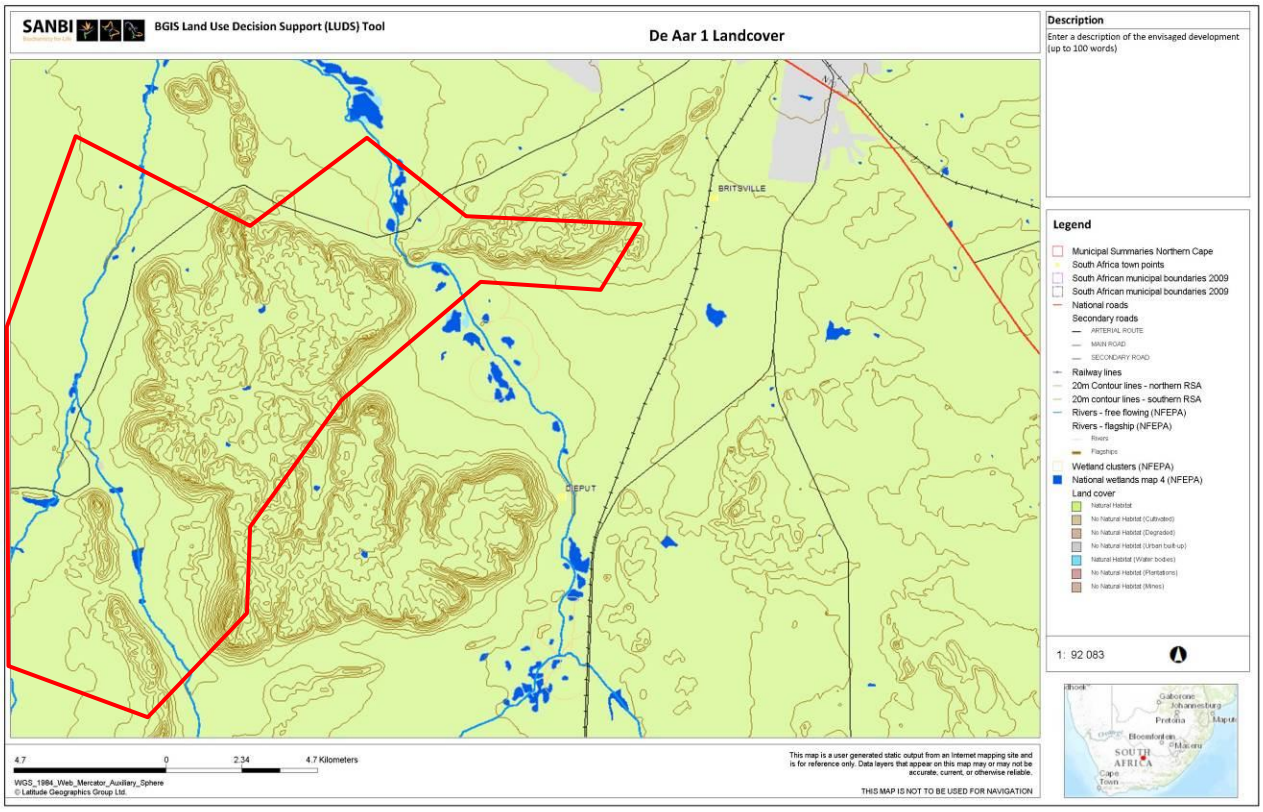


Figure 12. Land cover map for the area (SANBI Biodiversity GIS, 2014)

6.1.7. FRESHWATER BIODIVERSITY AND CONSERVATION

Figure 13 is the Freshwater Ecosystem Protected Areas (FEPA) map for the study area. FEPAs are strategic spatial priorities for conserving freshwater ecosystems and associated biodiversity. FEPAs were determined through a process of systematic biodiversity planning and were identified using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries.

The tributaries of the Elandsfontein River within the study area (pale green areas in Figure 13) have been identified as upstream catchments to the Brak River, which has certain reaches mapped as a FEPA river (darker green areas in Figure 13). In upstream catchments it is important that the rivers be managed in such a manner to ensure no degradation occurs in the downstream FEPA river.

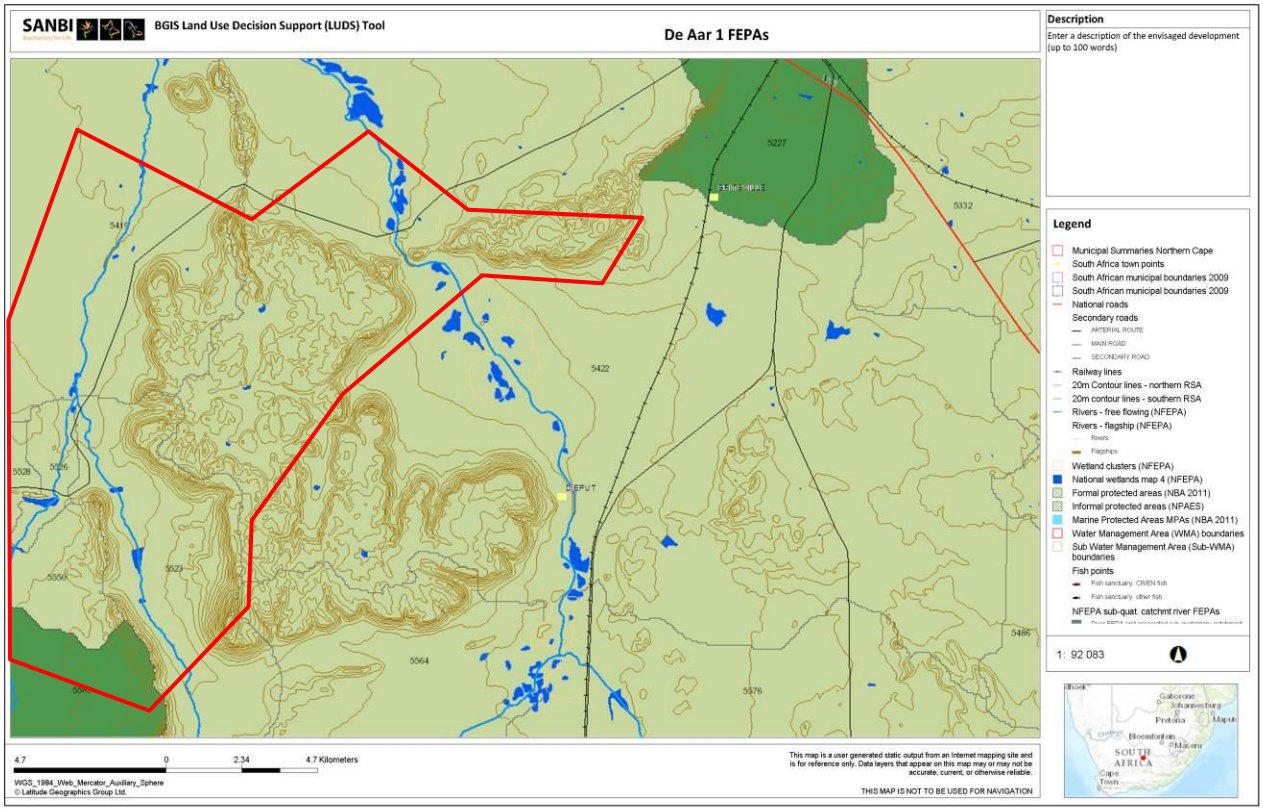


Figure 13. Freshwater Ecosystem Priority Areas for the study area (SANBI Biodiversity GIS, 2014)

6.2. FRESHWATER ASSESSMENT OF THE STUDY AREA

6.2.1 RIVER ASSESSMENT

The Index for Habitat Integrity (IHI) and a Site Characterisation were used to provide information on the ecological condition of the Elandsfontein River and its smaller tributaries within the study area (Figure 14).

A. RIVER CLASSIFICATION

In order to assess the condition and ecological importance and sensitivity of the rivers in the study area, it is necessary to understand how the rivers might have appeared under unimpacted conditions. This is achieved through classifying rivers according to their ecological characteristics, in order that it can be compared to ecologically similar rivers.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river condition should only be done between rivers that share similar physical and biological characteristics under natural conditions.

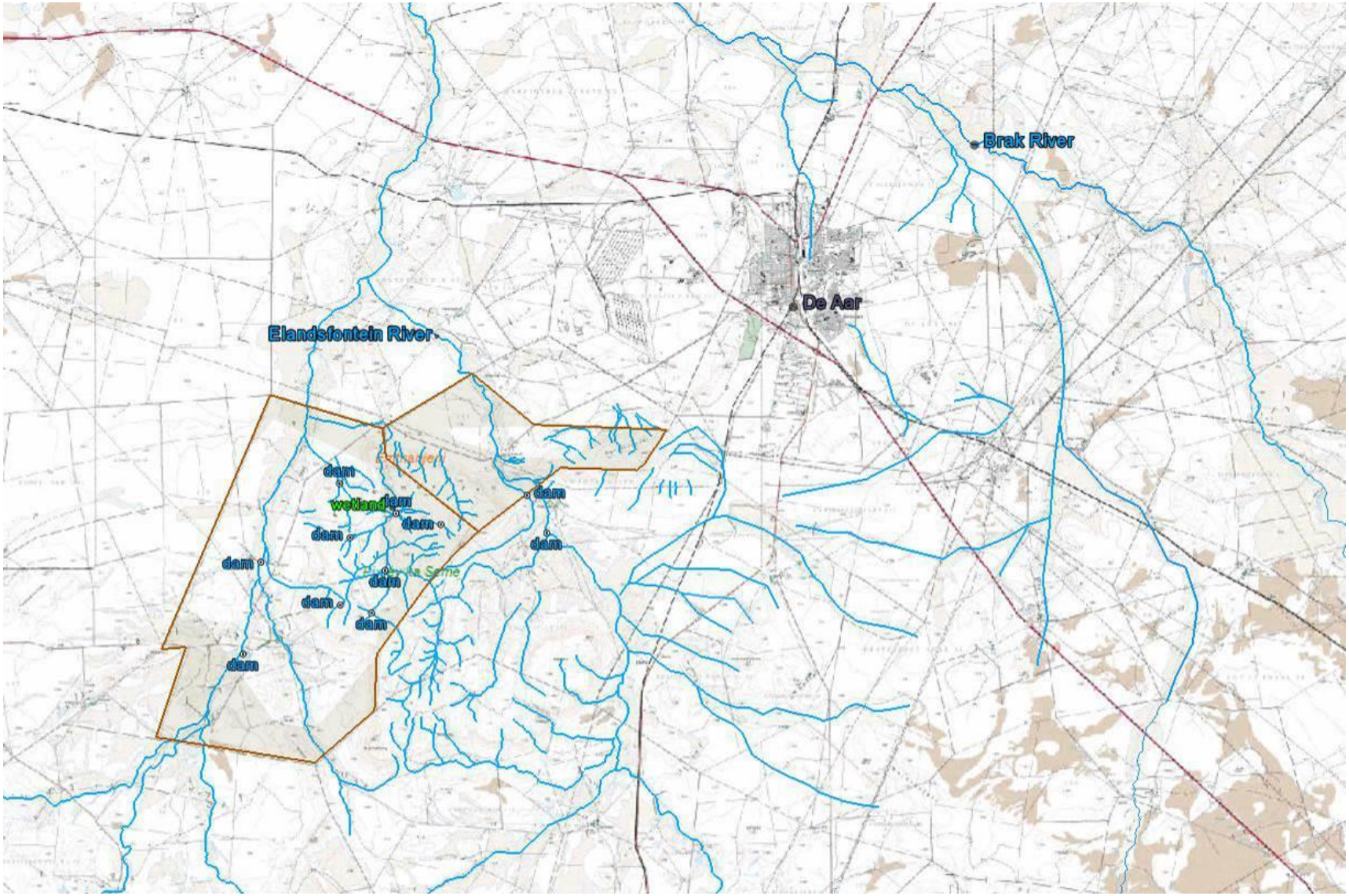


Figure 14. Water features in the study area

Thus, the classification of rivers provides the basis for assessing river condition to allow comparison between similar river types. The primary classification of rivers is a division into Ecoregions. Rivers within an ecoregion are further divided into sub-regions.

Ecoregions are groups of rivers within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation. For the purposes of this study, the ecoregional classification presented in Department of Water Affairs and Forestry in 1999, which divides the country's rivers into ecoregions, was used. The river assessed lies within the Nama Karoo Ecoregion, with the characteristics as described in Table 1.

Sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that these are a major factor in the determination of the distribution of the biota. Table 2 provides the geomorphological features of the streams assessed.

Table 1. Characteristics of the Nama Karoo Ecoregion (Dominant Types In Bold)

Main Attributes	Description
Terrain Morphology: Broad division	Plains; Low Relief**; Plains Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief;** Open Hills, Lowlands; Mountains; Moderate to High Relief; Closed Hills; Mountains; Moderate and High Relief
Vegetation types	Eastern Mixed Nama Karoo; Upper Nama Karoo; **Bushmanland Nama Karoo;** Orange River Nama Karoo
Altitude (m a.m.s.l)	300-1700
MAP (mm)	0 to 500
Rainfall seasonality	Late to very late summer to Winter
Mean annual temp. (°C)	12 to 20
Median annual simulated runoff (mm) for quaternary catchment	<5 to 60

B. RIVER/SITE CHARACTERISATION

The Elandsfontein River tributaries have predominantly a rocky substrate in their upper reaches becoming sandy in the lower reaches. The rivers drain shrubland vegetation in an area with a very low rainfall. As a result, the water flowing in these rivers are in general saline, turbid and seasonally to ephemerally flowing.

From the Site Characterisation assessments, the geomorphological and physical characteristics of the tributaries can be classified as shown in Table 2.

Table 2. Geomorphological and Physical features of the Elandsfontein and its smaller tributaries within the study area

River	Elandsfontein Tributary	Minor ephemeral Tributaries
Farm	Zwartekopjes	Smauspoort
Geomorphological Zone	Upper and lower foothill and floodplain	Source zone, Upper and Lower foothill
Lateral mobility	Unconfined	Semi-Confined to unconfined

Soils	Shallow soils over rock in higher lying areas, clayey soils along river within floodplain	Shallow soils
Channel form	Simple and complex in places	
Channel pattern	Single and multiple thread: low sinuosity	
Channel type	Mixed (alluvium dominating in the floodplain)	Alluvium with pebbles/gravel
Channel modification	Low modification increasing in lower reaches (farming and instream dams within the floodplain)	Low modification
Hydrological type	Seasonal	Ephemeral
Ecoregion	Nama Karoo	
DWA catchment	D62C	
Vegetation type	Northern Upper Karoo shrubland	Upper Karoo Hardeveld in upper reaches becoming Eastern and Northern Upper Karoo shrubland in lower reaches
Rainfall region	Autumn	

C. INDEX OF HABITAT INTEGRITY

The evaluation of Index of Habitat Integrity (IHI) provides a measure of the degree to which a river has been modified from its natural state. This assessment was undertaken for the tributaries of the Elandsfontein River within the study area (Tables 3 and 4). The methodology (DWAF, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of degradation of a river. The severity of each impact is ranked using a six-point scale with 0 (no impact), 1 to 5 (small impact), 6 to 10 (moderate impact), 11 to 15 (large impact), 16 to 20 (serious impact) and 21 to 25 (critical impact).

The IHI assessment is based on an evaluation of the impacts of two components of the rivers, the riparian zone and the instream habitat. Assessments are made separately for both components, but data for the riparian zone are interpreted primarily in terms of the potential impact on the instream component.

The estimated impact of each criterion is calculated as follows:

Rating for the criterion/maximum value (25) x weight (percent)

The estimated impacts of all criteria calculated in this way are summed, expressed as a percentage and subtracted from 100 to arrive at an assessment of habitat integrity for the instream and riparian components respectively. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category.

The Elandsfontein River within the study area consists of a wide braided floodplain with a number of in channel farm dams. The river has a number of tributaries, both larger ephemeral streams and smaller drainage lines that drain the higher lying Swartkoppies and Kasarmberge. A distinct riparian zone was not discernible within the river system. The results from the habitat integrity assessment for the river and its tributaries are shown in Tables 3 and 4.

Table 3. Index of Habitat Integrity Assessment results and criteria assessed in the Elandsfontein River and its tributaries within the study area: Instream Habitat

Instream Criteria	Weight	Elandsfontein River	Larger Tributaries	Minor tributaries
Water abstraction	14	12	6	2
Flow modification	13	15	7	3
Bed modification	13	11	6	4
Channel modification	13	6	4	3
Water quality	14	5	3	2
Inundation	10	14	5	3
Exotic macrophytes	9	0	0	0
Exotic fauna	8	2	1	0
Solid waste disposal	6	3	1	0
Category		**D**	**B**	**A/B**

Table 4. Index of Habitat Integrity Assessment results and criteria assessed in the Elandsfontein River and its tributaries within the study area: Riparian Habitat

Riparian Criteria	Weight	Elandsfontein River	Larger Tributaries	Minor tributaries
Water abstraction	13	12	6	2
Inundation	11	14	5	3
Flow modification	12	15	7	3
Water quality	13	5	3	2
Indigenous vegetation removal	13	5	2	3
Exotic vegetation encroachment	12	3	2	2
Bank erosion	14	8	2	5
Channel modification	12	6	4	3
Category		**D**	**B**	**B**

Within the study area, the habitat of the Elandsfontein River is considered to be largely modified while the tributaries area still in a largely natural condition. The riparian habitat is slightly more impacted as a result of surrounding farming activities.

D. ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The EIS (Table 5) assessment considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (Table 7). The median of the resultant score is calculated to derive the EIS category (Table 8).

Table 5. Results of the EIS assessment for the Elandsfontein River and its tributaries within the study area

Biotic Determinants	Elandsfontein River	Larger Tributaries	Minor tributaries
Rare and endangered biota	0	0	0
Unique biota	0	0	0
Intolerant biota	0	1	0
Species/taxon richness	1	1	1
Aquatic Habitat Determinants			
Diversity of aquatic habitat types or features	2	2	1
Refuge value of habitat type	2	2	1
Sensitivity of habitat to flow changes	2	3	2
Sensitivity of flow related water quality changes	2	3	2
Migration route/corridor for instream and riparian biota	2	2	2
National parks, wilderness areas, Nature Reserves, Natural Heritage sites, Natural areas, PNEs	0	0	0
RATINGS	0.9	1.4	0.7
EIS CATEGORY	**Low**	**Moderate**	**Low**

Table 6. Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Table 7. Definition of the four-point scale used to assess biotic and habitat determinants presumed to indicate either importance or sensitivity

Four point scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

The Elandsfontein River and its larger tributaries are considered to be of a moderate to low ecological importance and sensitivity while the minor tributaries are of a low or even marginal ecological importance and sensitivity.

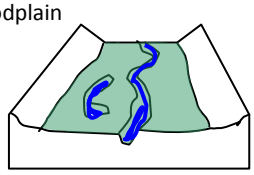
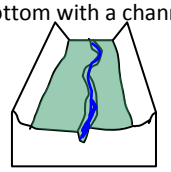
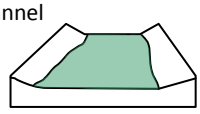
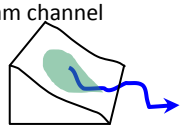
6.2.2 WETLAND ASSESSMENT

This section contains an assessment of the wetland area identified on site based on existing information as well as the field assessment. The wetland assessment consists of the following aspects: Wetland classification; Wetland integrity; and Ecosystem services supplied by the wetland.

A. WETLAND CLASSIFICATION

The classification of the wetlands in the study area into different wetland types was based on the WET-EcoServices technique (Kotze *et al*, 2005). The WET-EcoServices technique identifies seven main types of wetland based on hydro-geomorphic characteristics (Table 8).

Table 8. Wetland hydro-geomorphic types typically supporting inland wetlands in South Africa

Hydro-geomorphic types	Description	Source of water maintaining the wetland[1]	
		Surface	Sub-surface
Floodplain 	Valley bottom areas with a well-defined stream channel, gently sloped & characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel 	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hillslope seepage 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans) 	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important

Water source:	*	Contribution usually small
	***	Contribution usually large
	*/ ***	Contribution may be small or important depending on the local circumstances
		Wetland

According to Table 8 the wetland features within the study area can be classified as follows:

Table 9: Classification of wetland areas within study area

Name	Wetland features associated with a larger tributary of the Elandsfontein River in the northern portion of the study area
System	Inland
Ecoregion	Nama Karoo
Landscape setting	Valley floor
Longitudinal zonation	Channelled valley-bottom wetland – source zone
Drainage	Surface and sub-surface water contributions
Seasonality	Seasonal with possibly some permanent features at fountains
Anthropogenic influence	Largely natural
Geology	Recent alluvium deposits overlying sedimentary rock
Vegetation	Upper Karoo Hardeveld
Substrate	Shallow Alluvial Sand
Salinity	Fresh

B. WETLAND INTEGRITY

The Present Ecological Status (PES) Method (DWAF 2005) was used to establish the integrity of the wetlands in the study area and was based on the modified Habitat Integrity approach developed by Kleynhans (DWAF, 1999; Dickens *et al*, 2003). Tables 10 and 11 shows the criteria and results from the assessment of the habitat integrity of the wetlands. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 10. Habitat integrity assessment criteria for palustrine wetlands (Dickens *et al*, 2003)

Criteria & Attributes	Relevance
Hydrologic	
Flow Modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floralistic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water Quality	
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Hydraulic/Geomorphic	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities that reduce or change wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.

Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, etc.

The wetland area on the site is located within in steep sided valley and is still in a largely natural state. It is fed by two fountains, this together with the current water management practices within the plateau area have ensured that the flow to the wetland area is still largely unimpacted (Table 4).

Table 11. Wetland habitat integrity assessment (score of 0=critically modified to 5=unmodified)

Criteria & Attributes	Wetland score
Hydrologic	
Flow Modification	3.0
Permanent Inundation	3.0
Water Quality	
Water Quality Modification	4.0
Sediment Load Modification	4.0
Hydraulic/Geomorphic	
Canalisation	4.5
Topographic Alteration	4.5
Biota	
Terrestrial Encroachment	4.5
Indigenous Vegetation Removal	4.0
Invasive Plant Encroachment	4.0
Alien Fauna	4.5
Over utilisation of Biota	4.5
Total Mean	**4.0**
Category	**Largely natural**

Table 12. Relation between scores given and ecological categories

Scoring Guidelines Per Attribute*	Interpretation of Mean* of Scores for all Attributes: Rating of Present Ecological Status Category (PESC)
Natural, unmodified - score=5.	Within general acceptable range CATEGORY A >4; Unmodified, or approximates natural condition.
Largely natural - score=4.	CATEGORY B >3 and ≤4; Largely natural with few modifications, but with some loss of natural habitats.
Moderately modified- score=3.	CATEGORY C >2 and ≤3; moderately modified, but with some loss of natural habitats.
Largely modified - score=2.	CATEGORY D ≤2; largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
	OUTSIDE GENERALLY ACCEPTABLE RANGE
Seriously modified - rating=1.	CATEGORY E >0 and <2; seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
Critically modified - rating=0.	CLASS F 0; critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

C. ECOSYSTEM SERVICES SUPPLIED BY THE WETLAND

The assessment of the ecosystem services supplied by the wetland was conducted according to the guidelines as described by Kotze *et* al (2005). An assessment was undertaken that examines and rates the services listed in Table 13. The characteristics were scored according to the general levels of services provided. It is important to manage the wetland to ensure that it can continue to provide the valued goods and services:

Table 13. Goods and services assessment results for wetland areas (high=4; low=0)

Goods and services	Wetland score
Flood attenuation	3
Stream flow regulation	3.5
Sediment trapping	3.5
Phosphate trapping	2.5
Nitrate removal	2.5
Toxicant removal	2.0
Erosion control	3.5
Carbon storage	2.0
Maintenance of biodiversity	2.5
Water supply for human use	1
Natural resources	0
Cultivated foods	0
Cultural significance	0
Tourism and recreation	0
Education and research	0

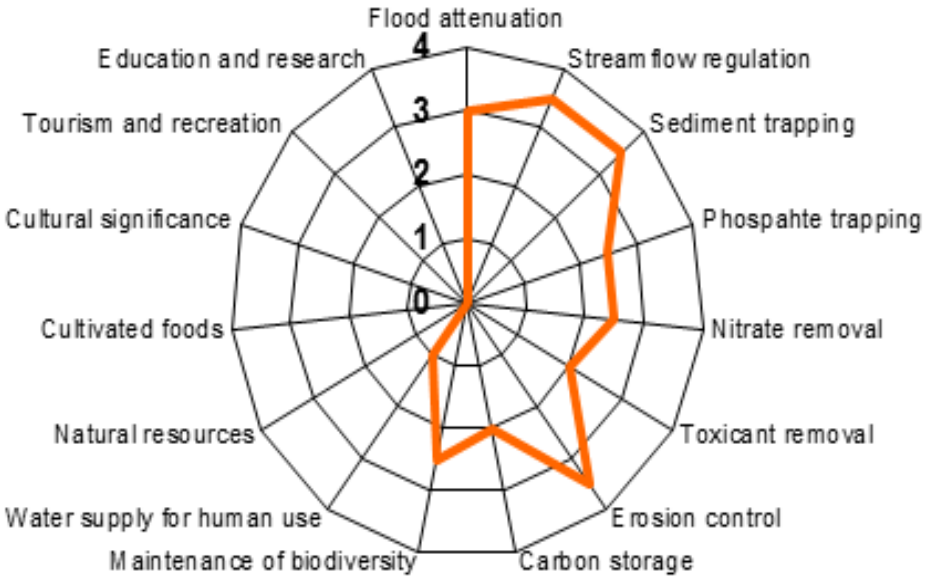


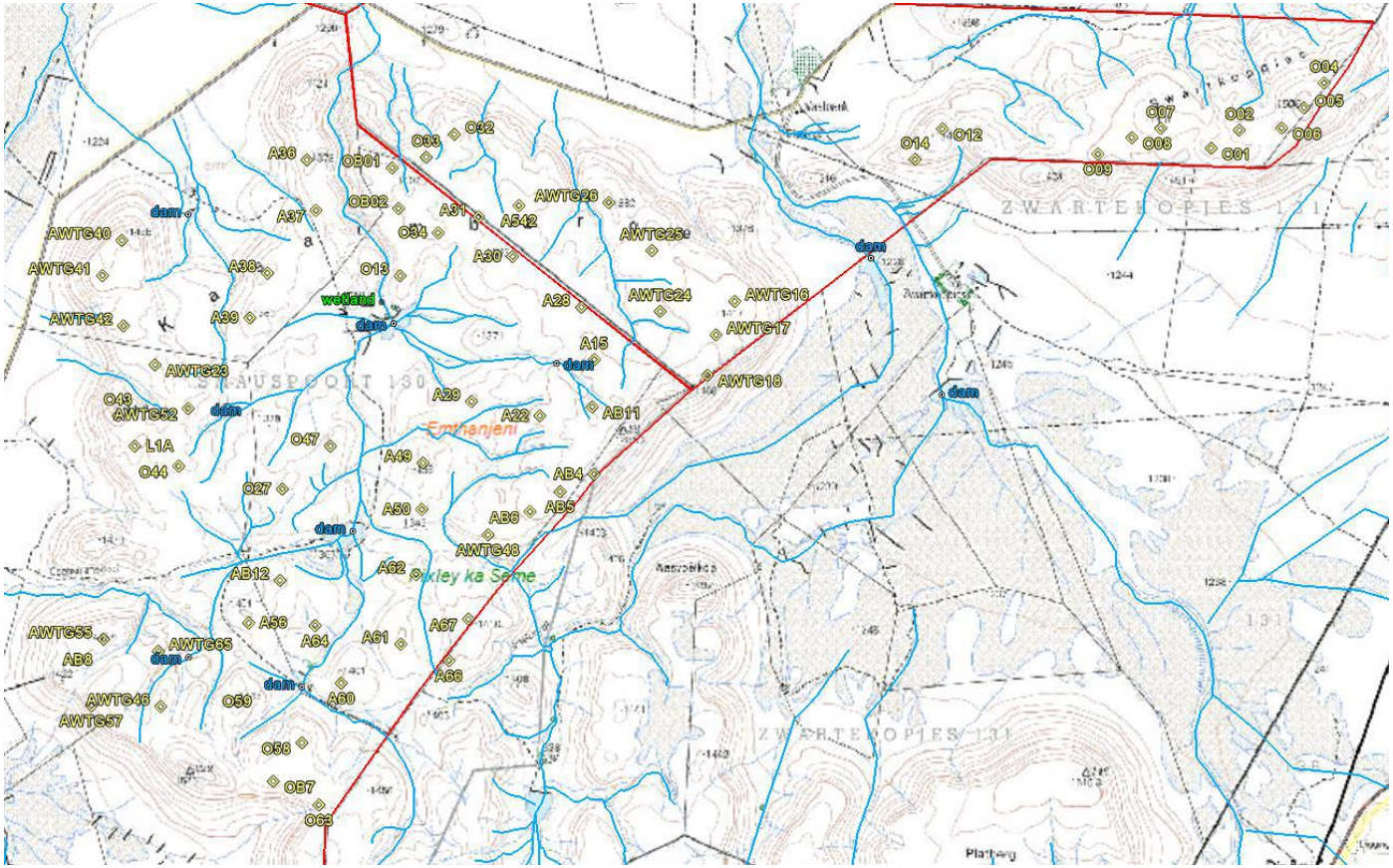
Figure 15. Ecosystem services provided by the wetland area in the study area

From Figure 15 it can be clearly seen that in terms of goods and services, the wetland areas provide the valuable services, particularly in terms of flood attenuation/ stream flow regulation functionality, erosion control and sediment trapping. The wetland areas also provide some wetland habitat for aquatic life.

6.3 OVERVIEW OF PROPOSED ACTIVITIES IN RELATION TO FRESHWATER FEATURES

The various activities associated with the proposed wind energy facility are discussed in the following tables:

Table 14. Assessment of Proposed Activities within the Study Area: Wind turbine layout



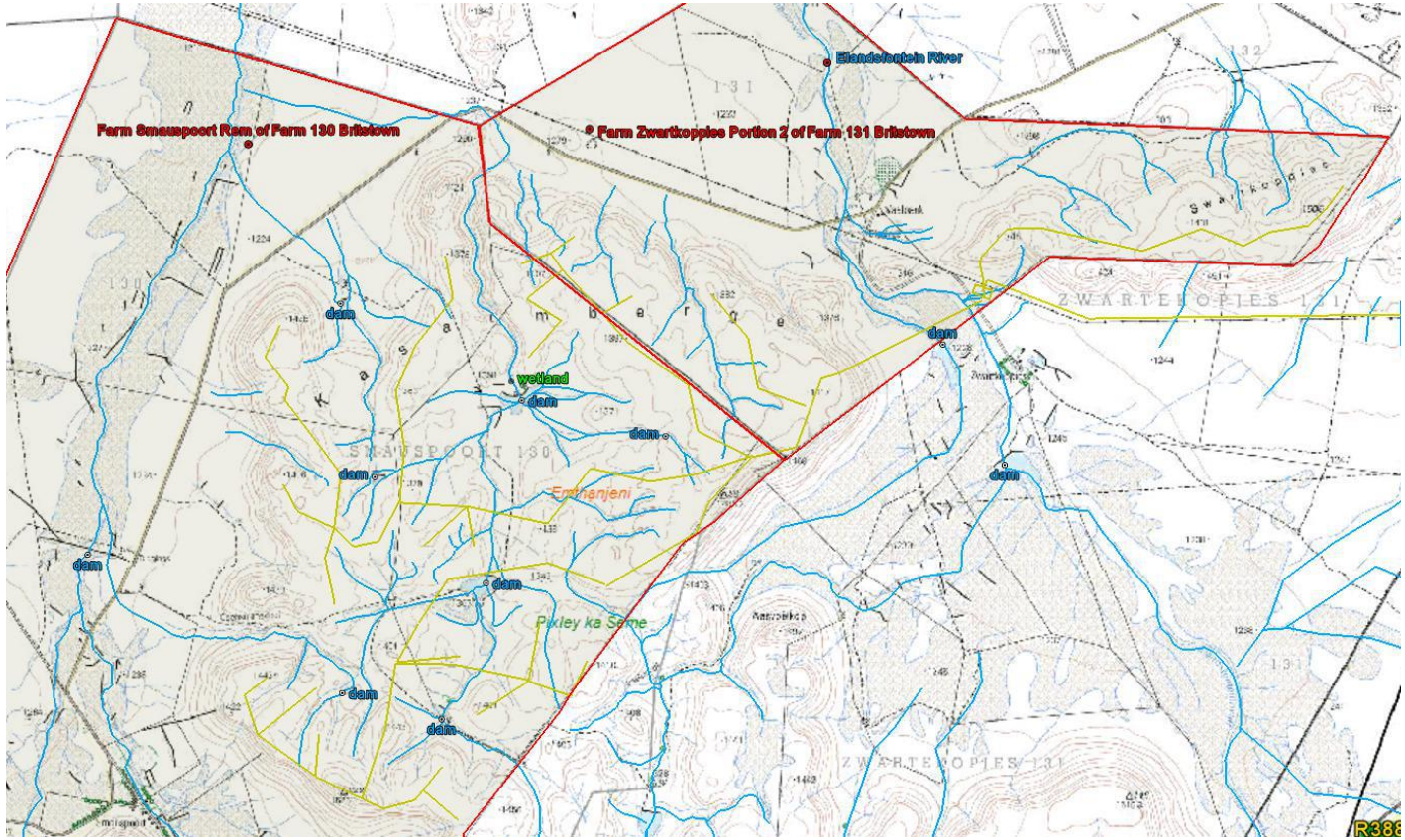
Comments:

The turbines are all located more than 100m away from any of the delineated drainage channels, thus the potential impact is likely to be of a low/very low significance. Activities during the construction phase of the project could be expected to result from clearing of natural vegetation cover and any possible construction activities adjacent to the drainage lines.

Longer term impacts that could be expected relate to a change to runoff characteristics due to hardening of surfaces and removal of cover vegetation. This may result in increased erosion and sedimentation within drainage channels. Increased disturbance of the vegetation could also result in growth of invasive alien plants which is currently very low in the area.

Operational activities should as far as possible be limited to the delineated site for the proposed development and the identified access routes. Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants.

Table 15. Assessment of Proposed Activities within the Study Area: Electrical layout and Substation/Control building

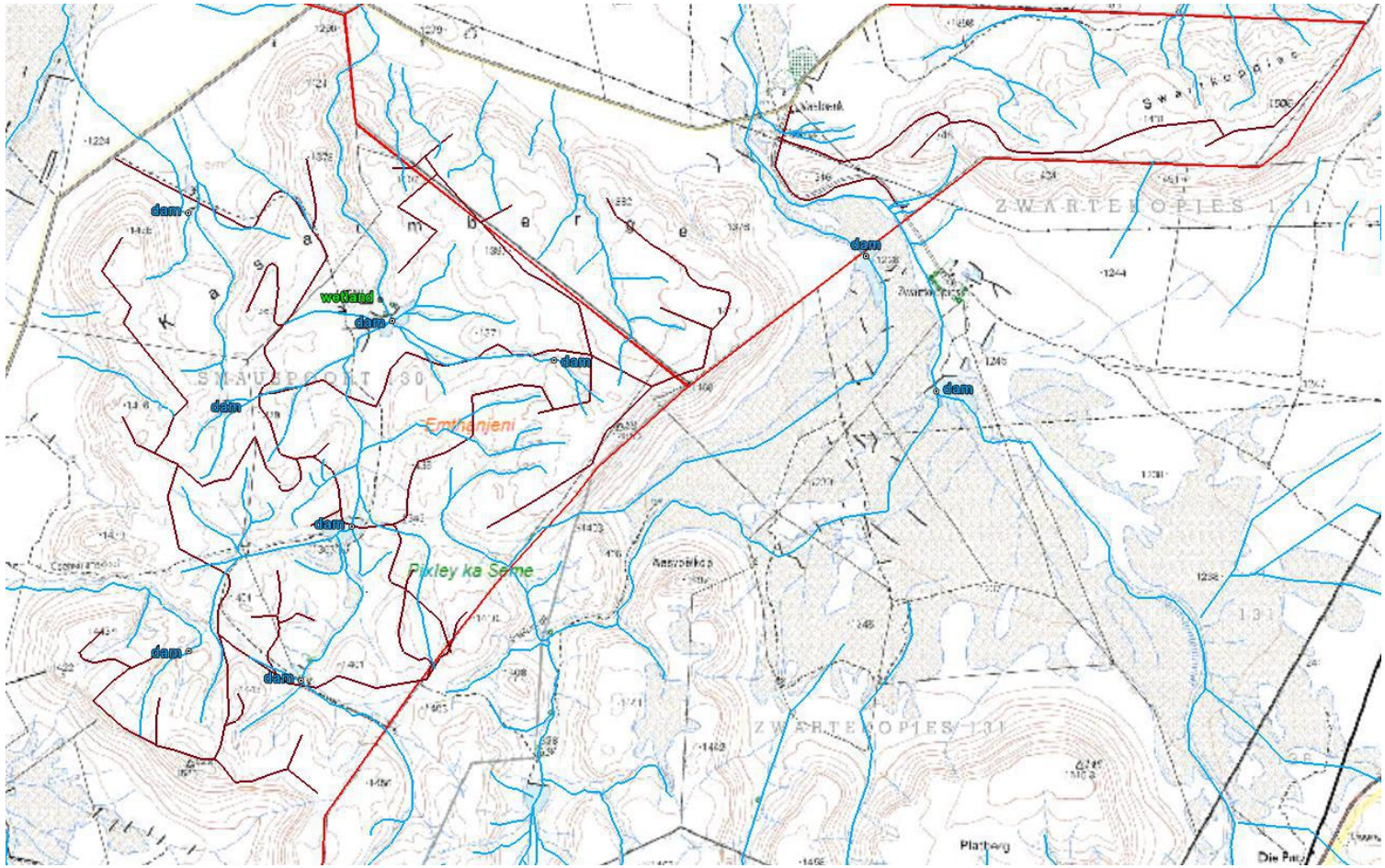


Comments:

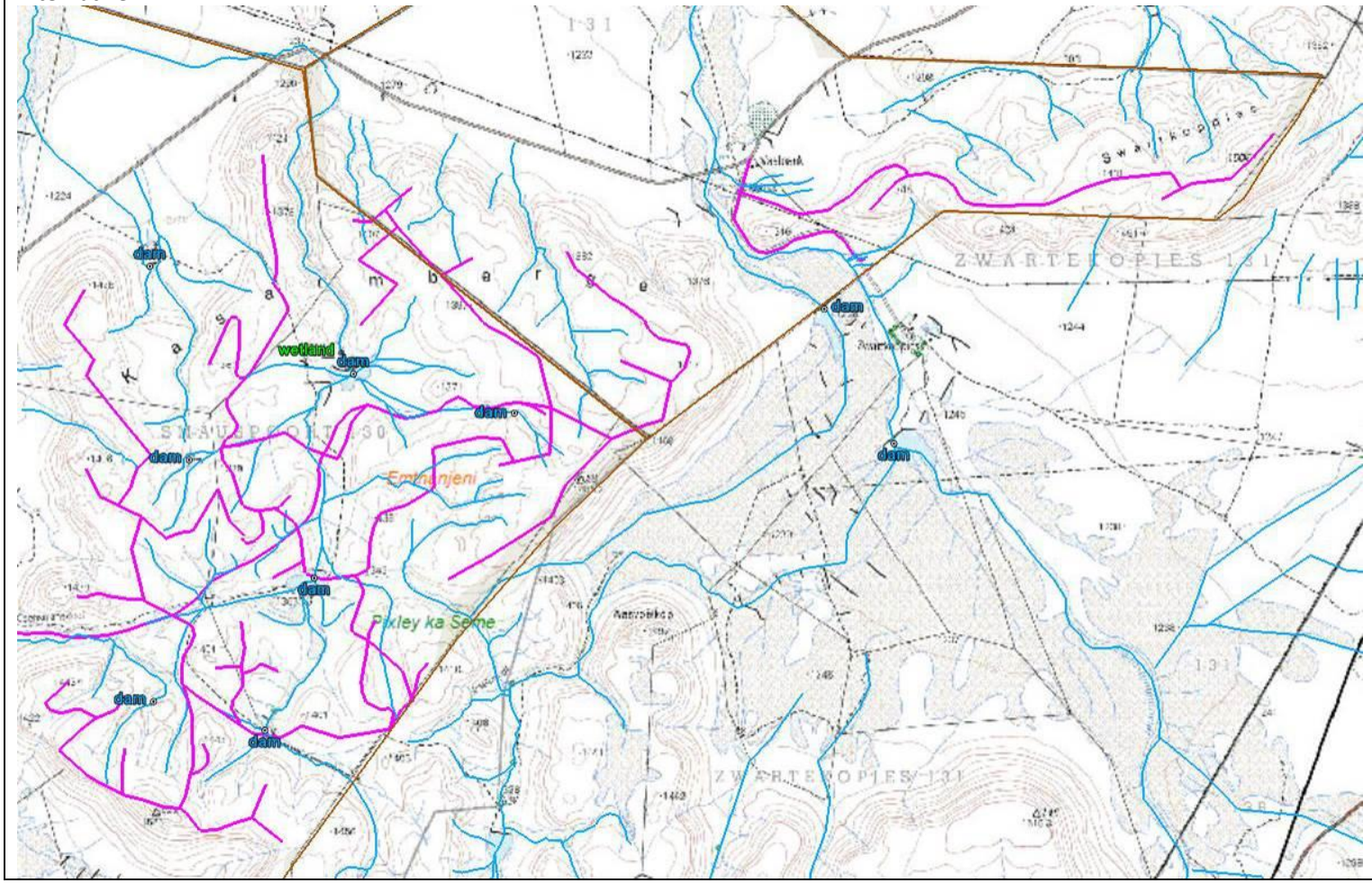
Internal 33kV overhead transmission lines that would connect the turbines to the onsite substation. Internal transmission lines would follow the route of the access roads as far as possible. Any potential impact of this activity is thus incorporated into the potential impact of the access roads that is addressed in the following table. The potential impact of this activity is also expected to be much less than that of the access roads as the transmission lines can easy span over the drainage lines and avoid placing any structures within 30m of the drainage lines.

The on-site substation and control building would require an area of 100m by 200m and would be located adjacent to the Elandsfontein River. At the proposed location there are some drainage lines passing through the site. These drainage lines are relatively small and of a low ecological importance. One could consider to divert these channels around the proposed substation and/or to do some minor adjustment to the location of the facility. Recommended mitigation measures would be to ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete.

Table 16. Assessment of Proposed Activities within the Study Area: Access Roads

Preferred Alternative:	**Comments:**
	The major impacts associated with the access roads relate to loss of instream habitat and indigenous vegetation within riparian zones at stream crossings and potential invasive alien plant growth as well as the potential for flow and water quality impacts and the direct impacts on the soil (erosion of drainage channels). Due to the fact that the habitat and riparian vegetation associated with the ephemeral streams is negligible, as well as the frequency of flow in the stream, the impact can be expected to be minimal. The proposed access roads should as far as possible make use of existing roads. In terms of the new access roads, where the access roads cross streams they should as far as possible cross perpendicular to the stream to minimise the disturbance within the stream/drainage channel. Roads created parallel to the channels should be located at least 20m away from the stream channel. Temporary roads created during the construction phase should also comply with the requisite 20m buffer and be rehabilitated once construction activities are complete.

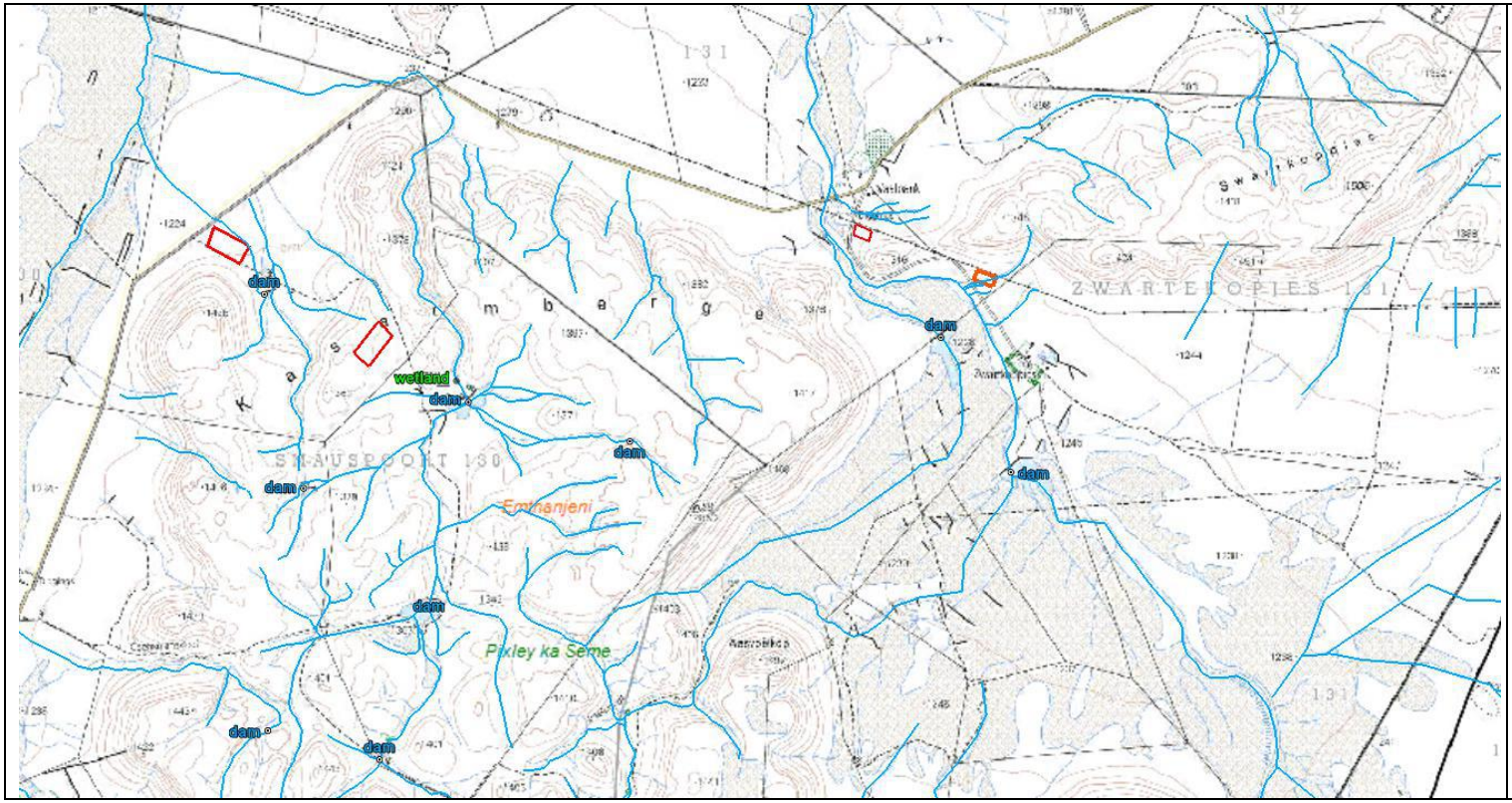
Alternative 1:



Comments:

The main difference between the preferred access routes and the alternative is the main access to the site. The alternative route access is via a relatively steep valley where the road is located adjacent to and crosses the stream twice. This stream is seen as a large stream that is deemed to be more ecologically important than the minor streams crossed by the entry road for the preferred access route.

Table 17. Assessment of Proposed Activities within the Study Area: Construction Camps



Comments:

Three temporary construction camps are proposed (400 x 200m). The camps are located largely outside of any streams or drainage lines. Recommended mitigation measures would be to ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete.

The onsite substation/control building will also include a temporary construction yard. As mentioned for the location of the substation, these drainage lines are relatively small and of a low ecological importance. One could consider to divert these channels around the proposed substation camp and/or to do some minor adjustment to the location of the camp.

7. ASSESSMENT OF IMPACTS

7.1 DESCRIPTION AND ASSESSMENT OF IMPACTS OF PROPOSED ACTIVITIES

This section provides an assessment of the overall potential impacts to freshwater ecosystems that are likely to be associated with the proposed activities. The assessment methodology as outlined in Appendix C was utilised to evaluate the identified potential impacts. The impact assessment and recommended mitigation measures are grouped, as in the previous section, according to the various proposed activities, that is, the proposed wind energy facilities, internal electricity distribution layout and sub-station, access routes and construction camps.

7.1.1. WIND TURBINES

A. CONSTRUCTION PHASE ACTIVITIES

Nature of Impact: The proposed wind energy facility would consist out of 67 turbines. The turbine tower comprises sections that are bolted to the concrete foundation of 201m^2 per turbine. A hard standing of 50 x 50 m would be constructed adjacent to each turbine location for a crane. In total, an area of approximately 2,500m^2, including the turbine foundation, will be disturbed per turbine (a total of 167 500 m^2 for the site). The total area of the farms associated with the project is 11 766 ha, thus the total area to be cleared for the turbines represents less than 1% of the total area of the site. Activities relating specifically to the turbines during the construction phase of the project could thus be expected to result from the clearing of natural vegetation cover and any possible construction activities adjacent to the drainage lines.

Significance of impacts without mitigation: A localized shorter term impact of medium to low intensity (depending on the distance between the construction activities and the freshwater features) that is expected to have a low overall significance in terms of its impact on the identified aquatic ecosystems in the area. From the proposed layout, it can be seen that no turbine would be located within approximately 100m of drainage lines.

Proposed mitigation: Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facilities and the identified access routes. No turbine (including its area of disturbance) should be located within 100m of drainage lines within the Elandsfontein River (measured from the centre of the channel). The small wetland area in the centre of the site as well as the larger stream channels should be considered as 'no-go' portions of the site (green lines in Figure 16). It is important that any of the cleared areas are rehabilitated after construction is completed.

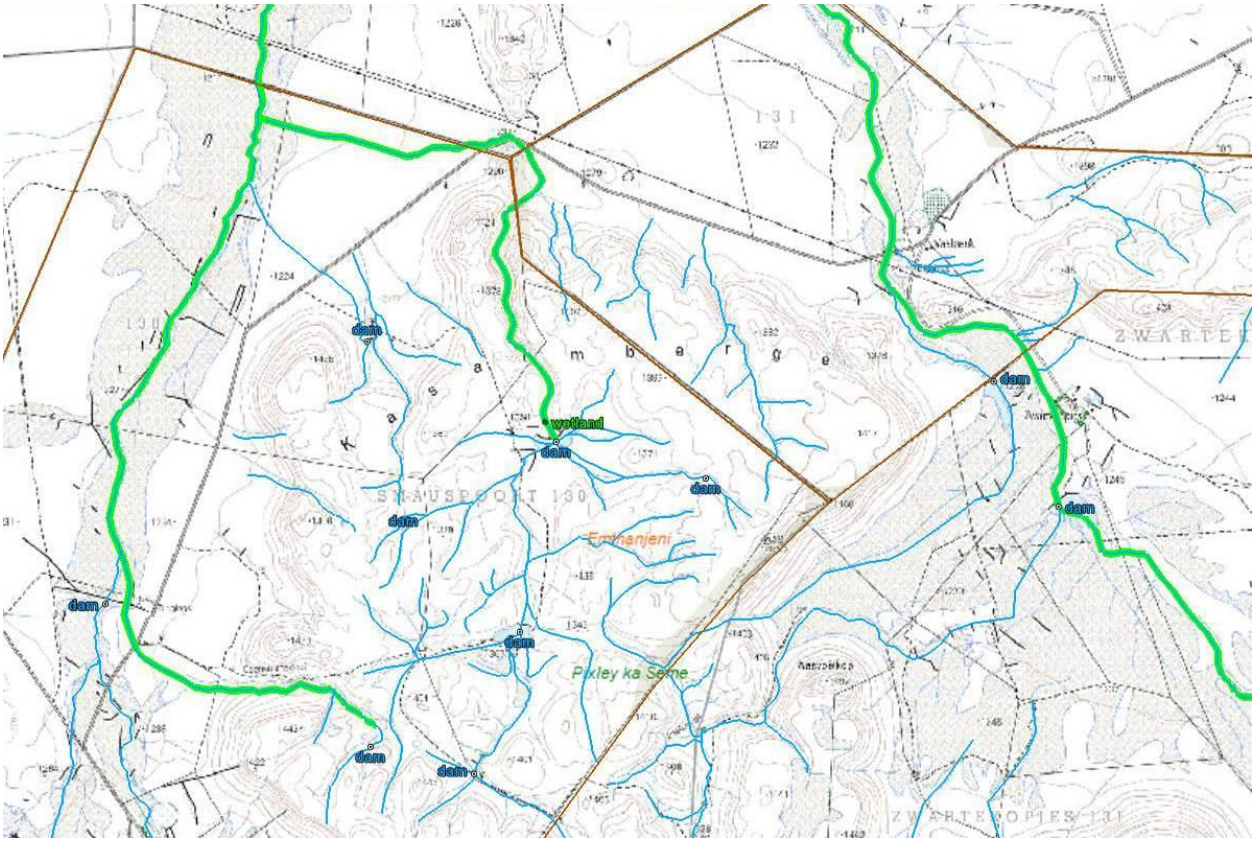


Figure 16: Recommended 'no-go' area from a freshwater perspective

Significance of impacts after mitigation: A localized, short-term impact will still occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be very low.

B. OPERATION PHASE ACTIVITIES

Nature of Impact: Turbines are designed to operate continuously, unattended and with low maintenance for more than 20 years or greater than 120 000 hours of operation. Once operating, the proposed wind energy facilities would be monitored and controlled remotely, with a mobile team for maintenance, when required. There would be basic operation and maintenance including storage facilities on site. The site will be decommissioned and cleared once the life-span of the turbines is exceeded or the turbines will be upgraded and the old turbines removed.

Longer term impacts that could be expected relate to a change to runoff characteristics as a result of hardening of surfaces and removal of cover vegetation. This may result in increased erosion and sedimentation within drainage channels. Increased disturbance of the vegetation could also result in growth of invasive alien plants which is currently very low in the area.

Significance of impacts without mitigation: A localized longer term impact impact of low to very low intensity (depending on the distance between the turbines and the freshwater features) that is expected to

have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Proposed mitigation: Operational activities should as far as possible be limited to the delineated site for the proposed development and the identified access routes. Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants.

Any storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities site. Should any erosion features develop, they should be stabilised as soon as possible. Water sources should be obtained from, and sewage and solid waste or disposed of, outside of the plateau areas for the operation phase.

Significance of impacts after mitigation: A localized, long-term impact will still occur during the operational phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be very low.

7.1.2. INTERNAL ELECTICITY DISTRIBUTION LAYOUT AND SUB-STATION:

A. CONSTRUCTION PHASE ACTIVITIES

Nature of Impact: Each turbine will be connected to the on-site substation via a 33kV overhead transmission line. The transmission line would follow the route of the proposed access roads as much as possible. The total length of internal transmission lines is 77 km. At the substation the voltage will be increased and evacuated via an Eskom 132kV transmission line connecting to the Hydra substation. Energy produced by the turbines will be sent via the 33kV transmission lines to the on-site substation. The on-site substation would require an area of 100m by 200m (20,000m^2) and would be located in the far central portion of the site. The area will be levelled and compacted. If required, imported material will be sourced or excess material from the turbine foundations will be used as fill. The area will be covered with a permeable geotextile and earthen mat and surfaced with 50mm crushed stone.

Significance of impacts without mitigation: The proposed electricity distribution network is likely to have a localized shorter term impact of low intensity that is expected to have a very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

The proposed substation is likely to have a more significant but still low impact that would be of a longer term nature if the facility is to be constructed within the delineated drainage channels. The low significance is due to the fact that the drainage lines are minor and of a low ecological importance.

Proposed mitigation: Monopoles for transmission lines should be placed outside of the recommended buffer for the streams/drainage lines (20m). Where new access routes and transmission lines need to be constructed through the drainage channels, disturbance of the channels should be limited and the crossing should preferably be perpendicular to the channel. Transmission lines and roads created parallel to the channels should be located at least 20m away from the stream channel. These areas should be rehabilitated after construction is complete and the areas monitored for growth of invasive alien plants.

With regards to the proposed substation, consider either to divert the drainage channel(s) that currently pass through the site around the proposed substation and/or to do some minor adjustment to the location of the facility. Recommended mitigation measures would be to ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete.

Significance of impacts after mitigation: A localized, short-term impact will occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a low to very low impact.

B. OPERATION PHASE ACTIVITIES

Nature of Impact: An impact of very limited significance is expected on the ephemeral streams after the construction phase.

Significance of impacts without mitigation: A localized longer term impact of low intensity that is expected to have a very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Proposed mitigation: Maintenance of transmission lines should only take place via the designated access routes. Storm water management at the proposed substation should ensure that erosion within the drainage channels at the facility does not take place. Any erosion within the channel at, or downstream of the facility should be monitored and mitigated.

Significance of impacts after mitigation: A localized, long-term impact will still occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low impact.

7.1.3. IMPACT OF THE ACCESS ROUTES:

A. CONSTRUCTION PHASE ACTIVITIES

Nature of Impact: The major impacts associated with the access roads relate to loss of instream habitat and indigenous vegetation within riparian zones at stream crossings and potential invasive alien plant growth as well as the potential for flow and water quality impacts and the direct impacts on the soil (erosion of drainage channels). Due to the fact that the habitat and riparian vegetation associated with the ephemeral streams is negligible, as well as the frequency of flow in the stream, the impact can be expected to be minimal.

Significance of impacts without mitigation: A localized shorter term impact of moderate to low intensity that is expected to have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Proposed mitigation: Existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. In terms of the new access roads, where the access roads cross streams they should as far as possible cross perpendicular to the stream to minimise the disturbance within the stream/drainage channel. Where access routes need to be constructed through ephemeral streams, disturbance of the channel should be limited. All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded. Roads created parallel to the channels should be located at least 20m away from the stream channel. Temporary roads created during the construction phase should also comply with the requisite 20m buffer and be rehabilitated once construction activities are complete. Road infrastructure and transmission lines should coincide as much as possible to minimize the road network and impact of these activities. Any disturbed areas should be rehabilitated to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Significance of impacts after mitigation: A localized, short-term impact can be expected to occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low impact. The alternative access route could be expected to more significant impact as it is located within a relatively steep valley where the road is located adjacent to and crosses the stream twice. This stream is seen as a large stream that is deemed to be more ecologically important than the minor streams crossed by the entry road for the preferred access route. It would be difficult to mitigate the impact of upgrading and utilising this road on the stream within the valley.

B. OPERATION PHASE ACTIVITIES

Nature of Impact: The major impacts associated with the access roads during the operation phase relate to the longer term disturbance to the instream and riparian habitat of the freshwater ecosystems along the designated routes.

Significance of impacts without mitigation: A localized longer term impact of low intensity that is expected to have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area. A more significant impact can be expected for the alternative access route.

Proposed mitigation: Maintenance of infrastructure related to the project should only take place via the designated access routes. Disturbed areas along the access routes should be monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth. Storm water control measures along the access roads should be monitored and managed to ensure that erosion does not take place within the drainage channels and streams at the road crossings.

Significance of impacts after mitigation: A localized, longer-term impact will occur during the operation phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low impact. As for the construction phase, the alternative access route could be expected to more significant impact as it would be difficult to mitigate the impact of upgrading and utilising this road on the stream within the valley.

7.1.4. IMPACT OF THE CONSTRUCTION CAMPS

A. CONSTRUCTION PHASE ACTIVITIES

Nature of Impact: Three temporary construction camps are proposed of 400 x 200m. The substation also includes a temporary construction yard. Activities relating specifically to the construction camps could result from the clearing of natural vegetation cover and any possible construction activities adjacent to the drainage lines.

Significance of impacts without mitigation: A localized shorter term impact of moderate to low intensity (depending on the distance between the construction activities and the freshwater features) that is expected to have a low overall significance in terms of its impact on the identified aquatic ecosystems in the area. From the proposed layout, it can be seen that the camps are located largely outside of any streams or drainage lines. As mentioned for the location of the substation does contain some drainage lines however, these drainage lines are relatively small and of a low ecological importance.

Proposed mitigation: Construction activities should as far as possible be limited to the identified construction camp sites. It is important that any of the cleared areas are rehabilitated after construction is completed.

Recommended mitigation measures would be to ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete. Monitoring of these sites post-construction will need to take place to ensure that have been adequately rehabilitated and do not provide opportunity of growth of invasive alien plants.

Water for the construction phase of the project should be obtained for sources outside of the plateau areas. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the drainage lines/ephemeral streams and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Programme for the construction phase.

Significance of impacts after mitigation: A localized, short-term impact will still occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be low to very low.

7.2. CUMULATIVE IMPACT OF THE ACTIVITIES ON FRESHWATER ECOSYSTEMS:

Land use in the study area currently consists of primarily of livestock and game farming. Due to the arid nature of the area, the carrying capacity of the land is low and livestock numbers in general are low. The land and climate are also not conducive to the cultivation of crops and pastures. Current land and water use impacts on the ephemeral streams are low. Due to the ephemeral character of these surface water systems, they are also slow to recover from any impacts such as over-grazing or erosion as a result of creation of road within drainage features.

The nature of the renewable energy projects allows them to have minimal impact on the surface water features with the correct mitigation measures (as are recommended in this report). Erosion and sedimentation from the project activities, together with the potential for invasive alien plant growth and the possible modification of surface water runoff and water quality may lead to additional impacts on the freshwater habitats within the study area. Most of the proposed activities for this project are outside of the identified freshwater features or along existing roads and provided the construction and operation activities of the projects remain contained within the allocated areas and any disturbed areas within the freshwater features rehabilitated, the overall impact should be limited and of a low significance.

In terms of the sensitivity of the site, the larger streams and the wetland area shown Figure 16 are deemed to be the most sensitive and should be treated as 'no-go' areas. The remainder of the site tends to consist of small drainage features that are considered to be less ecologically significant. Due to the sensitivity of the plateau area as a whole as a recharge area for the wider Elandsfontein Catchment, it would be essential that water sources for the project should be obtained from, and sewage and solid waste or disposed of, outside of the plateau areas.

Table 18: Impact table for the cumulative impact from proposed project and other existing and future planned activities:

Nature	Loss of freshwater ecosystem functionality and habitat		Status	-
Impact source(s)	Cumulative impact of existing farming related impacts together with future proposed renewable energy project			
Impacted aquatic ecosystem	Elandsfontein River and its tributaries within the study area			
Magnitude	Extent	Regional/local (medium to low)		
	Intensity	Medium to low		
	Duration	Long term		
	Reversibility	Reversible (medium)		
	Probability	Probable (medium)		
	Irreplaceability	Low		
Significance	Without mitigation	Low		L
	With mitigation	Very low		VL
Confidence	Medium/high			

7.3. "NO GO" ALTERNATIVE:

The site is likely to remain available to the farmers as rangeland or retained as wilderness area. These activities are all largely at a small scale and have a low impact on the freshwater features in the study area.

The tributaries of the Elandsfontein River within the study area can therefore be expected to remain in their current state of largely natural under the existing land use activities. The more impacted Elandsfontein River is also likely to remain in its current state of being largely modified, where this modification has been the result of farming activities.

Table 19: Impact table for the "No-go" alternative:

Nature	Loss of freshwater ecosystem functionality and habitat		Status	-
Impact source(s)	Impact of existing farming related impacts			
Impacted aquatic ecosystem	Elandsfontein River and its tributaries within the study area			
Magnitude	Extent	Local (low)		
	Intensity	Medium to low		
	Duration	Long term		
	Reversibility	Reversible (medium)		
	Probability	Probable (medium)		
	Irreplaceability	Low		
Significance	Without mitigation	Low to very low		L/VL
	With mitigation	Very low		VL
Confidence	Medium/high			

7.4. IMPACT TABLES FOR THE POTENTIAL IMPACTS OF THE PROPOSED ACTIVITIES:

7.4.1. CONSTRUCTION PHASE ACTIVITIES:

Potential impact on freshwater features	Proposed wind energy facilities
Nature of impact:	***Limited disturbance of freshwater related habitats*** as a result of construction work
Extent and duration of impact:	Localised short term impacts
Intensity of Impact	Medium
Probability of occurrence:	Low probability - dependant on proximity of construction activities to stream beds and drainage lines
Degree to which impact can be reversed:	Medium - Partially to fully reversible
Irreplaceability of resources:	Medium to low
Significance of impact pre-mitigation	Low
Degree of mitigation possible:	Medium to high
Proposed mitigation:	Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facilities and the identified access routes. No turbine (including its area of disturbance) should be located within 100m of drainage lines within the Elandsfontein River (measured from the centre of the channel). The small wetland area in the centre of the site as well as the larger stream channels should be considered as 'no-go' portions of the site. Cleared areas should be rehabilitated after construction is completed.
Significance after mitigation	Very Low
Confidence	Medium to high

Potential impact on freshwater features	Proposed electricity distribution network and substation
Nature of impact:	***Disturbance of aquatic habitat and possibly impedance/diversion of flow at river crossings*** for the access road (the lines impacts are associated with access roads impacts)
Extent and duration of impact:	Localised short term impacts
Intensity of Impact	Low
Probability of occurrence:	Medium to low - Probable depending on the extent of construction activities within streams/drainage lines
Degree to which impact can be reversed:	Medium to high - Partially to fully reversible
Irreplaceability of resources:	Medium to Low
Significance of impact pre-mitigation	Low to Very low
Degree of mitigation possible:	Medium to high
Proposed mitigation:	Monopoles for transmission lines should be placed outside of the recommended buffer for the streams/drainage lines (20m). Where new access routes and transmission lines need to be constructed through the drainage channels, disturbance of the channels should be limited and the crossing should preferably be perpendicular to the channel. Transmission lines and roads created parallel to the channels should be located at least 20m away from the stream channel. These areas should be rehabilitated after construction is complete and the areas monitored for growth of invasive alien plants. With regards to the proposed substation, consider either to divert the drainage channel(s) that currently pass through the site around the proposed substation and/or to do some minor adjustment to the location of the facility. Ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete.
Significance after mitigation	Very Low
Confidence	Medium to high

Potential impact on freshwater features	Proposed access routes
Nature of impact:	***Disturbance of aquatic habitat and possibly impedance/diversion of flow at river crossings*** for the access road
Extent and duration of impact:	Localised short term impacts
Intensity of Impact	Low
Probability of occurrence:	Medium - Probable depending on the extent of construction activities within streams/drainage lines
Degree to which impact can be reversed:	Medium to high - Partially to fully reversible
Irreplaceability of resources:	Medium to Low
Significance of impact pre-mitigation	Low to Very low
Degree of mitigation possible:	Medium to high
Proposed mitigation:	Existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. In terms of the new access roads, where the access roads cross streams they should as far as possible cross perpendicular to the stream to minimise the disturbance within the stream/drainage channel. Where access routes need to be constructed through ephemeral streams, disturbance of the channel should be limited. All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded. Roads created parallel to the channels should

	be located at least 20m away from the stream channel. Temporary roads created during the construction phase should also comply with the requisite 20m buffer and be rehabilitated once construction activities are complete. Road infrastructure and transmission lines should coincide as much as possible to minimize the road network and impact of these activities. Any disturbed areas should be rehabilitated to ensure that these areas do not become subject to erosion or invasive alien plant growth.
Significance after mitigation	Very Low
Confidence	Medium to high

Potential impact on freshwater features	Proposed construction camps
Nature of impact:	***Disturbance of aquatic habitat and possibly impedance/diversion of flow and water quality modification***
Extent and duration of impact:	Localised short term impacts
Intensity of Impact	Medium to low
Probability of occurrence:	Medium to low - Probable depending on proximity of construction camps to stream beds and drainage lines
Degree to which impact can be reversed:	Medium to high- Partially to fully reversible
Irreplaceability of resources:	Medium to low
Significance of impact pre-mitigation	Low
Degree of mitigation possible:	Medium to high
Proposed mitigation:	Construction activities should as far as possible be limited to the identified construction camp sites. It is important that any of the cleared areas are rehabilitated after construction is completed. One could consider to divert these channels around the proposed camp at the substation and/or to do some minor adjustment to the location of the structures. Recommended mitigation measures would be to ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete. Monitoring of these sites post-construction will need to take place to ensure that have been adequately rehabilitated and do not provide opportunity of growth of invasive alien plants. Water for the construction phase of the project should be obtained for sources outside of the plateau areas. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the drainage lines/ephemeral streams and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Programme for the construction phase.
Significance after mitigation	Low to Very Low
Confidence	Medium to high

7.4.2. OPERATION PHASE ACTIVITIES:

Potential impact on freshwater features	Maintenance of wind energy facilities
Nature of impact:	Limited ***disturbance of freshwater related habitats*** at the river crossings for

	transmission lines and access roads as well as along the length of the site adjacent to any streams
Extent and duration of impact:	Localised longer term impacts
Intensity of Impact	Low to very low
Probability of occurrence:	Probable as a result of maintenance activities adjacent to stream beds and riparian zones
Degree to which impact can be reversed:	Fully reversible
Irreplaceability of resources:	Medium to Low
Significance of impact pre-mitigation	Low to very low
Cumulative impact prior to mitigation:	Low due to the existing disturbances within these streams
Degree of mitigation possible:	Very low
Proposed mitigation:	Operational activities should as far as possible be limited to the delineated site for the proposed development and the identified access routes. Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants. Any storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities site. Should any erosion features develop, they should be stabilised as soon as possible. Water sources should be obtained from, and sewage and solid waste or disposed of, outside of the plateau areas for the operation phase.
Significance after mitigation	Very Low
Cumulative impact post mitigation:	Very Low
Confidence	Medium

Potential impact on freshwater features	Proposed electricity distribution network and substation
Nature of impact:	Disturbance of habitat and possibly impedance/diversion of flow at river crossings of the access road to the lines
Extent and duration of impact:	Localised longer term impacts
Intensity of Impact	Low
Probability of occurrence:	Probable to improbable
Degree to which impact can be reversed:	Fully reversible
Irreplaceability of resources:	Medium to Low
Significance of impact pre-mitigation	Very low
Cumulative impact prior to mitigation:	Low
Degree of mitigation possible:	Very low
Proposed mitigation:	Maintenance of transmission lines should only take place via the designated access routes. Storm water management at the proposed substation should ensure that erosion within the drainage channels at the facility does not take place. Any erosion within the channel at, or downstream of, the facility should be monitored and mitigated.
Significance after mitigation	Very Low
Cumulative impact post mitigation:	Very Low impact
Confidence	Medium

Potential impact on freshwater features	Proposed access routes
Nature of impact:	Disturbance of habitat and possibly impedance/diversion of flow at river crossings
Extent and duration of impact:	Localised longer term impacts
Intensity of Impact	Low
Probability of occurrence:	Probable to improbable
Degree to which impact can be reversed:	High
Irreplaceability of resources:	Medium to Low
Significance of impact pre-mitigation	Very Low
Cumulative impact prior to mitigation:	Low
Degree of mitigation possible:	Very low
Proposed mitigation:	Maintenance of infrastructure related to the project should only take place via the designated access routes. Disturbed areas along the access routes should be monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth. Storm water control measures along the access roads should be monitored and managed to ensure that erosion does not take place within the drainage channels and streams at the road crossings.
Significance after mitigation	Very Low
Cumulative impact post mitigation:	Very Low
Confidence	Medium

8. CONCLUSIONS AND RECOMMENDATIONS

The main aquatic features within the study area are associated with the Elandsfontein tributary of the Brak River, a seasonal tributary within the Orange River System. The larger tributaries of the Elandsfontein River have well defined channels while the smaller ephemeral streams and drainage channels generally flow within wide flat valleys with poorly defined channels with little clear associated vegetation. Small to moderate sized, shallow instream dams have been constructed within many of the Elandsfontein River drainage channels. A wetland area exists within a steep-sided valley of a larger tributary of the Elandsfontein River as it exits the Kasarmberge in the north of the site.

Land use in the study area currently consists of primarily of livestock and game farming. Due to the arid nature of the area, the carrying capacity of the land is low and livestock numbers in general are low. The land and climate are also not conducive to the cultivation of crops and pastures. Current land and water use impacts on the ephemeral streams are low. Due to the ephemeral character of these surface water systems, they are also slow to recover from any impacts such as over-grazing or erosion as a result of creation of road within drainage features.

Within the study area, the habitat of the Elandsfontein River is considered to be largely modified while the tributaries area still in a largely natural condition. The riparian habitat is slightly more impacted as a result of surrounding farming activities. The Elandsfontein River and its larger tributaries are considered to be of a moderate to low ecological importance and sensitivity while the minor tributaries are of a low or even

marginal ecological importance and sensitivity. The wetland area on the site is located within in steep sided valley and is still in a largely natural state. It is fed by two fountains, this together with the current water management practices within the plateau area have ensured that the flow to the wetland area is still largely unimpacted.

The nature of the renewable energy projects allows them to have minimal impact on the surface water features with the correct mitigation measures (as are recommended in this report). Erosion and sedimentation from the project activities, together with the potential for invasive alien plant growth and the possible modification of surface water runoff and water quality may lead to additional impacts on the freshwater habitats within the study area. Most of the proposed activities for this project are outside of the identified freshwater features or along existing roads and provided the construction and operation activities of the projects remain contained within the allocated areas and any disturbed areas within the freshwater features rehabilitated, the overall impact should be limited and of a low significance.

In terms of the sensitivity of the site, the larger streams and the wetland area are deemed to be the most sensitive and should be treated as 'no-go' areas. The remainder of the site tends to consist of small drainage features that are considered to be less ecologically significant. Due to the sensitivity of the plateau area as a whole as a recharge area for the wider Elandsfontein Catchment, it would be essential that water sources for the project should be obtained from, and sewage and solid waste or disposed of, outside of the plateau areas.

Proposed mitigation measures are as follows:

- Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facilities and the identified access routes. No turbine (including its area of disturbance) should be located within 100m of drainage lines within the Elandsfontein River (measured from the centre of the channel). The small wetland area in the centre of the site as well as the larger stream channels should be considered as 'no-go' portions of the site. It is important that any of the cleared areas are rehabilitated after construction is completed.

- Existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded.

- Road infrastructure and transmission lines should coincide as much as possible to minimize the road network and impact of these activities. Where new access routes need to be constructed through the drainage channels, disturbance of the channels should be limited and the crossing should preferably be perpendicular to the channel. Transmission lines and roads created parallel to the channels should be located at least 20m away from the stream channel. Any disturbed areas within the stream or drainage channels should be rehabilitated

- Temporary roads created during the construction phase should also comply with the requisite 20m buffer and be rehabilitated once construction activities are complete.

- Monopoles for transmission lines should be placed outside of the recommended buffer for the streams/drainage lines (20m). After construction is complete and the areas monitored for growth of invasive alien plants.

- With regards to the proposed substation, consider either to divert the drainage channel(s) that currently pass through the site around the proposed substation and/or to do some minor adjustment to the location of the facility. Ensure that on-site storm water management is such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete.

- Activities at the construction camps should as far as possible be limited to the identified footprint for construction camp sites. Cleared areas are rehabilitated after construction is completed. Ensure that on-site storm water management at the construction camps should be such that erosion within the drainage lines is minimised and that the channels are rehabilitated once construction activities are complete. Monitoring of these sites post-construction will need to take place to ensure that they have been adequately rehabilitated and do not provide opportunity of growth of invasive alien plants.

- Water for the construction phase of the project should be obtained for sources outside of the plateau areas. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the drainage lines/ephemeral streams and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Programme for the construction phase.

- Operational activities should as far as possible be limited to the wind turbine sites, the substation/control building and the identified access routes. Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants. Any storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities sites. Should any erosion features develop, they should be stabilised as soon as possible. Water sources for the operational phase of the project should be obtained from, and sewage and solid waste or disposed of, outside of the plateau areas for the operation phase.

In terms of project alternatives, the main difference between the preferred access route and the alternative is the main access to the site. The alternative route access is via a relatively steep valley where the road is located adjacent to and crosses the stream twice. This stream is seen as a large stream that is deemed to be more ecologically important than the minor streams crossed by the entry road for the preferred access route. One can therefore expect the alternative access route to have a more significant impact and thus be least preferred from an aquatic point of view.

A water use authorization application may need to be submitted to the Department of Water Affairs Free State Regional Office for approval of the water use aspects of the proposed activities. It is likely that the proposed activity can be authorised by means of the General Authorisation.

9. REFERENCES

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ANNEXURE A: DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	
NEAS Reference Number:	
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

BASIC ASSESSMENT FOR ADDITIONAL ACTIVITIES AT AUTHORISED LONGYUAN MULILO DE AAR WIND POWER FACILITY (100MW) NEAR DE AAR, NORTHERN CAPE

Specialist:	BlueScience		
Contact person:	Toni Belcher		
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Postal code:	7130	Cell:	082 883 8055
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Professional affiliation(s) (if any)	SACNASP (Environmental and Ecological Sciences) – 400040/10		

Project Consultant:	Aurecon South Africa Pty (Ltd)		
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E-mail:	Franci.gresse@aurecongroup.com		

4.2 The specialist appointed in terms of the Regulations_

I, Antonia Belcher , declare that --

General declaration:

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

BlueScience

Name of company (if applicable):

13 January 2013

Date:

ANNEXURE B: CURRICULUM VITAE

A Belcher

Full Name	Antonia Belcher
Year of Birth	1966
Nationality	South African
Profession	Aquatic Ecologist and Environmental Management (P. Sci. Nat. 400040/10)
Years in Profession	23 years

Professional Qualifications:

1998	M.Sc. – Environmental Management (*cum laude*)	Potchefstroom University
1989	B.Sc. (Hons) – Oceanography	University of Port Elizabeth
1987	B.Sc. – Mathematics, Applied Mathematics	University of Port Elizabeth
1984	Matriculation	Lawson Brown High School

Key Skills:

Areas of specialisation: Water education, Monitoring and evaluation of water resources, Catchment management, River management, Wetlands, Estuaries, Water resource legislation, Water resource institutions, River classification, River Reserve determination and implementation, Aquatic ecosystem assessments (Environmental Impact Assessments).

Toni Belcher has worked in the Department of Water Affairs and Forestry in South Africa for more than 17 years. During this period she worked for the Directorate Water Quality Management, the Institute for Water Quality Studies and the Western Cape Regional Office and has built up a wide skills base on water resource management and water resource quality for rivers, estuaries and the coastal marine environment. Prior to this she taught mathematics for a period of two years. She is currently working in her private capacity, in the fields of water resource and water environmental education, as well as undertaking aquatic ecosystem assessments for environmental impact assessment and water use authorisation purposes. In 2006 she was awarded a Woman in Water award for Environmental Education and was a runner up for the Woman in Water prize for Water Research.

Summary of Experience:

2007 – Present: Self-employed. Toni has conducted more than **200 freshwater assessments** studies as input into EIA decision making processes. Toni has conducted **more than 100 water use license applications**. Toni has done specialist work on **more than 25 power line** and substation applications projects and more than **15 alternative energy projects**.

1999 – 2007 Assistant and Deputy Director, Water Resource Protection, Western Cape Regional Office, Department of Water Affairs, Cape Town.

1995 – 1999 Hydrologist and Assistant Director, Institute for Water Quality Studies, Department of Water Affairs and Forestry, Pretoria

1991 – 1995 Water Pollution Control Officer, Water Quality Management, Department of Water Affairs, Pretoria.

1989 – 1990 Mathematics tutor and administrator, Master Maths, Randburg and Braamfontein Colleges, Johannesburg.

1987 – 1988 Part-time field researcher, Department of Oceanography, University of Port Elizabeth.

Papers and Publications:

More than 100 publications, papers and posters relating mostly to water resource quality and river health assessments, as well as water use authorisations, for Southern African rivers.

Recent projects that she has been involved in are:

- Compilation of a background document as well as a framework management plan towards the development of an integrated water resources management plan for the Sandveld; Department of Water Affairs, South Africa
- Specialist on the City of Cape Town project: Determination of additional resources to manage pollution in storm water and river systems; and
- Development and piloting of a National Strategy to Improve Gender Representation in Water Management Institutions, where the focus is on improving the capacity (specifically amongst women) to participate in water related decision making, Department of Water Affairs and Forestry, South Africa;
- The classification of significant water resources in the Olifants/Doorn Water Management Area (WMA 17), Department of Water Affairs, South Africa
- Freshwater contributions towards the Environmental Management Plan for Mapoteng and Semonkong Water Supply Infrastructure. Prepared for Lesotho Water and Sewerage Authority

APPENDIX C: IMPACT ASSESSMENT METHODOLOGY

Criteria and ratings:

1. Extent

"Extent" defines the physical extent or spatial scale of the impact.

Rating	Description
LOCAL	Extending only as far as the activity, limited to the site and its immediate surroundings. Specialist studies to specify extent.
REGIONAL	Western Cape. Specialist studies to specify extent.
NATIONAL	South Africa
INTERNATIONAL	

2. Duration

"Duration" gives an indication of how long the impact would occur.

Rating	Description
SHORT TERM	0 - 5 years
MEDIUM TERM	5 - 15 years
LONG TERM	Where the impact will cease after the operational life of the activity, either because of natural processes or by human intervention.
PERMANENT	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.

3. Intensity

"Intensity" establishes whether the impact would be destructive or benign.

Rating	Description
ZERO TO VERY LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes continue, albeit in a slightly modified way.
MEDIUM	Where the affected environment is altered, but natural, cultural and social functions and processes continue, albeit in a modified way.
HIGH	Where natural, cultural and social functions or processes are altered to the extent that it will temporarily or permanently cease.

4. Loss of resources

"Loss of resource" refers to the degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable.

Rating	Description
LOW	Where the activity results in a loss of a particular resource but where the natural, cultural and social functions and processes are not affected.
MEDIUM	Where the loss of a resource occurs, but natural, cultural and social functions and processes continue, albeit in a modified way.
HIGH	Where the activity results in an irreplaceable loss of a resource.

5. Status of impact

The status of an impact is used to describe whether the impact would have a negative, positive or zero effect on the affected environment. An impact may therefore be negative, positive (or referred to as a benefit) or neutral.

6. Probability

"Probability" describes the likelihood of the impact occurring.

Rating	Description
IMPROBABLE	Where the possibility of the impact to materialise is very low either because of design or historic experience.
PROBABLE	Where there is a distinct possibility that the impact will occur.
HIGHLY PROBABLE	Where it is most likely that the impact will occur.
DEFINITE	Where the impact will occur regardless of any prevention measures.

7. Degree of confidence

This indicates the degree of confidence in the impact predictions, based on the availability of information and specialist knowledge.

Rating	Description
HIGH	Greater than 70% sure of impact prediction.
MEDIUM	Between 35% and 70% sure of impact prediction.
LOW	Less than 35% sure of impact prediction.

8. Significance

"Significance" attempts to evaluate the importance of a particular impact, and in doing so incorporates the above three scales (i.e. extent, duration and intensity).

Rating	Description
VERY HIGH	Impacts could be EITHER: of high intensity at a regional level and endure in the long term; OR of high intensity at a national level in the medium term; OR of medium intensity at a national level in the long term.
HIGH	Impacts could be EITHER: of high intensity at a regional level and endure in the medium term; OR of high intensity at a national level in the short term; OR of medium intensity at a national level in the medium term; OR of low intensity at a national level in the long term; OR of high intensity at a local level in the long term; OR of medium intensity at a regional level in the long term.
MEDIUM	Impacts could be EITHER: of high intensity at a local level and endure in the medium term; OR of medium intensity at a regional level in the medium term; OR of high intensity at a regional level in the short term; OR of medium intensity at a national level in the short term; OR of medium intensity at a local level in the long term; OR of low intensity at a national level in the medium term; OR of low intensity at a regional level in the long term.
LOW	Impacts could be EITHER of low intensity at a regional level and endure in the medium term; OR of low intensity at a national level in the short term; OR of high intensity at a local level and endure in the short term; OR of medium intensity at a regional level in the short term; OR of low intensity at a local level in the long term; OR of medium intensity at a local level and endure in the medium term.
VERY LOW	Impacts could be EITHER of low intensity at a local level and endure in the medium term; OR of low intensity at a regional level and endure in the short term; OR of low to medium intensity at a local level and endure in the short term.
INSIGNIFICANT	Impacts with: Zero to very low intensity with any combination of extent and duration.
UNKNOWN	In certain cases it may not be possible to determine the significance of an impact.

9. Degree to which impact can be mitigated

This indicates the degree to which an impact can be reduced / enhanced.

Rating	Description
NONE	No change in impact after mitigation.
VERY LOW	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact.
LOW	Where the significance rating drops by one level, after mitigation.
MEDIUM	Where the significance rating drops by two to three levels, after mitigation.
HIGH	Where the significance rating drops by more than three levels, after mitigation.

10 Reversibility of an impact

This refers to the degree to which an impact can be reversed.

Rating	Description
IRREVERSIBLE	Where the impact is permanent.
PARTIALLY REVERSIBLE	Where the impact can be partially reversed.
FULLY REVERSIBLE	Where the impact can be completely reversed.