8. ASSESSMENT OF THE BIOPHYSICAL ENVIRONMENT

8.1. Hydrogeology

8.1.1. Introduction

Bohlweki Environmental appointed SRK Consulting to undertake the necessary hydrogeological studies for the proposed CCGT power plant in the Amersfoort area, Mpumalanga Province. SRK Consulting's Screening Report (SRK Screening Report Ref. 378710, 24 October 2007), provided an indication of ideal, acceptable, and sensitive sites, from a groundwater perspective. The preliminary assessment identified that the CCGT power plant could potentially impact on the groundwater regime, and an assessment of groundwater resources (aquifers and potential for development of reliable assured groundwater supplies), vulnerability to potential surface contaminant sources (depth to groundwater), and geology (geological structures which can act as preferential flow paths) was required to assist in selecting the most suitable site for the power generation activities, from an environmental perspective.

The screening specialist (biophysical, social and economic) studies allowed for the identification of six (6) sites for assessment during the Scoping phase. The candidate sites were assessed, using a groundwater site comparison, which allowed for the identification of the most suitable site(s), or positions of the sites, for the development of a CCGT power plant and ancillary infrastructure from a groundwater perspective (refer to Appendix J for the full Scoping Hydrogeology Specialist Report).

8.1.2. Methodology

A literature data review for each candidate site was conducted. Based on the proposed power generation project having the potential to negatively impact on the groundwater, the six candidate sites (Sites 1, 2a, 2b, 3a, 3b, and 3c on Figure 5.4 – Chapter 5) were assessed according to groundwater criteria, which included:

- the aquifers on each site ;
- groundwater resources (usage and potential);
- the depth to groundwater (vulnerability);
- hydrochemistry (potable or poor quality);
- the presence or absence of large geological structures (preferential flow paths for groundwater/contaminant movement and enhanced groundwater potential); and
- the occurrence of shallow vulnerable groundwater resources, such as wetlands, alluvial (vulnerable) aquifers, endoreic pans.

- ***Site evaluation process***

The candidate site suitability included a groundwater site comparison, which allowed for the determination of the most suitable sites/s for the proposed power generation project from a groundwater perspective. This process requires that a hydrogeology site comparison be

conducted, utilising hydrogeology specific weighing factors where a value of 1 has a higher importance weighting than a **0.5** value, which has a lower weighting according to a hydrogeology overview. This methodology is based on a variation of the guidelines provided by the Department of Water Affairs and Forestry – *Protocol for the protection of groundwater from contamination from sanitation practices* (DWAF, 2003). In terms of this methodology each site is given a rating (1 to 5) in terms of sensitivity to the various hydrogeology elements. Some hydrogeology elements were considered to be more important and thus were multiplied by an importance factor of 1 and those hydrogeology elements considered less important were multiplied by an importance factor of 0.5. The total ranking of each site was then averaged using a total of 45 (each importance factor was multiplied by the highest rating of 5) and percentages calculated. These percentage were then linked to Table 8.1 below, which reflects the hydrogeology percentage relating to the site preference rating class.

Table 8.1 Hydrogeology percentage relating to site preference rating class

Site Preference	Hydrogeology Percentage Relating to Site Preference Rating (SPR) Class
Sensitive (1)	0 - 20%
Not preferred (2)	21 – 40%
Acceptable (3)	41 – 60%
Preferred (4)	61 – 80%
Ideal (5)	81 – 100%

This comparison allows for the identification of the most suitable site from a groundwater perspective. Table 8.3 presents the site comparison.

The following data was assessed for the groundwater site comparison at each of the candidate sites:

- soil permeability;
- shallow groundwater conditions on site;
- presence of intrusive lithologies;
- groundwater contribution to base flow;
- ambient quality;
- vadose zone characteristics (aquifer vulnerability);
- borehole yields;
- borehole density;
- groundwater potential;
- aquifer classification;
- downstream users; and
- distance to major water course / discharge areas.

8.1.3. Potential Impacts on Hydrology

A review of the proposed CCGT process and infrastructure was conducted. This allowed for the identification of potential impacts to the groundwater regime. These envisaged impacts are included in Table 8.2.

Table 8.2 Potential nature of impacts on groundwater regime

Aspect	Nature of Impact
Raw water dams	Source of artificial recharge to the groundwater
Water (neutralised) storage tanks	Possible source of artificial recharge
Sewage plant and dams	Seepage or irrigation of effluent may impact on groundwater
Treated (demineralised) water system	Resultant wet waste brine may impact on groundwater
Recovery (dirty water) dams	Overflow, seepage, or irrigation may impact on groundwater
Fuel oil and stored chemicals	Oil/chemicals enters water and requires treatment
Solid waste site	Source of leachate or poor quality water
Borrow pits	Reduced runoff and enhanced recharge
Air quality abatement technology	Wet waste and water use (if used)

The impacts are thus related to potential artificial recharge, causing increased groundwater levels, changes in groundwater flow patterns, and the potential to cause deterioration of groundwater quality with time.

Based on the available data and envisaged impacts on the groundwater resources, the following issues have been compiled for consideration when assessing site suitability:

- The CCGT power plant and ancillary infrastructure can potentially impact negatively on the groundwater. The site should, therefore, be located in an area with limited groundwater resources and potential (if possible).
- Artificial recharge can increase groundwater levels directly adjacent to the water impoundments associated with power generation. Groundwater levels can become elevated because of infiltration.
- Pollution plumes are envisaged to only extend over small areas / distances if the CCGT is located on a non-aquifer system.
- Persistent sources of contaminants can alter the hydrochemistry, causing an increase in dissolved solids and metals. The sources must, therefore, be located within areas where groundwater usage or potential for use is reduced.

Location of the CCGT and ancillary infrastructure, from a groundwater perspective, should be located on areas of limited groundwater potential, usage, and sustainability.

8.1.4. Site Preference Rating (SPR)

Table 8.3 below illustrates the site selection comparison in terms of hydrogeology.

Table 8.3 Site selection comparison

	Scoring in terms of suitability						
Site selection elements	**Site 1**	**Site 2a**	**Site 2b**	**Site 3a**	**Site 3b**	**Site 3c**	**Importance aspect (0-1)**
Soil Characterisation (Permeability)	3	5	4	4	4	5	0.5
Shallow aquifer conditions per unit area	2	2	4	3	2	2	1
Presence of intrusive lithologies	4	2	3	3	3	2	1
Groundwater contribution to river flow	2	4	4	4	3	3	0.5
Ambient quality	3	2	2	4	4	3	0.5
Unsaturated zone characteristics- aquifer vulnerability (lithology type & depth)	4	3	3	3	3	3	0.5
Borehole Yields	4	2	2	2	2	2	1
Borehole density	3	4	3	4	3	2	0.5
Groundwater Potential	4	2	3	3	3	2	0.5
Aquifer classification (importance, yield etc - Parsons)	4	2	3	3	3	2	1
Down stream users	3	2	2	4	3	3	1
Distance to major water courses/discharge areas	3	2	2	3	3	3	1
Subtotal	29.5	22	25.5	29	26	23	(45)
SPR	**65.6**	**48.9**	**56.7**	**64.4**	**57.8**	**51.1**	
Ranking	**4**	**3**	**3**	**4**	**3**	**3**	

8.1.5. Conclusions

Site 1 proved to be the highest ranking site from a groundwater perspective. The site was rated as the best suitable site due to the following factors:

- No geological features, including the presence of dolerite dykes or sills, are present on the site;

- No springs or seeps are mapped on site or were visible during the field investigation;
- Low borehole density (1 wind pump);
- Low borehole yields (low yields within Vryheid Formation rocks, 0.1 to 0.5 l/s);
- Limited groundwater potential;
- Limited aquifers on site; and
- Possible poor quality groundwater due to surrounding land use (ash disposal).

Site 3a and 3b were ranked second and third respectively in terms of site suitability for the development of the CCGT power plant and associated infrastructure.

8.1.6. Recommendations

It is envisaged that based on the input of the various specialists (biophysical, social and economic), a maximum of three sites will be evaluated during the EIA phase of the proposed study. During the EIA study additional site-specific groundwater data will be compiled. The data will be obtained from a hydrocensus on the selected sites. It is proposed that due to lack of hydrochemical data, groundwater samples will be collected from existing boreholes, where possible.

Groundwater levels, borehole yields, and usage will be determined to assist in assessing possible impacts on the groundwater resources.

This data plus additional CCGT details will be compiled in a detailed hydrogeological study (a risk assessment) to aid in developing optimal mitigation and management plans to reduce the impact of the CCGT power plant on the groundwater regime.

8.2. Hydrology

8.2.1. Introduction

Bohlweki Environmental appointed SRK Consulting to undertake the necessary hydrological studies for the proposed CCGT power plant in the Amersfoort area, Mpumalanga Province. SRK Consulting have compiled a Screening report (SRK Report Ref. 378710, 24 October 2007), which provided an indication of ideal, acceptable, and sensitive areas within a ± 12 km radius of the Majuba power station, from a hydrology perspective.

The preliminary assessment of suitable sites was based on surface water resources (rivers, streams, dams), vulnerability to potential surface contaminant sources (surface runoff from industry and disturbed areas due to infrastructure due to the drainage density), slope (erosion problems due to steep slopes), problems associated with water supply to the power station, existing land use areas and sensitive areas (wetlands).

The resultant screening data were added to the other specialist inputs (biophysical, social and economic), which allowed for the identification of six (6) candidate sites for assessment during the Scoping phase. This report details an assessment of the candidate sites and provides

recommendations regarding site suitability from a hydrological perspective (refer to Appendix J for the full Scoping Hydrology Specialist Report).

8.2.2. Methodology

The objectives of the scoping report were to conduct a site sensitivity analysis in order to give an indication as to which of the proposed candidate sites would be hydrologically preferential. The principal tasks in assessing the candidate site's suitability were found to be:

- potential flooding;
- slope (including runoff, erosion, waste and pollutant transport);
- generation and transport of industrial and domestic waste;
- availability of water to the CCGT power plant (be more suitably approached in the EIA phase);
- water supply demands to environment and other water users satisfied (be more suitably approached in the EIA Report);
- drainage density (including erosion, waste and pollutant transport);
- wetlands or other fatal flaws; and
- denuded or natural land use *vs* more sophisticated land uses.

In order to determine the most suitable site/s, for the proposed power generation project, a hydrology site comparison was conducted using hydrology specific weighing factors where a value of **1** has a higher importance weighting than a **0.5** value, which has a lower weighting according to a hydrology overview. This methodology is based on a variation of the guidelines provided by the Department of Water Affairs and Forestry – *Protocol for the protection of groundwater from contamination from sanitation practices* (DWAF, 2003). In terms of this methodology each site is given a rating (1 to 5) in terms of sensitivity to the various hydrology elements. Some hydrology elements were considered to be more important and thus were multiplied by an importance factor of 1 and those hydrology elements considered less important were multiplied by an importance factor of 0.5. The total ranking of each site was then averaged using a total of 45 (each hydrology element was multiplied by the highest rating of 5) and percentages calculated. These percentage were then linked to Table 8.4 below, which reflects the hydrology percentage relating to the site preference rating class.

Table 8.4 reflects the hydrology percentage relating to the site preference rating class.

Table 8.4 Hydrology percentage relating to site preference rating class

Site Preference	Hydrology Percentage Relating to Site Preference Rating (SPR) Class
Sensitive (1)	0 - 20%
Not preferred (2)	21 – 40%
Acceptable (3)	41 – 60%
Preferred (4)	61 – 80%
Ideal (5)	81 – 100%

8.2.3. Potential Impacts on Hydrology

Flooding areas and slope were used as the basis for the hydrological sensitivity analysis.

According to best practice and regulations in most municipal areas in South Africa, infrastructure must be built outside the 1 in 100 year floodline. Further, Regulation 704 of the National Water Act (1998) states that all infrastructures must be at least 100 metres from a water course and outside the 1 in 100 year floodline. The reasons for keeping infrastructure out of flooding areas is quite clearly to avoid expensive infrastructural damage, ensure safety of those using the infrastructure, protect water courses from pollution during floods and protect the riparian areas around water courses.

Areas sensitive to flooding were identified as any area within 100m of a river or water body. Full floodline modeling to delineate 1 in 100 year floodlines was not feasible at this stage. Areas more than 100m from a water course but less than 200m were zoned as acceptable. These areas were not ideal as there was a possibility of occasional flooding problems but in general they had a low likelihood of being within the 1 in 100 year floodline.

The slope of an area has a large impact on hydrology. Steeper slopes produce quicker and large storm flows which are more likely to result in erosion and sediment transport. Generally, stormwater flows on steeper slopes are more difficult to control. In terms of Regulation 704 of the National Water Act (1998), stormwater from a site should be contained and treated and clean stormwater flowing onto a site should be diverted around the site. Hence, the control of stormwater and consequently slope influences the degree of environmental impact and as a result the difficulty and expense of mitigating that impact.

8.2.4. Site Preference Rating (SPR)

Table 8.5 below illustrates the site selection comparison in terms of hydrology.

Table 8.5 Site selection comparison

	Scoring in terms of suitability						
Site selection elements	**Site 1**	**Site 2a**	**Site 2b**	**Site 3a**	**Site 3b**	**Site 3c**	**Importance aspect (0-1)**
Flooding	4	3	3	2	3	2	1
Slope (including runoff, waste and pollutant transport)	4	2	3	3	3	2	1
Increased runoff	4	2	2	3	3	2	1
Generation and transport of industrial and domestic waste	3	2	2	2	3	3	1
Availability of water to the CCGT power plant	3	3	3	3	3	3	0.5

	Scoring in terms of suitability						
Site selection elements	**Site 1**	**Site 2a**	**Site 2b**	**Site 3a**	**Site 3b**	**Site 3c**	**Importance aspect (0-1)**
Water supply demands to environment and other water users satisfied	2	2	2	2	2	2	1
Drainage density (including erosion, waste and pollutant transport)	3	3	2	3	4	3	0.5
Wetlands or other fatal flaws	4	5	5	5	4	4	1
Denuded or natural land use *vs* more sophisticated land uses.	3	3	4	3	3	3	0.5
Subtotal	25.5	20.5	21.5	21.5	23	19.5	(45)
Percentage	68	55	57	57	61	52	
Ranking	**4**	**3**	**3**	**3**	**4**	**3**	

8.2.5. Conclusions

All the candidate sites were assessed in the Scoping Study by way of a hydrology weighted scoring system. This method resulted in Sites 1 being the best suited for the proposed construction of the CCGT power plant. Site 3b and Site 2b were ranked second and third respectively in terms of sites selected for the development of the CCGT power plant. In saying that Site 1, 2b and 3b were found to be the most favourable, certain environmental concerns still have to be adhered to, such as building the proposed plant outside of the flooding zone, containing storm water flows and thus controlling the erosion, pollutants as well as the industrial and domestic wastes generated from the proposed plant. Another concern with Site 1 is that it must be built at least 100 m away from the wetland to the south.

8.2.6. Recommendations

It is recommended that a full EIA study be done with Site 1 specifically in mind. This process will entail a thorough examination of the site, and from a hydrology perspective, making informed assessments as to the repercussions of the proposed CCGT power plant on the surface water resources locally and regionally with a view of both the primary and secondary effects.

The plan for the EIA study from a hydrological viewpoint should entail the following:

- site visit to assess local hydrology;
- review water supply details to the CCGT plant – inter-catchment transfer schemes taken into account and incorporating an accurate water balance for the plant;
- assessing the local climate;

- pre- and post development description of the hydrology, focussing on mean annual runoff, peak flows and volumes, drainage density and water quality studies including sampling and utilising the DWAF databases;
- assessing the local infrastructure, including the dams in the vicinity, their size, their specific water uses and what the probability of breaking or not with the increased water supply needed in the area. The dams supplying the CCGT plant will be included in the water balance as well. The dams will need to be assessed in terms of the long term impacts, with the dam being required to be fuller, of the increased discharge from the dam. The infrastructure will also include what stormwater management systems would have to be implemented to contain stormwater flows in accordance with Regulation 704 of the National Water Act, 1998;
- controlling erosion, pollutants as well as industrial and domestic waste;
- assess if there are any fatal flaws or environmental conflicts; and
- the downstream water users would need to be considered in terms of water availability, water quality and their ability to continue with their livelihoods.

8.3. Flora

8.3.1. Introduction

The increase in human demand for space and life-supporting resources results in the rapid loss of natural open space in South Africa. When natural systems are rezoned for development, indigenous flora are replaced by exotic species and converted to sterile landscapes with no dynamic propensity or intrinsic ecological value (Wood *et al.,* 1994). The proposed project may result in the disturbance and/or loss of approximately 100ha of grassland of varying status, depending on the final site selection. This section will focus on highlighting areas that are regarded sensitive and therefore not suitable for the proposed development (refer to Appendix J for the full Scoping Biodiversity Specialist Report).

8.3.2. Methodology

- ***Floristic Habitat Attributes and Status***

The physical environment was briefly inspected during a site visit in November 2007 and visual observations pertaining to the various ecological attributes of the proposed sites and surrounding habitat were made. Part of the results presented in this section is based on available GIS information and reflects a low level of available detail for the study area. The objectives of this study are therefore to obtain a basic overview of floristic variations and the general status of habitat types likely to be affected by the proposed development.

A desktop analysis of available biotic and biophysical attributes of the proposed corridors (and alternative alignments) was performed whereby the following databases were consulted:

- regional vegetation (Mucina and Rutherford, 2006);
- land cover classes;
- relief (20 m contour interval);
- wetlands, rivers, drainage lines and other impoundments (based on ENPAT, 2001);

- protected and conservation areas; and
- settlement and transformed areas.

These databases were utilised to identify areas that constitute:

- natural vegetation;
- areas of environmental sensitivity;
- areas likely to sustain floristic species of importance; and
- protected areas.

The likely presence of threatened, near-threatened and conservation important taxa were based on the presence of suitable habitat and through various field guides and atlases. Distribution records, obtained from SANBI (2007) were also consulted. The Probability of Occurrence of conservation important taxa was based on their respective geographical area of occupancy (rather than the extent of occupancy) and habitat suitability.

A subjective impact rating was attributed to each of the sites for the expected significance of potential impacts, based on the status and conservation potential of the observed floristic attributes present on the site and in the immediate surrounds. These ratings were:

High	1 (severe impacts, not mitigatable, fatal flaw);
Medium-high	2 (severe impacts, intensive/ costly mitigations measures);
Medium	3 (moderate impacts, mitigatable);
Medium-low	4 (moderate impacts, highly mitigatable); and
Low	5 (low/ no impacts)

Ranking each site in terms of the above criteria resulted in a floral score equating to the site preference rating class that highlighted areas that are regarded more or less ideal for the proposed development. The suitability of respective sites will generally exhibit the following characteristics:

Table 8.6 Floral score relating to site preference rating class

Site Preference	SPR (general flora description)	Floral score equating to SPR class
Sensitive (1)	The vegetation is in pristine or near pristine state. Very little/ no signs of disturbance are present. The floristic diversity is high with several species of concern known to be present/ potentially present. Ecological functioning is intact and low fragmentation and isolation factors are attributed. The conservation importance is high.	5-8
Not Preferred (2)	The vegetation is in a good condition with little evidence of disturbances/ degradation. Species diversity is high and moderately high Red Data (RD) probabilities are attributed. The ecological functioning is intact and very little rehabilitation is needed. Low fragmentation and isolation factors are attributed. The	9-12

Site Preference	SPR (general flora description)	Floral score equating to SPR class
	area is of medium conservation importance.	
Acceptable (3)	Vegetation is moderately degraded, but natural vegetation does occur in some places. Medium floristic species diversity is present with moderate RD probabilities. Invasive plants are present but at low densities. The inherent ecological function is still intact but may be compromised by the current levels of degradation if not managed properly. Successful rehabilitation of the area is possible, but costly. Moderate fragmentation and isolation factors are attributed. The conservation value is regarded moderate.	13-16
Preferred (4)	Vegetation is largely transformed and degraded, exhibiting low floristic species diversity, weeds and invasive plants present, low RD probabilities. The ecological function is compromised and a low conservation value is attributed. The potential for successful rehabilitation is however moderate-low. High fragmentation and isolation factors are attributed.	17-20
Ideal (5)	Vegetation is entirely transformed or in a degraded state, exhibiting low species diversity, extensive weeds and aliens, low RD species probability. The area has little inherent ecological functionality left and is entirely fragmented and isolated. Low/no conservation value with low potential for successful rehabilitation.	21-25

8.3.3. Potential Impacts on Flora

The following impacts were identified that could potentially affect the floristic environment adversely:

- *Destruction of threatened species and habitat*
  The loss of threatened/ protected species or habitat that is regarded suitable for these species is a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as they generally occur in low numbers, but they are extremely important in terms of the biodiversity of an area and a high conservation value is placed on the presence of such species.

- *Destruction of sensitive habitat types (outcrops, riparian fringes, non-perennial streams, river, etc.)*

Sensitive habitat types include ridges, outcrops, riparian habitat and localised floristic variations of significant physiognomic variation and species composition. These areas represent centres of atypical habitat and comprising biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is attributed to the floristic communities of these areas as they contribute significantly to the biodiversity of a region.

- *Destruction of pristine habitat*
  The largest extent of the study area comprises natural grassland habitat. It is however not considered pristine throughout the area and over utilisation, high grazing pressure and poor management strategies led to changes in species composition and depletion of the herbaceous layer. Aspects such as the degree of grazing, visible erosion and infestation by alien plant species are taken into account in this section.

- *Changes in the local and regional biodiversity*
  Transformation of grassland habitat during the construction process will inevitably result in the creation of atypical and artificial habitat types that are not considered representative of the regional vegetation. Due to the severity of transformation, surrounding areas are frequently invaded by shrubs and alien species not generally associated with the area.

- *Impacts on surrounding natural habitat and species*
  A possibility exists that surrounding areas and species present in surrounding areas could be affected by impacts resulting from construction and operational activities. These impacts could include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species. Areas that are particularly prone to this impact include riparian zones where impacts that affect the water quality results in impacts further downstream.

8.3.4. Site Preference Rating

Table 8.7 Site preference ranking according to floristic sensitivity

	Scoring in terms of suitability					
Site selection elements	**Site 1**	**Site 2a**	**Site 2b**	**Site 3a**	**Site 3b**	**Site 3c**
Threatened species	3	3	2	4	4	3
Landscape sensitivity	2	3	3	3	4	3
Pristine habitat	3	2	2	4	4	2
Habitat transformation	4	2	2	4	5	2
Surrounding habitat	5	2	2	5	5	3
SPR	**17**	**12**	**11**	**20**	**22**	**13**
Ranking	**4**	**2**	**2**	**4**	**5**	**3**

8.3.5. Conclusions and Recommendations

Areas that constitute pristine natural grasslands, rocky outcrops and riparian are not regarded suitable for the proposed development. Conversely, the proposed sample plots that are characterised by, or situated in close proximity to transformed and degraded habitat will be regarded more suitable for the proposed development. Site 3b has been identified as being the best suited site for the proposed construction of the CCGT power plant. Site 1 and Site 3c were ranked second and third respectively from a floral perspective.

Biodiversity aspects that should be taken into account in selecting a suitable site include environmental attributes that renders an area sensitive, including:

- the potential/ confirmed presence of Red Data flora or fauna species;
- the presence of sensitive habitat types;
- untransformed regional vegetation types;
- areas that are generally regarded as sensitive (ridges, outcrops, rivers, wetlands, etc.); and

Conversely, utilising areas that are already transformed, or situated in close proximity to such areas, is regarded a good approach.

By eliminating biologically sensitive areas, likely impacts on the biological environment will be minimised to a large extent.

In selected cases it is unavoidable to impact on sensitive areas, such riparian zones. In this case the use of buffer zones, strict mitigation measures and monitoring programmes are recommended.

8.4. Fauna

8.4.1. Introduction

The study area incorporates natural grassland, transformed areas (mainly maize fields), outcrops and wetlands. Significant differences in faunal composition, and ultimately faunal sensitivity, is therefore expected to exist between the various sites.

The proposed development may result in the disturbance and/or loss of approximately 100ha of grassland of varying status, depending on the final site selection. This section will focus on highlighting areas that are regarded sensitive in terms of faunal attributes and therefore not regarded suitable for the proposed project (refer to Appendix J for the full Scoping Biodiversity Specialist Report).

8.4.2. Methodology

- ***Status of available faunal habitat***

The study area was investigated during a short site visit conducted in November 2007. Results presented in this section are based on available literature and the brief examination of the study area; it does not include any results obtained from detailed trappings and active searches periods. The aim is purely to assess available habitat and the status thereof in terms of faunal attributes; knowledge of habitat requirements of sensitive species is used extensively to determine the relative faunal sensitivity of each proposed site.

Desktop analyses of potential Red Data fauna inhabitants were compiled using:

- Invertebrates – IUCN 2004 Red Data list;
- Amphibians – Atlas and Red Data book of the frogs of South Africa;
- Reptiles – IUCN 2004 Red Data list;
- Birds – Roberts Multimedia Birds; and
- Mammals – Red Data Book of the Mammals of South Africa – a conservation assessment.

An assessment of the potential habitat available is based on the vegetation assessment relevant to this project. The Probability of Occurrence of Red Data taxa were based on known geographical distribution and habitat suitability.

A subjective rating was attributed to each of the sites for the respective impacts, based on the status of available faunal habitat on the site, as well as in the immediate surrounds. These ratings were:

High	1 (severe impacts, not mitigatable, fatal flaw);
Medium-high	2 (severe impacts, intensive/ costly mitigations measures);
Medium	3 (moderate impacts, mitigatable);
Medium-low	4 (moderate impacts, highly mitigatable); and
Low	5 (low/ no impacts)

Ranking each site in terms of the above criteria resulted in a faunal score equating to the site preference rating class that highlighted areas that are regarded more or less ideal for the proposed development. The suitability of respective sites will generally exhibit the following characteristics:

Table 8.8 Faunal score relating to site preference rating class

Site Preference	SPR (general fauna description)	Faunal score equating to SPR class
Sensitive (1)	Available habitat is in pristine or near pristine state and suitable for diverse faunal assemblages. Very little/ no signs of disturbance are present. The faunal diversity is high with several species of concern known to be present/ potentially present. Ecological functioning is intact and low fragmentation and isolation factors are attributed. The conservation importance is high.	5-8
Not Preferred (2)	Available habitat is in a good condition with little evidence of disturbances/ degradation. Faunal species diversity is high and moderately high RD probabilities are attributed. Frequent evidence of faunal presence is noted. The ecological functioning is intact and very little rehabilitation is needed. Low fragmentation and isolation factors are attributed. The area is of medium conservation importance.	9-12
Acceptable (3)	Available habitat is moderately degraded, but natural habitat does occur in some places. Medium faunal diversity is noted with some evidence of faunal presence. Moderate RD probabilities are estimated. The inherent ecological function is still intact but may be compromised by the current levels of degradation if not managed. Successful rehabilitation of the area is possible, but costly. Moderate fragmentation and isolation factors are attributed. The conservation value is regarded moderate.	13-16
Preferred (4)	Available habitat is largely transformed and degraded, exhibiting low faunal diversity or evidence of diverse faunal assemblages with low RD faunal probabilities. The ecological function is compromised and a low conservation value is attributed. The potential for successful rehabilitation is however moderate-low. High fragmentation and isolation factors are attributed.	17-20
Ideal (5)	Available habitat is entirely transformed or in a degraded state, exhibiting low faunal species diversity or evidence of the presence of diverse faunal assemblages and low RD fauna probability. The area has little inherent ecological functionality left and is entirely fragmented and isolated. Low/no conservation value with low potential for successful rehabilitation.	21-25

8.4.3. Potential Impacts on Fauna

The following impacts were identified that will affect the faunal habitat adversely:

- *Destruction of threatened species and habitat*
  The loss of threatened/ protected species or habitat that is regarded suitable for these species is a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as they generally occur in low numbers, but they are extremely important in terms of the biodiversity of an area and a high conservation value is placed on the presence of such species.

- *Destruction of sensitive habitat types (outcrops, riparian fringes, non-perennial streams, river, etc.)*
  Sensitive habitat types include ridges, outcrops, riparian habitat and localised faunal habitat. These areas represent centres of atypical habitat, comprising biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is attributed to the faunal assemblages of these areas as they contribute significantly to the biodiversity of a region.

- *Destruction of pristine habitat*
  The largest extent of the study area comprises natural grassland habitat. It is however not considered pristine throughout the area and over utilisation, high grazing pressure and poor management strategies led to changes in species composition and depletion of the herbaceous layer. Aspects such as the degree of grazing, visible erosion and infestation by alien plant species are taken into account in this section. Degradation factors therefore influences the faunal sensitivities of the region and immediate surrounds adversely.

- *Changes in the local and regional biodiversity*
  Transformation of natural habitat during the construction process will inevitably result in the creation of atypical and artificial habitat types that are not considered representative of the region and also not particularly suitable to natural faunal assemblages.

- *Impacts on surrounding natural habitat and species*
  The possibility exists that surrounding areas and species present in surrounding areas could be affected by impacts resulting from construction and operational activities. These impacts could include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species. Areas that are particularly prone to this impact include riparian zones where impacts that affect the water quality results in impacts further downstream.

8.4.4. Site Preference Rating

Table 8.9 Site preference ranking according to faunal sensitivity

	Scoring in terms of suitability					
Site selection elements	**Site 1**	**Site 2a**	**Site 2b**	**Site 3a**	**Site 3b**	**Site 3c**
Threatened species	4	1	1	3	5	3
Landscape sensitivity	3	1	1	3	5	2
Pristine habitat	3	2	2	3	5	2
Habitat transformation	3	2	2	3	5	3
Surrounding habitat	3	2	2	3	5	3
SPR	**16**	**8**	**8**	**15**	**25**	**13**
Ranking	**3**	**1**	**1**	**3**	**5**	**3**

8.4.5. Conclusions and Recommendations

Areas that constitute pristine natural grasslands, rocky outcrops and riparian zones are not regarded suitable for the proposed development. Conversely, the proposed sample plots that are characterised by, or situated in close proximity to transformed and degraded habitat is regarded more suitable for the proposed development. Site 3b has been identified as being the best suited site for the proposed construction of the CCGT power plant. Site 1 and Site 3c were ranked second and third respectively from a faunal perspective.

The conservation of areas that are suitable for Red Data species and pristine faunal habitat represents the main focus of conservation strategies, although not the only objectives. Early identification and elimination of these areas from the selection process is therefore critical. From the preliminary results it is therefore evident that Sites 2a and 2b are not regarded suitable in terms of faunal attributes. The loss of these areas is expected to affect faunal diversity on a local and regional scale, in spite of the relative small size of the areas. The use of either of the remaining sites is therefore recommended with suitable mitigation measures to protect surrounding sensitive habitat.

Site 3b is therefore ideal for the placement of the CCGT power plant with Sites 1; 3a and 3c being acceptable from a faunal perspective.