6 RECEIVING ENVIRONMENT

6.1 Introduction

According to section 28(e) of the NEMA Regulations, this section includes a description of the baseline environment that may be affected by the proposed activity and the manner in which the biophysical, social, economic and cultural aspects of the environment may be affected by the proposed activity as well as a description of the environmental issues that were identified and assessed during the impact assessment process.

6.2 Study Area in Regional Context

6.2.1 Locality

Tutuka Power Station is located approximately 25 km north-north-east (NNE) of Standerton in the Mpumalanga Province (**Figure 6.1**). The power station falls within the Lekwa Local Municipality which falls within the Gert Sibande District Municipality (**Figure 6.2**).

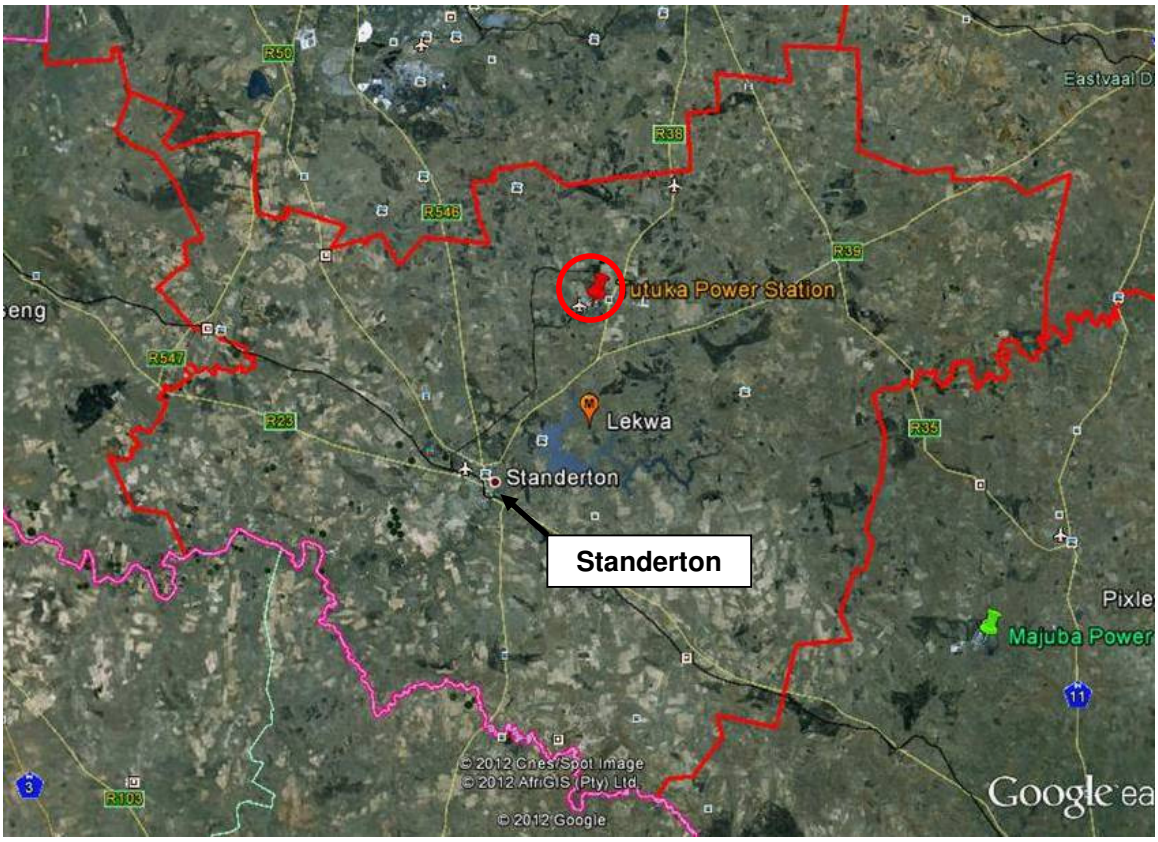

Figure 6.1: Location of Tutuka Power Station within the Lekwa Local Municipality

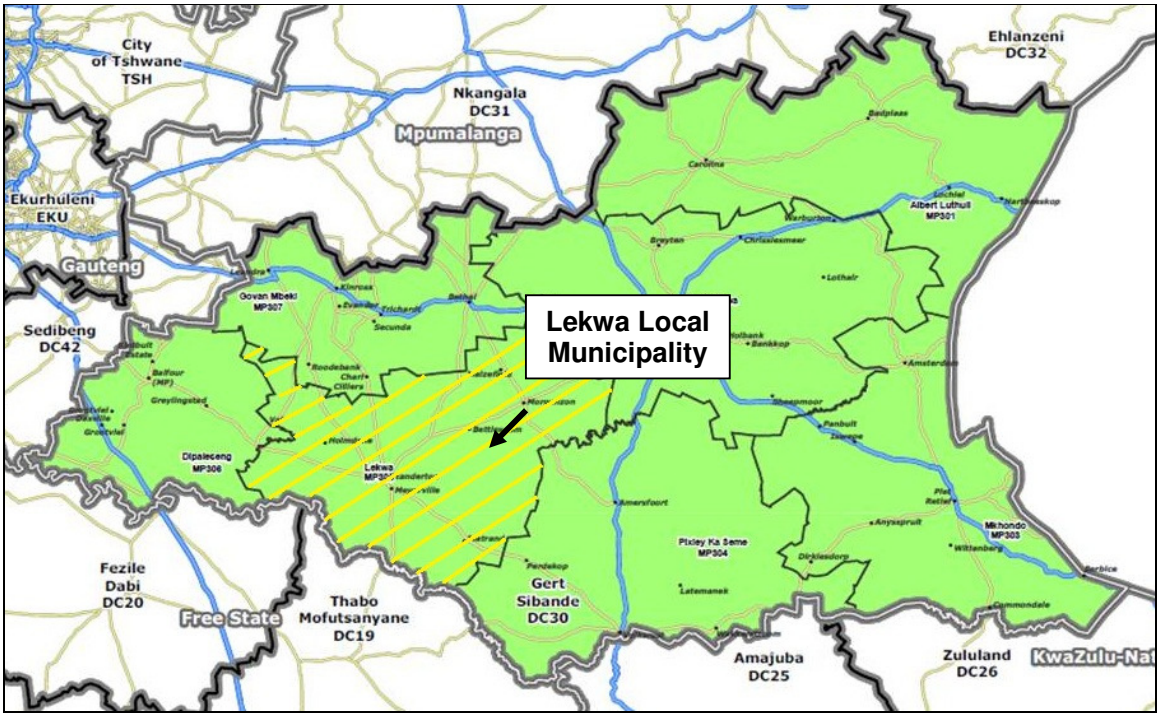

Figure 6.2: Location of Lekwa Local Municipality within the Gert Sibande District Municipality

6.2.2 Study Area

The study area comprises all land within a radius of 8 km from the power station, as this area was assessed in order to identify potential alternatives sites. The 8km radius was deemed to be a feasible radius within which the ashing operations can take place.

The original area proposed by Eskom for the continuous ashing facility is approximately 800 ha, for the remaining life of 41 years for this power station, which is located on the eastern and southern portion of the existing Tutuka Power Station ash disposal facility. This area would form a continuation of the current ashing activities, which are in line with Eskom's historical plans for ashing. This area was incorporated into the EIA process as *Alternative A* after undergoing the appropriate site selection process.

The Tutuka Continuous Ashing EIA study area is therefore located within the 8 km radius around the source of ash, within the Tutuka Power Station (**Figure 6.3**). The study area is approximately 200 square kilometres in size and includes a total of 24 different farms divided into 128 farm portions. A list of the affected farm portions is included in **Table 6.1**.

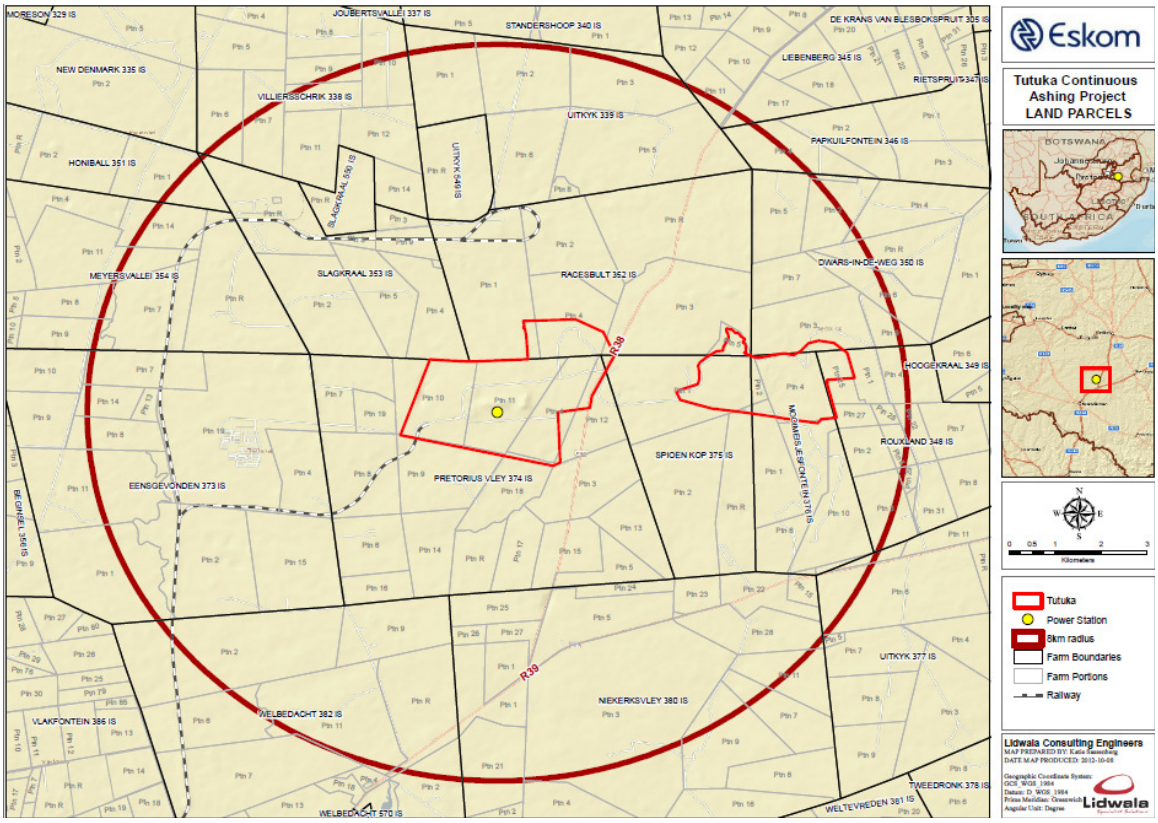

Figure 6.3: Tutuka Continuous Ashing EIA Study Area (indicating both the power station and the existing ashing area to the East)

Table 6.1: Farm Portions situated within the Tutuka Continuous Ashing EIA Study Area

SG Code	Farm No.	Portion No.	Farm Name
T0IS00000000033900005	339	5	UITKYK 339 IS
T0IS00000000033900006	339	6	UITKYK 339 IS
T0IS00000000033900008	339	8	UITKYK 339 IS
T0IS00000000033900009	339	9	UITKYK 339 IS
T0IS00000000034500011	345	11	LIEBENBERG 345 IS
T0IS00000000038200000	382	R	WELBEDACHT 382 IS
T0IS00000000038200002	382	2	WELBEDACHT 382 IS
T0IS00000000038200002	382	2	WELBEDACHT 382 IS
T0IS00000000038200006	382	6	WELBEDACHT 382 IS
T0IS00000000038200009	382	9	WELBEDACHT 382 IS
T0IS00000000038200011	382	11	WELBEDACHT 382 IS
T0IS00000000034600004	346	4	PAPKUILFONTEIN 346 IS
T0IS00000000034800002	348	2	ROUXLAND 348 IS
T0IS00000000034800003	348	3	ROUXLAND 348 IS
T0IS00000000034800004	348	4	ROUXLAND 348 IS
T0IS00000000034800005	348	5	ROUXLAND 348 IS
T0IS00000000037300002	373	2	EENSGEVONDEN 373 IS
T0IS00000000037300004	373	4	EENSGEVONDEN 373 IS

SG Code	Farm No.	Portion No.	Farm Name
T0IS00000000037300007	373	7	EENSGEVONDEN 373 IS
T0IS00000000037300008	373	8	EENSGEVONDEN 373 IS
T0IS00000000037300011	373	11	EENSGEVONDEN 373 IS
T0IS00000000037300011	373	11	EENSGEVONDEN 373 IS
T0IS00000000037300013	373	13	EENSGEVONDEN 373 IS
T0IS00000000035400007	354	7	MEYERSVALLEI 354 IS
T0IS00000000035400008	354	8	MEYERSVALLEI 354 IS
T0IS00000000033800006	338	6	VILLIERSSCHRIK 338 IS
T0IS00000000033800007	338	7	VILLIERSSCHRIK 338 IS
T0IS00000000033800009	338	9	VILLIERSSCHRIK 338 IS
T0IS00000000033800010	338	10	VILLIERSSCHRIK 338 IS
T0IS00000000033800011	338	11	VILLIERSSCHRIK 338 IS
T0IS00000000033800012	338	12	VILLIERSSCHRIK 338 IS
T0IS00000000033800013	338	13	VILLIERSSCHRIK 338 IS
T0IS00000000033800014	338	14	VILLIERSSCHRIK 338 IS
T0IS00000000033900001	339	1	UITKYK 339 IS
T0IS00000000033900002	339	2	UITKYK 339 IS
T0IS00000000033900003	339	3	UITKYK 339 IS
T0IS00000000034500017	345	17	LIEBENBERG 345 IS
T0IS00000000034500032	345	32	LIEBENBERG 345 IS
T0IS00000000034800001	348	1	ROUXLAND 348 IS
T0IS00000000034800022	348	22	ROUXLAND 348 IS
T0IS00000000034800025	348	25	ROUXLAND 348 IS
T0IS00000000034800027	348	27	ROUXLAND 348 IS
T0IS00000000034800028	348	28	ROUXLAND 348 IS
T0IS00000000034800029	348	29	ROUXLAND 348 IS
T0IS00000000035000000	350	R	DWARS-IN-DE-WEG 350 IS
T0IS00000000035000002	350	2	DWARS-IN-DE-WEG 350 IS
T0IS00000000035000003	350	3	DWARS-IN-DE-WEG 350 IS
T0IS00000000035000004	350	4	DWARS-IN-DE-WEG 350 IS
T0IS00000000035000005	350	5	DWARS-IN-DE-WEG 350 IS
T0IS00000000035000006	350	6	DWARS-IN-DE-WEG 350 IS
T0IS00000000035000007	350	7	DWARS-IN-DE-WEG 350 IS
T0IS00000000035000009	350	9	DWARS-IN-DE-WEG 350 IS
T0IS00000000035100001	351	1	HONIBALL 351 IS
T0IS00000000035200000	352	R	RACESBULT 352 IS
T0IS00000000035200001	352	1	RACESBULT 352 IS
T0IS00000000035200002	352	2	RACESBULT 352 IS
T0IS00000000035200003	352	3	RACESBULT 352 IS
T0IS00000000035200004	352	4	RACESBULT 352 IS
T0IS00000000035200005	352	5	RACESBULT 352 IS
T0IS00000000035300000	353	R	SLAGKRAAL 353 IS
T0IS00000000035300002	353	2	SLAGKRAAL 353 IS
T0IS00000000035300003	353	3	SLAGKRAAL 353 IS
T0IS00000000035300004	353	4	SLAGKRAAL 353 IS

SG Code	Farm No.	Portion No.	Farm Name
T0IS00000000035300005	353	5	SLAGKRAAL 353 IS
T0IS00000000035300006	353	6	SLAGKRAAL 353 IS
T0IS00000000035300007	353	7	SLAGKRAAL 353 IS
T0IS00000000035300008	353	8	SLAGKRAAL 353 IS
T0IS00000000035300009	353	9	SLAGKRAAL 353 IS
T0IS00000000035400000	354	R	MEYERSVALLEI 354 IS
T0IS00000000035400009	354	9	MEYERSVALLEI 354 IS
T0IS00000000035400011	354	11	MEYERSVALLEI 354 IS
T0IS00000000035400014	354	14	MEYERSVALLEI 354 IS
T0IS00000000038000003	380	3	NIEKERKSVLEY 380 IS
T0IS00000000038000005	380	5	NIEKERKSVLEY 380 IS
T0IS00000000038000007	380	7	NIEKERKSVLEY 380 IS
T0IS00000000038000009	380	9	NIEKERKSVLEY 380 IS
T0IS00000000038000011	380	11	NIEKERKSVLEY 380 IS
T0IS00000000038000015	380	15	NIEKERKSVLEY 380 IS
T0IS00000000038000018	380	18	NIEKERKSVLEY 380 IS
T0IS00000000038000021	380	21	NIEKERKSVLEY 380 IS
T0IS00000000038000022	380	22	NIEKERKSVLEY 380 IS
T0IS00000000038000023	380	23	NIEKERKSVLEY 380 IS
T0IS00000000038000024	380	24	NIEKERKSVLEY 380 IS
T0IS00000000038000025	380	25	NIEKERKSVLEY 380 IS
T0IS00000000038000026	380	26	NIEKERKSVLEY 380 IS
T0IS00000000038000027	380	27	NIEKERKSVLEY 380 IS
T0IS00000000037300001	373	1	EENSGEVONDEN 373 IS
T0IS00000000037300014	373	14	EENSGEVONDEN 373 IS
T0IS00000000037300015	373	15	EENSGEVONDEN 373 IS
T0IS00000000037300019	373	19	EENSGEVONDEN 373 IS
T0IS00000000037400000	374	R	PRETORIUS VLEY 374 IS
T0IS00000000037400003	374	3	PRETORIUS VLEY 374 IS
T0IS00000000037400004	374	4	PRETORIUS VLEY 374 IS
T0IS00000000037400005	374	5	PRETORIUS VLEY 374 IS
T0IS00000000037400006	374	6	PRETORIUS VLEY 374 IS
T0IS00000000037400007	374	7	PRETORIUS VLEY 374 IS
T0IS00000000037400008	374	8	PRETORIUS VLEY 374 IS
T0IS00000000037400009	374	9	PRETORIUS VLEY 374 IS
T0IS00000000037400010	374	10	PRETORIUS VLEY 374 IS
T0IS00000000037400011	374	11	PRETORIUS VLEY 374 IS
T0IS00000000037400012	374	12	PRETORIUS VLEY 374 IS
T0IS00000000037400013	374	13	PRETORIUS VLEY 374 IS
T0IS00000000037400014	374	14	PRETORIUS VLEY 374 IS
T0IS00000000037400015	374	15	PRETORIUS VLEY 374 IS
T0IS00000000037400016	374	16	PRETORIUS VLEY 374 IS
T0IS00000000037400017	374	17	PRETORIUS VLEY 374 IS
T0IS00000000037400018	374	18	PRETORIUS VLEY 374 IS
T0IS00000000037400019	374	19	PRETORIUS VLEY 374 IS

SG Code	Farm No.	Portion No.	Farm Name
T0IS00000000037500000	375	R	SPIOEN KOP 375 IS
T0IS00000000037500001	375	1	SPIOEN KOP 375 IS
T0IS00000000037500002	375	2	SPIOEN KOP 375 IS
T0IS00000000037600001	376	1	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600002	376	2	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600003	376	3	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600004	376	4	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600005	376	5	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600006	376	6	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600006	376	6	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600007	376	7	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037600010	376	10	MOOIMEISJESFONTEIN 376 IS
T0IS00000000037700005	377	5	UITKYK 377 IS
T0IS00000000037700006	377	6	UITKYK 377 IS
T0IS00000000037700012	377	12	UITKYK 377 IS
T0IS00000000038000001	380	1	NIEKERKSVLEY 380 IS
T0IS00000000038000001	380	1	NIEKERKSVLEY 380 IS
T0IS00000000038000028	380	28	NIEKERKSVLEY 380 IS
T0IS00000000055000000	550	R	SLAGKRAAL 550 IS
T0IS00000000054900000	549	R	UITKYK 549 IS

6.3 Description of the Baseline Environment

6.3.1 Topography

The study area is characterised by the strong undulating character typical of the Mpumalanga province with low ridges east of the study area. The natural topography of the area has been disturbed as a result of various agricultural and power generation activities.

6.3.2 Climate

The climate in the study area can be described as typical highveld conditions with summers that are moderate and wet, while winters are cold and dry. Severe frost and snow are sometimes experienced. The area also falls within the mist belt.

The mean annual precipitation is approximately 580 mm/year, with rain experienced predominantly in the summer months (October to April). **Figure 6.4** shows the monthly rainfall for the study area experienced during the period August 2011 to July 2012 (as measured at the Grootdraaidam monitoring site).

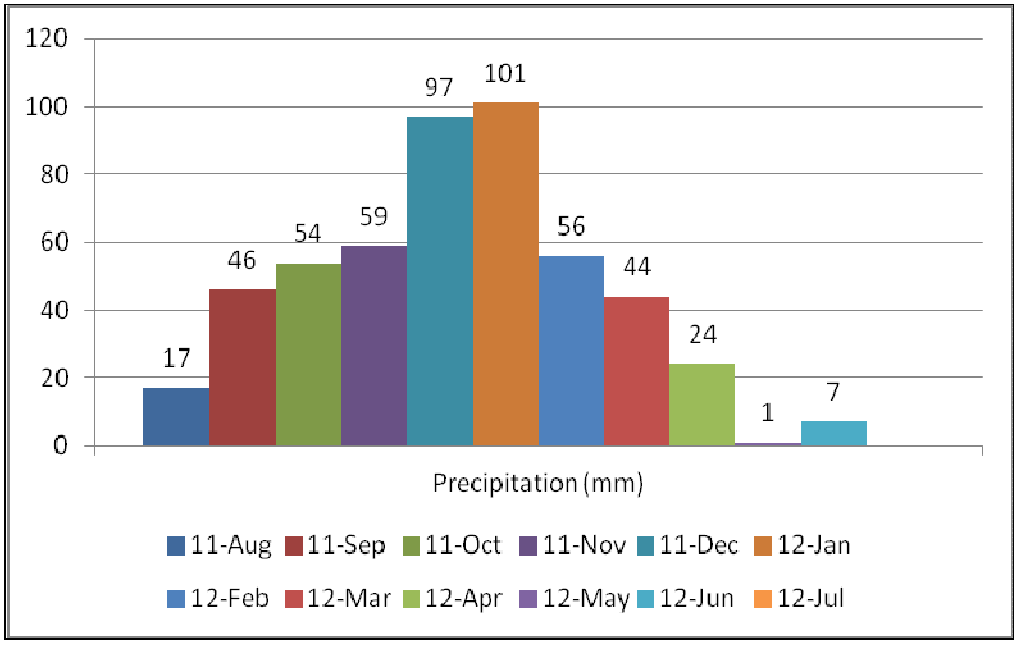

Figure 6.4: The monthly rainfall as measured at the Grootdraaidam monitoring site during the period August 2011 to July 2012

Annual average maximum, minimum and mean temperatures for the study area are given as 31.5°C, 0.9°C and 15.3°C, respectively, based on the measured data at the Eskom Grootdraaidam monitoring site for the period 2009-2011. Average daily maximum temperatures range from 35.7°C in October to 24.5°C in July, with daily minima ranging from 11.7°C in January to -9.8°C in June (**Figure 6.5**).

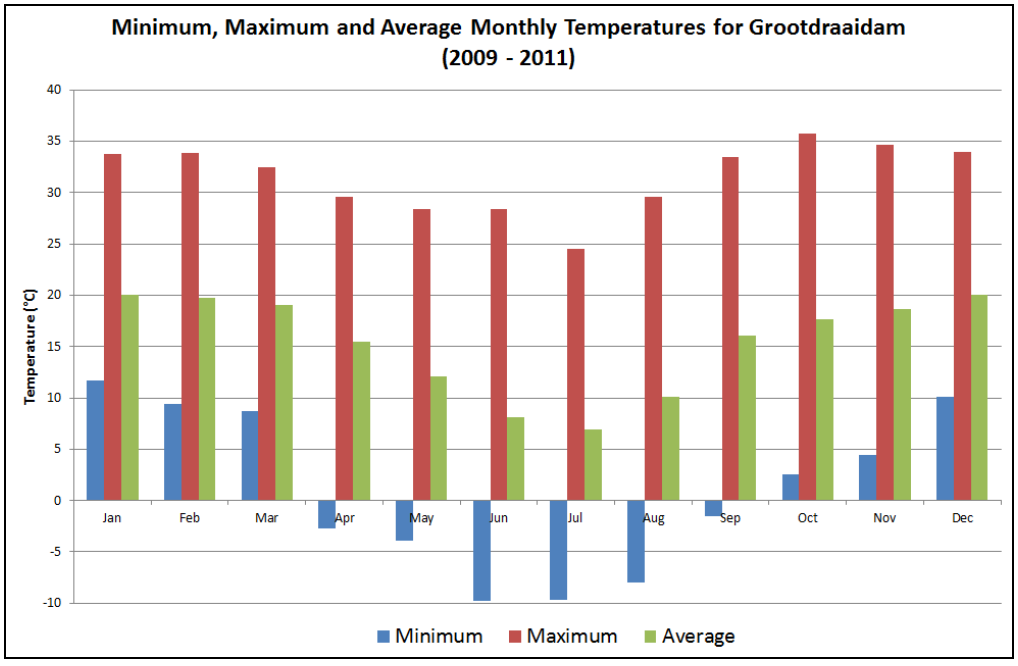

Figure 6.5: Average monthly maximum, minimum and mean temperatures measured at the Grootdraaidam monitoring site

The prevailing wind direction is recorded as being east-south-easterly winds. **Figure 6.6** shows the period, day-time and night-time wind roses for the Tutuka Power Station.

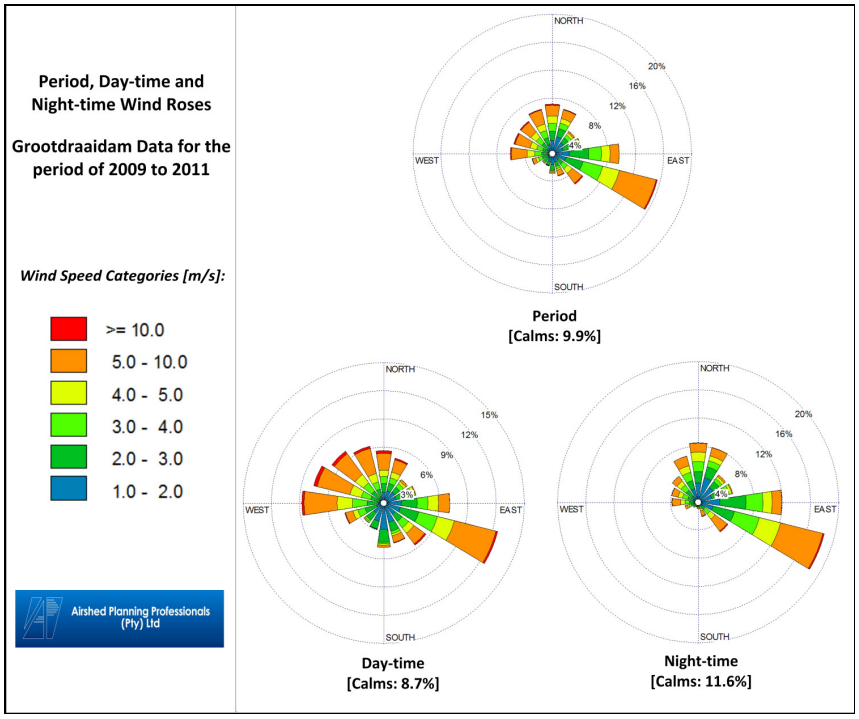

Figure 6.6: Period, day-time and night-time wind roses for the Tutuka Power Station

6.3.3 Geology

Tutuka Power Station and surrounding area (8 km radius) is underlain by rocks of Permian to Jurassic age **Figure 6.7.** More specifically:

- Permian Ecca Group - Vryheid Formation;
- Karoo Supergroup – Karoo Dolerite.

- ***Vryheid Formation***

  The Vryheid Formation is made up of various lithofacies arranged in up-ward coarsening cycles which are essentially deltaic in origin. The formation can generally be divided into a lower fluvial dominated deltaic interval, a middle fluvial interval and an upper fluvial-dominated deltaic interval which are associated with 'lower sandstone unit, 'coal zone' and 'upper sandstone unit' (Johnson et al, 2006). In the vicinity of Tutuka the geology is mainly arenaceous sandstone.

- ***Karoo Dolerite***

  The area in the vicinity of Tutuka (and on a wider scale) is intruded by a network of dykes, sills and discordant sheets that are well developed in the sedimentary sequences (Johnson et al, 2006). The intrusions predominately consist of ultramafic /

mafic rocks consisting of dolerite, diabase, gabbro, norite, carbonatite, anorthosite and pyroxenite.

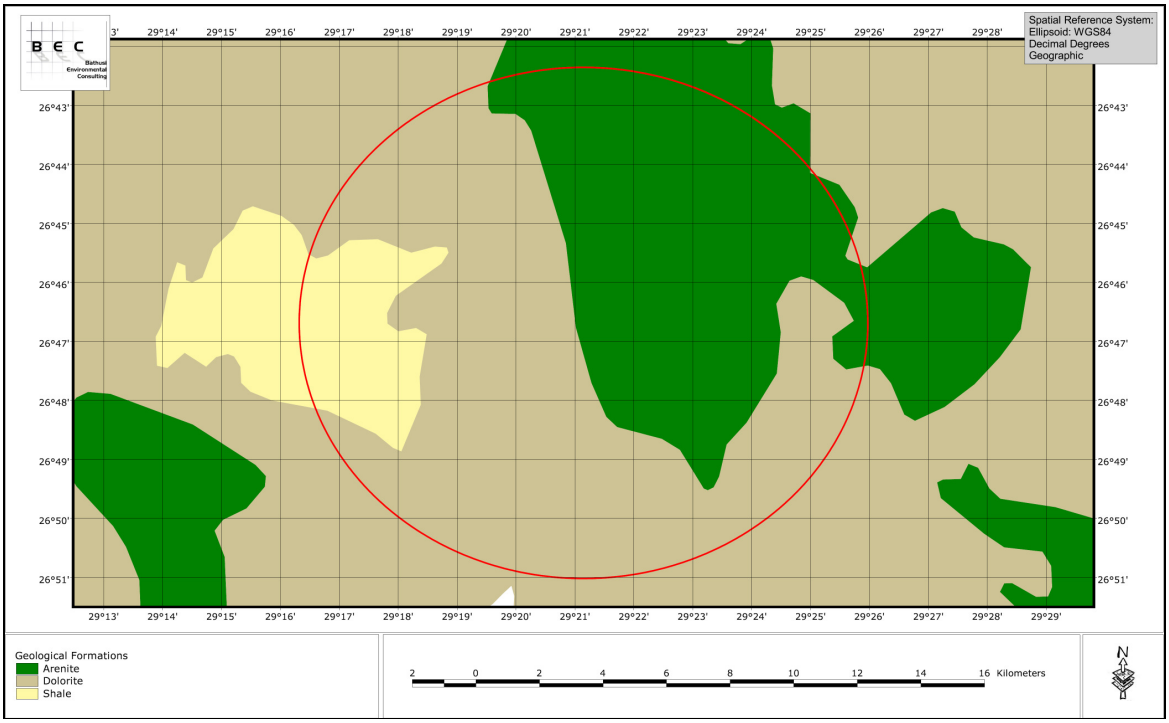

Figure 6.7: Geology of the Study area

6.3.4 Land Cover and Land Use

Land cover categories are presented in **Figure 6.8**. For the purpose of this assessment, land cover are loosely categorised into classes that represent natural habitat and categories that contribute to habitat degradation and transformation on a local or regional scale. In terms of the importance for biodiversity, the assumption is that landscapes exhibiting high transformation levels are normally occupied by plant communities and faunal assemblages that do not necessarily reflect the original or pristine status. This is particularly important in the case of conservation important taxa as these plants and animals generally exhibit extremely low tolerances levels towards disturbances. This is one of the main reasons for the threatened status of these species. Changes in the natural environment available to these species are therefore likely to result in severe impacts on these species and, subsequently, their conservation status.

Three important aspects are associated with habitat changes that accompany certain land uses. Permanent transformation of natural habitat by land uses such as agriculture, mining and urbanisation results in the permanent decimation of available habitat as these areas will not recover to the original pristine status. A second aspect of habitat transformation or degradation is that it affects species directly, namely changes in species presence/ absence and –composition. This result from the exodus of species for which habitat conditions have become unfavourable, the decrease in abundance of certain

species because of decreased habitat size, or an influx of species that are better adapted to the altered environment. While some, or most, of the new species that occupy an area might be indigenous, they are not necessarily endemic to the affected area. Lastly, a larger threat to the natural biodiversity of a region is represented by the influx of invasive exotic species that can effectively sterilise large tracts of remaining natural habitat.

The study area is situated within the Lekwa Municipality, which comprises a total of 458,519ha. The BGIS (2007) assessment indicates that approximately 63.8% of the municipality are currently considered untransformed. This figure is however regarded an overestimation of the true extent of remaining natural (pristine) grassland habitat in the region. This statement is based on the following:

- The current land cover, as presented in ENPAT does not accurately reflect the current land cover status in all instances; in particular, recent agricultural activities and localised stands of exotics are not captured within the existing data (pers. obs.); and
- It is well established that the status of much of the remaining portions of 'natural grassland' is not accurately summarized in the assessment. These 'natural grasslands' frequently comprehend poor quality grassland or even pastures that exhibit severely altered species compositions and depleted diversity that does not reflect the natural grassland of the region (pers. obs.).

By inclusion of portions of land cover categories that do not reflect the natural status of the ecological environment, with particular reference to sub-climax grassland types, in the category of 'Natural Grassland' a fallacious view is created of the extent of remaining natural habitat in the region. It is therefore extremely likely that remaining untransformed habitat within the municipality is much lower than initially anticipated. Ultimately, the greater region is characterised by high levels of habitat transformation, isolation and habitat fragmentation, resulting from persistent increases in mining and agricultural activities, urban developments, linear infrastructure and poor management practices.

Severity of impacts that commercial agriculture (maize production) has had on the natural environment are evident from the mosaical appearance of land cover in the immediate region. Limited natural habitat remains within the greater area, reflecting similar trends on a municipality and provincial level. These pockets of natural grassland are in a relative advanced state of fragmentation and habitat isolation and connectivity in some parts are low. Other limited land transformation effects result from industrial and urban development. Road and railway infrastructure in the region caused a high degree of habitat fragmentation and isolation.

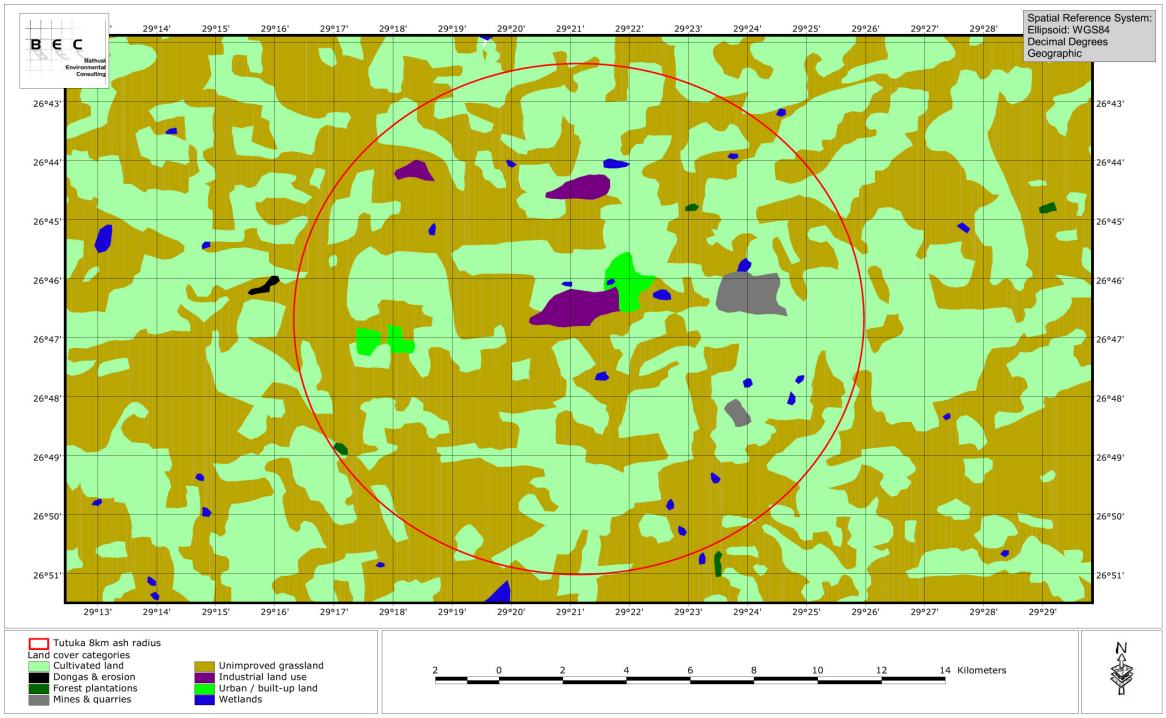

Figure 6.8: Land cover categories in the study area

6.3.5 Land Type

The existing ash disposal facility is situated within the Ea17 land type unit (**Figure 6.9**). Land type units classified as E, indicate land with a high base status, dark coloured and/ or red soils, usually clayey, associated with basic parent materials. A land type more than half of which is covered by soil forms with vertic, melanic and red structured diagnostic horizons qualifies for inclusion in unit Ea, provided that it does not qualify for inclusion in units A, B or C. Land types in which these soils cover less than half of the area may also qualify for inclusion (i) where duplex soils occur in the non-rock land but where unit Ea soils cover a larger area than the duplex soils, or (ii) where exposed rock covers more than half the land type.

Figure 6.9: Land type units with the study area

6.3.6 Natural Vegetation

- **Regional Vegetation - VEGMAP**

The study site corresponds to the Grassland Biome as defined by Mucina & Rutherford (VegMap, 2006). This unit is found in the eastern, precipitation-rich regions of the Highveld. Grasslands of these parts are regarded 'sour grasslands'. The vegetation of the study area corresponds to an ecological type known as Soweto Highveld Grassland.

- *Soweto Highveld Grassland*
  The Soweto Highveld Grassland comprises a gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus* and *Tristachya leucothrix*. Only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover in undisturbed areas. This vegetation type is regarded '**Endangered**' with a target of 24%. Only a handful of patches are statutorily conserved, including Wadrift, Krugersdorp, Leeuwkuil, Suikerboschrand and Rolfe's Pan Nature Reserve. Almost half of the area is already transformed by cultivation, urban sprawl, mining and building of road infrastructure. Some areas have been flooded by dams (Grootdraai, Leeukuil, Trichardtsfontein, Vaal, Willem Brummer). Erosion is generally very low.

- **MBCP Categories**

The local and regional designation of Mpumalanga Terrestrial Biodiversity Conservation Categories (MBCP) is illustrated in **Figure 6.10**.

The mandate for conserving biodiversity lies with state agencies at national, provincial and local levels of government, forming part of a wider responsibility for the environment and the sustainable use of natural resources. Constitutional and national laws require these environmental issues to be dealt with in cooperative, participatory, transparent and integrated ways. The MBCP is the first spatial biodiversity plan for Mpumalanga that is based on scientifically determined and quantified biodiversity objectives. The purpose of the MBCP is to contribute to sustainable development in Mpumalanga.

The MBCP maps the distribution of Mpumalanga Province's known biodiversity into seven categories (Lötter & Ferrar, 2006). These are ranked according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature. The categories are:

- **Protected areas** - already protected and managed for conservation;
- **Irreplaceable areas** - no other options available to meet targets––protection crucial;
- **Highly Significant areas** - protection needed, very limited choice for meeting targets;

- **Important and Necessary areas** - protection needed, greater choice in meeting targets;
- **Ecological Corridors** – mixed natural and transformed areas, identified for long term connectivity and biological movement;
- **Areas of Least Concern** – natural areas with most choices, including for development;
- **Areas with No Natural Habitat Remaining** – transformed areas that do not contribute to meeting targets.

The study area comprises four of these categories (**Figure 6.10**), namely:

- Highly Significant (red);
- Important & Necessary (green);
- No Natural Habitat Remaining (grey); and
- Least Concern (yellow).

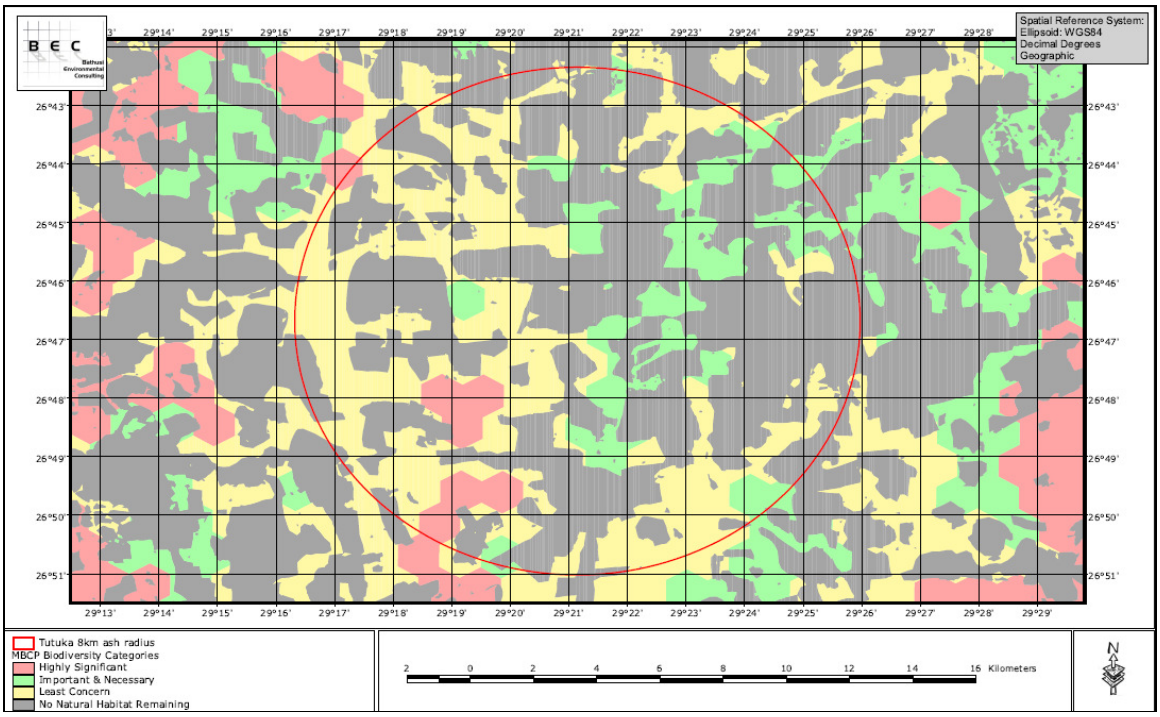

Figure 6.10: The MBCP categories as they relate to the study area.

- **Species of Conservation Importance**

South Africa's Red List system is based on the IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001), amended to include additional categories to indicate species that are of local conservation concern. The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). Taking the habitat that is available as well

as the status thereof into consideration, it is regarded likely that plant species included in the Threatened category might be present within the study areas.

Mpumalanga Province comprises 4,256 plant species of which 276 are included in the following conservation categories:

1 Extinct;
2 Critically Rare;
30 Endangered;
80 Vulnerable;
36 Near Threatened;
47 Rare;
25 Declining;
19 Data Deficient – insufficient information (DDD); and
36 Data Deficient – taxonomical problem (DDT).

Data records indicate the presence of only two plant species of conservation importance within the ¼-degree grids that are sympatric to the study area, including.

- *Drimia elata* (Data Deficient); and
- *Cineraria austrotransvaalensis* (Near Threatened).

In addition to the species currently captured in the SANBI infobase (POSA, 2011), the following provincially protected plants are known to occur within the region of the study area (Mpumalanga Nature Conservation Act No.10 of 1998) (**Table 6.2**).

Table 6.2: Plant species of conservation importance within the region of the study area

Species Name	Family	Status
Eucomis autumnalis subsp. clavata	Hyacinthaceae	Provincially protected
Eulophia ovalis var. ovalis	Orchidaceae	Provincially protected
Gladiolus dalenii subsp. dalenii	Iridaceae	Provincially protected
Gladiolus elliotii	Iridaceae	Provincially protected
Gladiolus longicollis subsp. platypetalus	Iridaceae	Provincially protected
Haemanthus humilis subsp. hirsutus	Amaryllidaceae	Provincially protected
Haemanthus montanus	Amaryllidaceae	Provincially protected

Further detail can be obtained from the Biodiversity Specialist Report in **Appendix M**.

6.3.7 Animal Life

A total of 109 Red Data species from five categories (IUCN) are known to occur in Mpumalanga (Invertebrates, Reptiles, Frogs and Mammals) and the Q-grids 2629CB and 2629CD (birds), included in the following conservation categories:

- 22 species are listed as Data Deficient (DD);
- 41 species are listed as Near Threatened (NT);

- 30 species are listed as Vulnerable (VU);
- 11 species are listed as Endangered (EN); and
- 4 species are listed as Critically Endangered (CR)

Estimations for the probability of occurrence (PoC) for Red Data fauna taxa for the study area yielded the following results (**Table 6.3**):

- 40 species have a low PoC;
- 21 species have a moderate-low PoC;
- 25 species have a moderate PoC;
- 8 species have a moderate-high PoC; and
- 15 species have a high PoC.

Table 6.3: Red Data Faunal assessment for the study area

Species Details			**Probability**
Biological Name	**English Name**	**RD**	**Assessment**
Butterflies			
Aloeides barbarae	Barbara's Copper	Endangered	low
Aloeides merces	Wakkerstroom Copper	Vulnerable	moderate-low
Aloeides nubilus	Cloud Copper	Endangered	low
Aloeides rossouwi	Rossouw's Copper	Endangered	low
Chrysoritis aureus	Heidelberg Opal	Vulnerable	low
Chrysoritis phosphor borealis	Scarce Scarlet	Data Deficient	moderate-low
Lepidochrysops irvingi	Irving's Blue	Vulnerable	low
Lepidochrysops jefferyi	Jeffrey's Blue	Endangered	low
Lepidochrysops swanepoeli	Swanepoel's Blue	Vulnerable	low
Metisella meninx	Marsh Sylph	Vulnerable	moderate
Frogs			
Breviceps sopranus	Whistling Rain Frog	Data Deficient	low
Hemisus guttatus	Spotted Shovel-nosed Frog	Vulnerable	moderate-low
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened	moderate
Strongylopus wageri	Plain Stream Frog	Near Threatened	low
Reptiles			
Acontias breviceps	Short-headed Legless Skink	Near Threatened	moderate-low
Afroedura major	Swazi Flat Gecko	Near Threatened	low
Chamaesaura aenea	Coppery Grass Lizard	Near Threatened	moderate
Chamaesaura macrolepis	Large-scaled Grass Lizard	Near Threatened	low
Homoroselaps dorsalis	Striped Harlequin Snake	Near Threatened	moderate-low
Kininyx natalensis	Natal Hinged Tortoise	Near Threatened	low
Lamprophis fuscus	Yellow-bellied House Snake	Near Threatened	moderate-low
Smaug giganteus	Giant Girdled Lizard	Vulnerable	moderate
Tetradactylus breyeri	Breyer's Long-tailed Seps	Vulnerable	moderate-low
Birds			
Phoenicopterus roseus	Greater Flamingo	Near Threatened	moderate-high
Phoenicopterus minor	Lesser Flamingo	Near Threatened	moderate-high
Mycteria ibis	Yellow-billed Stork	Near Threatened	moderate-low
Ciconia nigra	Black Stork	Near Threatened	moderate
Leptoptilos crumeniferus	Marabou Stork	Near Threatened	moderate-low
Geronticus calvus	Southern Bald Ibis	Vulnerable	moderate
Botaurus stellaris	Eurasian Bittern	Critically Rare	moderate
Sagittarius serpentarius	Secretarybird	Near Threatened	high

Species Details			Probability
Biological Name	**English Name**	**RD**	**Assessment**
Gyps coprotheres	Cape Vulture	Vulnerable	moderate
Circus ranivorus	African Marsh Harrier	Vulnerable	high
Circus maurus	Black Harrier	Vulnerable	high
Circus macrourus	Pallid Harrier	Near Threatened	high
Hieraaetus ayresii	Ayres's Hawk-Eagle	Near Threatened	moderate-low
Polemaetus bellicosus	Martial Eagle	Vulnerable	moderate-high
Falco naumanni	Lesser Kestrel	Vulnerable	high
Falco biarmicus	Lanner Falcon	Near Threatened	high
Eupodotis caerulescens	Blue Korhaan	Near Threatened	high
Crex crex	Corn Crake	Vulnerable	moderate
Balearica regulorum	Grey Crowned Crane	Vulnerable	moderate-high
Anthropoides paradisea	Blue Crane	Vulnerable	high
Charadrius pallidus	Chestnut-banded Plover	Near Threatened	moderate-low
Rostratula benghalensis	Greater Painted-snipe	Near Threatened	moderate-low
Glareola nordmanni	Black-winged Pratincole	Near Threatened	moderate
Hydroprogne caspia	Caspian Tern	Near Threatened	moderate-low
Tyto capensis	African Grass-owl	Vulnerable	high
Alcedo semitorquata	Half-collared Kingfisher	Near Threatened	moderate
Mirafra cheniana	Melodious Lark	Near Threatened	moderate
Heteromirafra ruddi	Rudd's Lark	CR Critically Rare	moderate-low
Spizocorys fringillaris	Botha's Lark	Endangered	moderate-low
Mammals			
Chrysospalax villosus	Rough-haired Golden Mole	Critically Rare	moderate-low
Amblysomus hottentotus	Hottentot's Golden Mole	Data Deficient	moderate-low
Amblysomus robustus	Robust Golden Mole	Endangered	low
Amblysomus septentrionalis	Highveld Golden Mole	Near Threatened	high
Neamblysomus julianae	Juliana's Golden Mole	Vulnerable	low
Atelerix frontalis	South African Hedgehog	Near Threatened	moderate
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	Data Deficient	low
Myosorex cafer	Dark-footed Forest Shrew	Data Deficient	moderate-low
Myosorex varius	Forest Shrew	Data Deficient	high
Crocidura cyanea	Reddish-grey Musk Shrew	Data Deficient	high
Crocidura flavescens	Greater Musk Shrew	Data Deficient	moderate-high
Crocidura fuscomurina	Tiny Musk Shrew	Data Deficient	moderate
Crocidura hirta	Lesser Red Musk Shrew	Data Deficient	moderate
Crocidura maquassiensis	Maquassie Musk Shrew	Vulnerable	low
Crocidura mariquensis	Swamp Musk Shrew	Data Deficient	high
Crocidura silacea	Lesser Grey-brown Musk Shrew	Data Deficient	moderate-high
Suncus infinitesimus	Least Dwarf Shrew	Data Deficient	moderate
Suncus lixus	Greater Dwarf Shrew	Data Deficient	low
Suncus varilla	Lesser Dwarf Shrew	Data Deficient	moderate
Cloeotis percivali	Percival's Short-eared Trident Bat	Vulnerable	moderate-low
Rhinolophus blasii	Blasius's Horseshoe Bat	Near Threatened	moderate
Rhinolophus swinnyi	Swinny's Horseshoe Bat	Near Threatened	moderate-low
Miniopterus natalensis	Natal Long-fingered Bat	Near Threatened	moderate-high
Scotophilus nigrita	Giant Yellow House Bat	Near Threatened	low
Cercopithecus mitis	Samango Monkey	Vulnerable	low
Cercopithecus mitis labiatus	Samango Monkey	Endangered	low
Manis temminckii	Ground Pangolin	Vulnerable	low
Graphiurus platyops	Rock Dormouse	Data Deficient	low
Mystromys albicaudatus	White-tailed Rat	Endangered	moderate
Tatera leucogaster	Bushveld Gerbil	Data Deficient	low
Lemniscomys rosalia	Single-striped Mouse	Data Deficient	moderate

Species Details			Probability Assessment
Biological Name	**English Name**	**RD**	
Dasymys incomtus	Water Rat	Near Threatened	moderate
Grammomys dolichurus	Woodland Mouse	Data Deficient	low
Otomys slogetti	Sloggett's Rat	Data Deficient	moderate
Panthera pardus	Leopard	Near Threatened	moderate
Panthera leo	Lion	Vulnerable	low
Leptailurus serval	Serval	Near Threatened	high
Acinonyx jubatus	Cheetah	Vulnerable	low
Felis nigripes	Black-footed Cat	Vulnerable	low
Crocuta crocuta	Spotted Hyaena	Near Threatened	low
Parahyaena brunnea	Brown Hyaena	Near Threatened	high
Paracynictis selousi	Selous's Mongoose	Data Deficient	low
Rhynchogale melleri	Meller's Mongoose	Data Deficient	low
Canis adustus	Side-striped Jackal	Near Threatened	low
Lycaon pictus	African Wild Dog	Endangered	low
Mellivora capensis	Honey Badger	Near Threatened	moderate-high
Poecilogale albinucha	African Striped Weasel	Data Deficient	moderate
Hydrictis maculicollis	Spotted-necked Otter	Near Threatened	moderate
Loxodonta africana	African Savanna Elephant	Vulnerable	low
Diceros bicornis	Black Rhinoceros	Critically Rare	low
Ceratotherium simum	White Rhinoceros	Near Threatened	low
Hippopotamus amphibius	Common Hippopotamus	Vulnerable	low
Raphicerus sharpei	Sharpe's Grysbok	Near Threatened	low
Ourebia ourebi	Southern Oribi	Vulnerable	moderate-low
Hippotragus equinus	Roan Antelope	Vulnerable	low
Hippotragus niger	Southern Sable Antelope	Vulnerable	low
Damaliscus lunatus	Western Tsessebe	Endangered	low

Mpumalanga includes 31 provincially listed protected species (www.speciesstatus.sanbi.org – NEMBA status, **Table 6.3**).

Table 6.4: Protected Fauna species of Mpumalanga

Species Details			Probability Assessment
Binomial Name	***Colloquial Name***	***NEMBA status***	
Aonyx capensis	African Clawless Otter	protected	high
Atelerix frontalis	South African Hedgehog	protected	moderate
Bucorvus leadbeateri	Southern Ground-Hornbill	protected	low
Ceratogyrus bechuanicus	Starbust Horned Baboon Spider	protected	moderate-low
Ceratotherium simum	White Rhinoceros	protected	low
Circus ranivorus	African Marsh Harrier	protected	high
Connachaetus gnou	Black Wildebeest	protected	low
Crocuta crocuta	Spotted Hyaena	protected	low
Dromica species	Flightless Tiger Beetle species	protected	moderate-low
Felis nigripes	Black-footed Cat	protected	low
Graphipterus assimilis	Velvet Ground Beetle	protected	moderate-low
Harpactira gigas	Transvaal Banded Baboon Spider	protected	moderate-low
Hydrictis maculicollis	Spotted-necked Otter	protected	moderate-low
Leptailurus serval	Serval	protected	confirmed
Loxodonta africana	African Savanna Elephant	protected	low
Manticora species	Monster Tiger Beetle species	protected	moderate-low
Megacephala asperata	Tiger Beetle	protected	moderate-low
Megacephala regalis	Tiger Beetle	protected	moderate-low

Neotis denhami	Denham's Bustard	protected	moderate-high
Nigidius auriculatus	Stag Beetle	protected	moderate-low
Oonotus adspersus	Stag Beetle	protected	moderate-low
Oonotus interioris	Stag Beetle	protected	moderate-low
Oonotus rex	Stag Beetle	protected	moderate-low
Oonotus sericeus	Stag Beetle	protected	moderate-low
Parahyaena brunnea	Brown Hyaena	protected	high
Prosopocoilus petitclerci	Stag Beetle	protected	moderate-low
Prothyma guttipennis	Tiger Beetle	protected	moderate-low
Pterinochilus breyeri	Malelane Golden-brown Baboon Spider	protected	moderate-low
Pterinochilus nigrofulvus	Transvaal Golden Baboon Spider	protected	moderate-low
Raphicerus sharpei	Sharpe's Grysbok	protected	low
Redunca arundinum	Southern Reedbuck	protected	low

It is estimated that three of the eight species listed in **Table 6.4** are unlikely to occur in the study area (low) and 16 species moderately unlikely (moderate-low). Three species are considered at least moderately likely (moderate) and four species highly likely to occur in the study area (high).

Further detail can be obtained from the Biodiversity Specialist Report in **Appendix M**.

6.3.8 Avifauna

- ***Bird Micro Habitats***

It is important to understand the habitats available to birds at a smaller spatial scale, i.e. micro habitats. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food sources and man-made factors. Investigation of this study area revealed the following bird micro habitats.

- *Arable and/or cultivated lands*
  Arable or cultivated lands (**Figure 6.11**) can represent significant feeding areas for many bird species in any landscape for the following reasons: through opening up the soil surface (figure 3), land preparation makes many insects, seeds, bulbs and other food sources readily accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. Relevant bird species that may be attracted to these areas include most importantly the Blue Crane, Southern Bald Ibis, Blue Korhaan and White Stork. Marsh owls will also regularly forage over agricultural lands (**Figure 6.12**), especially in the late afternoon.

Figure 6.11: Agricultural lands observed in the study area**.**

Figure 6.12: One of four Marsh Owls observed in close vicinity to each other, foraging over agricultural lands in the study area.

- *Open Grasslands:*
  The only vegetation type (Mucina & Rutherford, 2006) present is "Soweto Highveld Grassland", which falls within the greater Grasslands Biome. It was not surprising, therefore, that the most extensive bird microhabitat available on this site is that of grasslands (**Figure 6.13** and **6.14**). Grassland may attract the Blue Crane, Black-winged Pratincole, Southern Bald Ibis, Blue Korhaan, Secretarybird, and White Stork. Pristine patches of grassland, near to water, may provide breeding habitat for the

African Grass Owl, although this species has not been recorded in the SABAP data for the study area. The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as being hunting habitat for raptors such as African Marsh Harrier, Lanner Falcon, Rock Kestrel (**Figure 6.15**), Lesser Kestrel, Amur Falcon and Black-shouldered kite. Important to this study is that Botha's Lark (Endangered) has been recorded in the quarter degree squares (SABAP1 data) examined, and is a relatively rare grassland species (**Figure 6.16**).

Figure 6.13: Grassland observed in the broader study area.

Figure 6.14: Burnt grasslands observed in the study area.

Figure 6.15: A Rock Kestrel perches, while foraging over grassland in the study area.

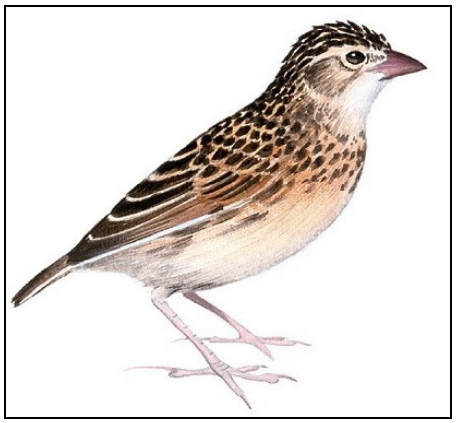

Figure 6.16: The Endangered Botha's Lark may occur in grasslands in the study area.

- *Dams:*
  Various waterfowl, waders and numerous duck species, may frequent the man-made dams within the study area (**Figure 6.17**). More importantly, Blue Cranes use dams to roost in communally, and Flamingos may use these areas as stop over points while moving between larger water bodies. Various Storks may also frequent these water bodies. One particular Dam (New Denmark Dam) is a Co-ordinated Waterbird Count (CWAC) site, and both Lesser and Greater Flamingos were observed here during the site visit.

Figure 6.17: A typical man-made farm dam, as observed in the study area.

- *Wetlands and Rivers or drainage lines:*
  In this area species such as Greater Flamingo, Lesser Flamingo, Yellow-billed Stork and Caspian Tern are attracted to water, and therefore may find flowing rivers or streams attractive. Non Red Data species may also occur in these areas for example herons. Rivers in their true form represent important habitat for many species, including Black Stork and a variety of other water birds, while the wooded riparian habitat along a river may provide habitat for various species such as the Hamerkop, African Darter, various cormorants, kingfishers, bee-eaters, robin-chats and numerous smaller species.

  According to GIS mapping using data from Mucina & Rutherford (2006), the only river in the study area is the Leeuspruit. 1 in 50 000 maps from the Surveyor General show the presence of the smaller Wolwespruit (which may not always flow) to the east of the existing ash disposal site. Numerous smaller drainage lines, some of which do not always carry water are also present in the broader area. Drainage lines, as well as all of the Rivers/"Spruite" discussed above, may serve as flight paths for several bird species.

Figure 6.18: This drainage line in the study area contained water, which appeared to be dammed by a tar road.

- *Stands of Alien vegetation:*
  Patches of alien trees were observed throughout the study area (**Figure 6.19**), often associated with a farm stead, or along farm roads. These areas will mostly be important to physically smaller bird species. These also provide perching, roosting and nesting habitats for various raptor species and larger birds such as francolins, Guineafowl, Herons and Hadeda Ibises.

Figure 6.19: A stand of alien trees in the study area.

- ***Relevant bird populations***

The relevant bird populations that have been reported by the South African Bird Atlas Projects (1 and 2) can be found below in **Tables 6.5** and **Table 6.6**. It is important to note that these species could have been recorded anywhere in the associated pentad or quarter degree square (QDGS), and not necessarily in the exact study area.

SABAP 2 data was examined for the pentads falling within an 8km radius from Tutuka Power Station, and which had been counted more than once. **Table 6.6** below shows report rates, based on the number of cards submitted, for the Red Data species identified in the four pentads meeting the above criteria. Interestingly, of the 16 red listed species identified in the SABAP 1 data, only 9 species have again been recorded in the SABAP 2 data for the pentads examined. This however, does not necessarily mean that these species do not occur here, or that they have moved from the area post SABAP1, but may merely be due to the low counting effort of the pentads or selective micro habitat counting by the SABAP2 field counters. White Stork, protected through the Bonn Convention, was recorded in both data sets. Botha's Lark was not recorded in pentads examined. An additional red listed species, the African Openbill, was recorded in the SABAP2 data only.

Table 6.5: Red Data species report rates for the two quarter degree squares which cover the study area-SABAP 1 (Harrison et al, 1997)

Species	**Cons. status**	**Report rate (%)**	
QDGS		**2629CD**	**2629CB**
Number of cards submitted		*69*	*55*
Total Species		*175*	*175*
Botha's Lark	EN	-	2
African Marsh Harrier	VU	-	2
Lesser Kestrel	VU	22	16
Blue Crane	VU	12	7
Southern Bald Ibis	VU	4	-
White-bellied Korhaan	VU	-	4
Yellow-billed Stork	NT	1	-
Secretary Bird	NT	10	9
Greater Flamingo	NT	1	2
Lesser Flamingo	NT	1	-
Black-winged Pratincole	NT	-	4
Pallid Harrier	NT	-	2
Lanner Falcon	NT	6	4

Blue Korhaan	NT	30	20
Caspian Tern	NT	13	-
White Stork	Bonn	3	2

CR = Critically Endangered; EN = Endangered; V = Vulnerable; NT = Near-threatened; Bonn = Protected Internationally under the Bonn Convention on Migratory Species.

Table 6.6: Report rates from Southern African Bird Atlas Project 2 (SABAP2) as of 09/10/2012**.**

Species	Cons. status	Pentad Report Rate (%)			
Pentad		*2645_2915*	*2645_2920*	*2640_2915*	*2650_2915*
No Cards		*12*	*3*	*16*	*4*
Total Species		*121*	*94*	*121*	*60*
Botha's Lark	EN	-	-	-	-
African Marsh Harrier	VU	-	-	-	-
Lesser Kestrel	VU	-	-	-	-
Blue Crane	VU	-	-	-	-
Southern Bald Ibis	VU	16.7	-	-	-
White-bellied Korhaan	VU	-	-	-	-
Yellow-billed Stork	NT	-	-	-	-
African Openbill	NT	-	-	6.3	-
Secretary Bird	NT	8.3	-	-	-
Greater Flamingo	NT	41.7	33.3	-	-
Lesser Flamingo	NT	8.3	-	-	-
Lanner Falcon	NT	8.3	-	-	-
Blue Korhaan	NT	-	33.3	18.8	-
Caspian Tern	NT	-	-	-	50
Black-winged Pratincole	NT	8.3	-	6.3	-
Pallid Harrier	NT	16.7	-	-	-
White Stork	Bonn	8.3	-	-	-

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near-threatened; Bonn = Protected Internationally under the Bonn Convention on Migratory Species.

Further detail can be obtained from the Avifauna Specialist Report in **Appendix J**.

6.3.9 Surface Water

The area falls over three quaternary catchments in the Upper Vaal Water Management Area (WMA), with the Tutuka Power Station located in the C11K quaternary catchment, draining southwards towards the Grootdraai Dam via the Leeuspruit (**Figure 6.20**). The study area is located in an Upstream Management Catchment (NFEPA – Nel et al., 2011).

The study area in relation to the National Freshwater Ecosystem Priority Areas (NFEPA) and the Mpumalanga Biodiversity Conservation Plan (MBCP) is shown in **Figure 6.21** and **Figure 6.22**, with National Freshwater Ecosystem Priority Areas (NFEPA) Fish Support

Areas located downstream (**Figure 6.21**). According to the MBCP (Ferrar & Lötter, 2007) the study area is located in an 'Ecosystem Maintenance' sub-catchment.

The main rivers in the 8 km radius of the Tutuka Power Station (**Figure 6.20**) include a tributary of the Leeuspruit and a tributary of the Vaal River, which are Order one rivers (**Table 6.7**), and the upper reaches of the Leeuspruit River (before the confluence with its tributary) being an Order one- and the lower reaches (after confluence with its tributary) an Order two river. Numerous smaller streams are shown in the 1:50 000 river coverage. The Leeuspruit and its tributary are classified as perennial rivers (with a Highveld 4 river signature), with the tributary of the Vaal River being non-perennial (Highveld 3 river signature).

The tributary of the Vaal, as indicated in **Figure 6.20 and 6.21**, will be affected by the Eskom proposed continuous ashing on alternative site A and B. The aquatic ecosystems in the immediate vicinity include:

- The tributary of the Vaal, which is a valley bottom system and is currently diverted and dammed at numerous places due to existing ashing activities (running north to south);
- Various zero order tributaries of the aforementioned system; and
- Visually observed seeps on, particularly on the western section of the property

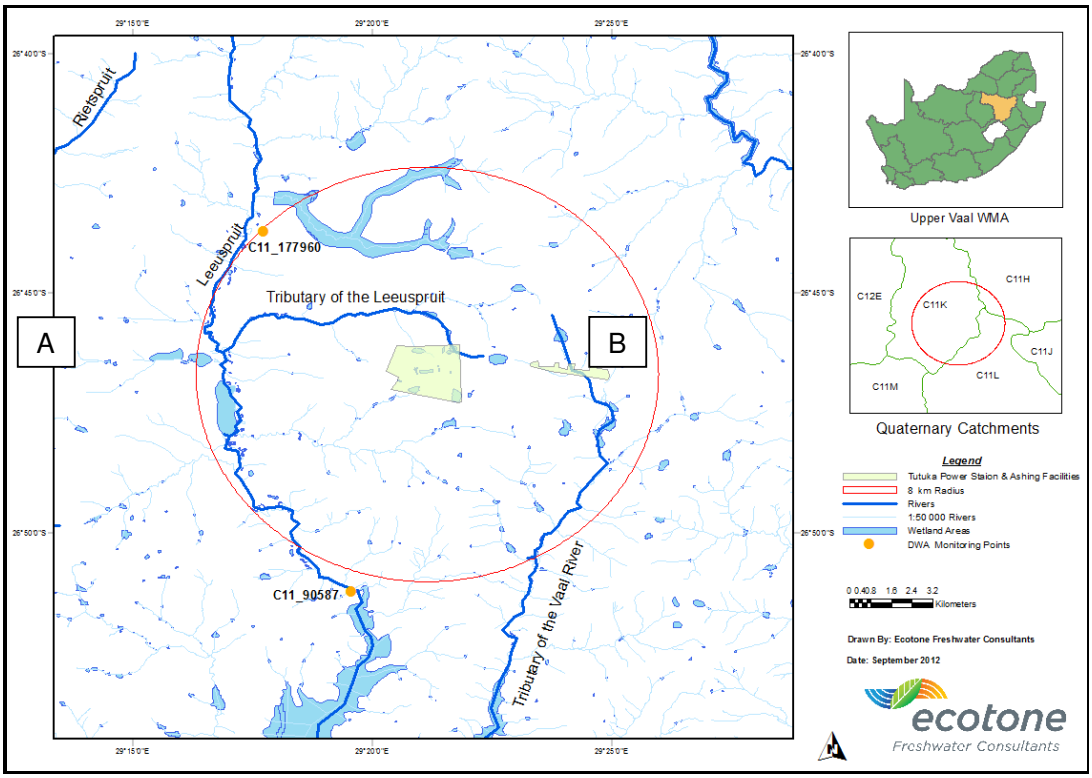

Figure 6.20: Tutuka Power Station, DWA monitoring points and main rivers located in the 8 km radius of the proposed Ash disposal facility (Nel et al., 2004; Chief Directorate – Surveys and Mapping, 2629; SANBI, 2010).

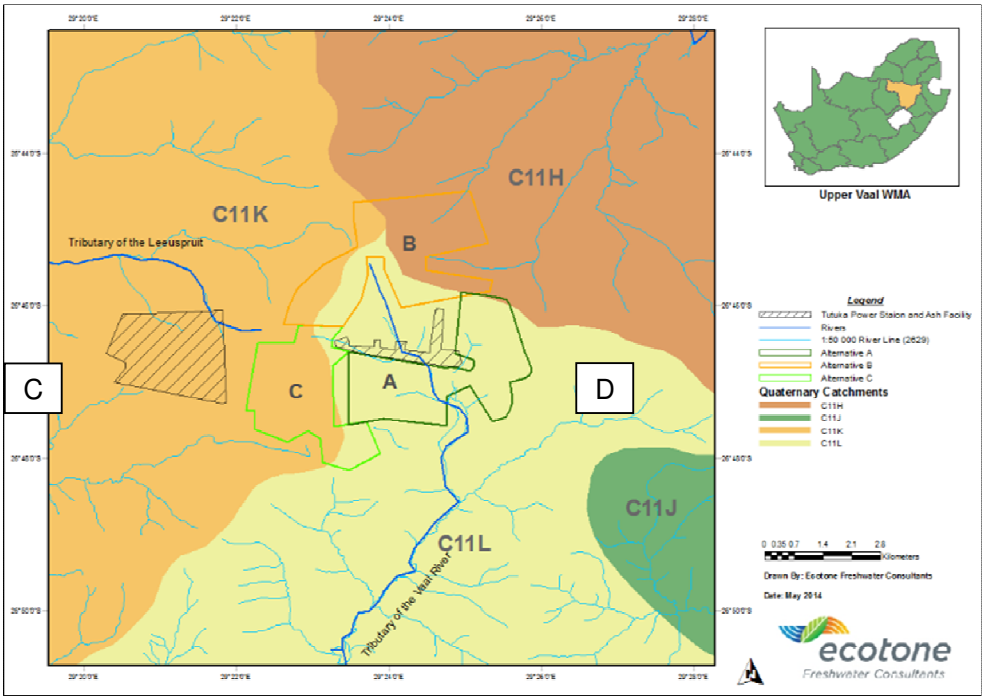

Figure 6.21: Map indicating the study area in relation to quaternary catchments (DWAF, 1995; DWAF, 2004; Nel et al., 2004; SANBI, 2010; Chief Directorate – Surveys and Mapping).

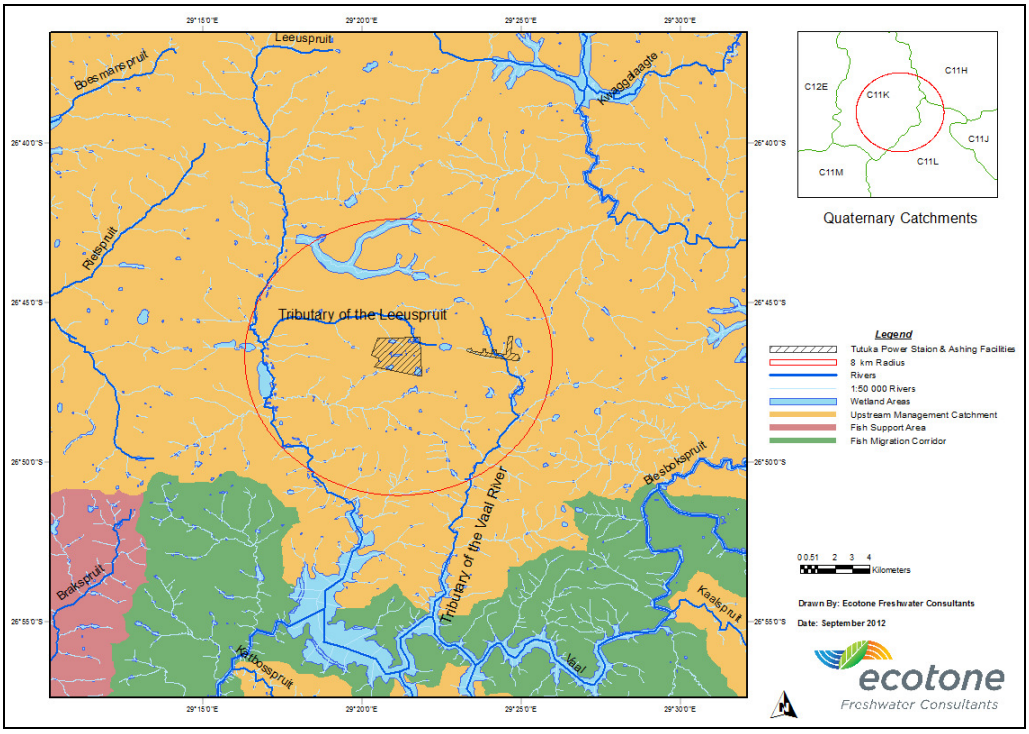

Figure 6.22: Map indicating the study area in relation to NFEPAs (Nel et al., 2004; SANBI, 2010; Nel et al., 2011).

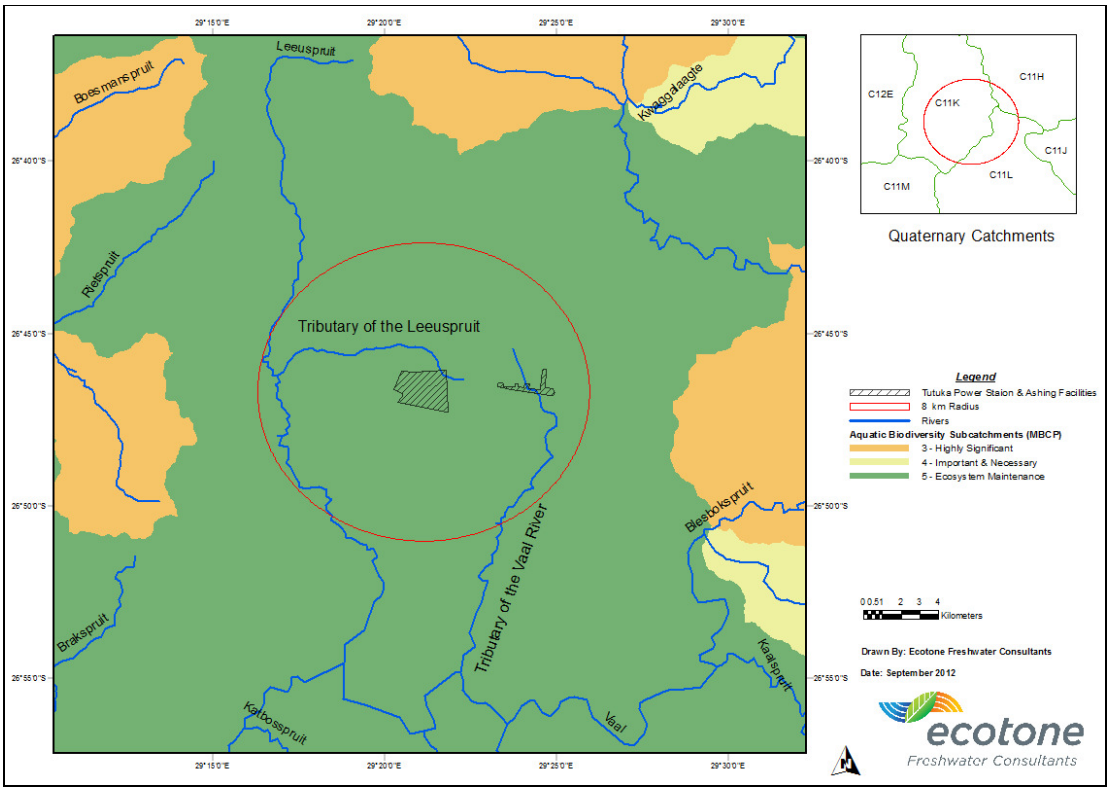

Figure 6.23: Map indicating the study area in relation to the MBCP (Nel et al., 2004; Ferrrar & Lötter, 2007).

Table 6.7: Desktop characterisation of the main rivers in the 8 km radius of the study area.

River	**Leeuspruit**	**Tributary of Leeuspruit**	**Tributary of Vaal**
River Order	1 & 2	1	1
Hydrological Class	Perennial	Perennial	Non-perennial
River Signature	Highveld 4	Highveld 4	Highveld 3
Conservation Status (Nel *et al.*, 2004)	Critically Endangered		
PES (Nel *et al.*, 2004)	**C**	**C**	**E/F**
Water Management Area	Upper Vaal		
Aquatic Ecoregion	Highveld		
Quaternary Catchment	C11K	C11K	C11L
PES	D*	**D***	**E/F#**
EIS	Moderate*		
PES: Present Ecological State; EIS: Ecological Importance and Sensitivity *DWAF (2007) ; #DWAF (2000)			

Nel et al. (2004) lists a status of critically endangered for all the river signatures associated with the study area. The ascribed river status indicates a limited amount of intact river systems carrying the same heterogeneity signatures nationally. This implies a

severe loss in aquatic ecological functioning and aquatic diversity in similar river signatures on a national scale (Nel et al., 2004).

Six attributes were used to obtain the Present Ecological State (PES) on desktop quaternary catchment level by the National Spatial Biodiversity Assessment (NSBA - Nel et al., 2004). These attributes predominantly allude to habitat integrity of in-stream and riparian habitat. With this in mind, the receiving Leeuspruit systems and the tributary of the Vaal River fall within a C (moderately modified ecosystem state) and E/F (serious to critical modified ecosystem state) –category [according to the NSBA (Nel et al., 2004)], respectively.

According to the desktop PES categories from DWAF (2007), the rivers in quaternary catchment C11K fall in a D ecological category, indicating a largely modified ecosystem with an impairment of health evident. No current PES categories could be obtained for the Vaal River tributary (C11L) and therefore the PES categories from DWAF (2000) were consulted. The tributary of the Vaal River falls in an unacceptable ecosystem state (DWAF, 2000), with most community characteristics seriously modified or having extremely low species diversity. The rivers in quaternary catchment C11K at present are affected by sedimentation (farming and grazing), introduction of Carp and exotics such as Willow trees, erosion and agricultural run-off (DWAF, 2000). The Ecological Importance and Sensitivity (EIS - DWAF, 2007) for both quaternary catchments is considered moderately sensitive.

- ***Catchment Drivers of Ecological Change***

As mentioned previously, the study area falls within the Upper Vaal WMA which includes the Vaal, Klip, Wilge, Liebenbergsvlei and Mooi Rivers. It covers a catchment area of 55 565 km^2 and includes the Vaal Dam, Grootdraai Dam and Sterkfontein Dam (DWAF, 2004). The Upper Vaal WMA is the most populous WMA in South Africa, with more than 80 % of the population residing in the area downstream of the Vaal Dam, and approximately 97% living in an urban environment. Land use in the WMA is dominated by cultivated dry land agriculture with the main crops being maize and wheat. About 75% of the irrigation is upstream of major storage dams and is supplied from rivers or farm dams (DWAF, 2004).

The majority of the water requirements of the WMA are for the urban, industrial and mining sectors (77 %), with 11 % for irrigation, 8 % for power generation and the remaining 4 % for rural water supplies. The Upper Vaal WMA is subdivided into three sub-areas, with the study area located in the 'upstream of the Vaal Dam' sub-area. Geographically, over 73 % of the total requirements for water are in the sub-area 'downstream of the Vaal Dam' and nearly 20 % in the sub-area upstream of the Vaal Dam. Most of the irrigation in the WMA is in the sub-area 'downstream of the Vaal Dam' (DWAF, 2004). The available water and total requirements for the year 2000, including transfers between WMAs is shown in **Table 6.8.**

Table 6.8: Reconciliation of requirements and available water for the year 2000 (million m^3/a) without yield of Mohale Dam (DWAF, 2004)

Sub-area	MAR	Local yield	Transfers in	Transfers out	Local requirement	Deficit
Wilge	868	59	0	0	60	-1
US of Vaal Dam	**1109**	**184**	**118**	**67**	**216**	**19**
DS of Vaal Dam	446	889	1224	1343	769	1
MAR: Natural Mean Annual Run-off; US: Upstream, DS: Downstream						

With regards to the 8 km radius under consideration in the current study for the proposed continuous ashing activities, the main drivers of ecological change for the immediate aquatic ecosystems are agriculture (mainly grazing), mining (e.g. the New Denmark Colliery), residential (e.g. Thuthukani Township) and the Tutuka Power Station and associated infrastructure.

- ***Historical Water Quality***

Historical water quality data (**Table 6.9**) were obtained for the Leeuspruit system in the C11K quaternary catchment from two relevant sites, namely:

- Upstream of the Tutuka Power Station at DWA gauging station C11_177960, which is situated downstream of the New Denmark Colliery and upstream of the confluence of the tributary of the Leeuspruit, and
- Downstream of the Tutuka Power Station at DWA gauging station C11_90587 at Welbedacht 382 upstream of the Grootdraai Dam (**Figure 6.21**).

These monitoring stations provide minimum, maximum, median and 90th percentile values for the variables (**Table 6.9**) measured between the periods 1999 to 2007 (C11_177960) and 1974 to 2007 (C11_90587). The water quality at DWA site C11_90587 (downstream of the Tutuka Power Station) shows a decrease in quality compared to the upstream site. Constituents of concern are noted as: pH, electrical conductivity (EC), sodium, chloride, fluoride and sulphate (**Table 6.9**).

Table 6.9: Historical water quality for two DWA monitoring sites on the Leeuspruit (C11K)

Variable	Abbreviation	Unit	C11_177960			C11_90587		
			Min	90th percentile		Min	90th percentile	
			Max	Median		Max	Median	
Position in relation to Tutuka Power Station			Upstream			Downstream		
pH		H^{1+} ions	8.6	8.25		10.39	8.65	
			6.5	7.7	n=65	6.07	8.1	n=1240

Variable	Abbreviation	Unit	C11_177960			C11_90587		
			Min	90th percentile		Min	90th percentile	
			Max	Median		Max	Median	
Position in relation to Tutuka Power Station			Upstream			Downstream		
Electrical Conductivity	EC	mS/m	239	46		491	159	
			17	33	n=65	10.8	44.2	n=1307
Total Dissolved Solids	TDS	ppm	-	-		3711	1072	
			-	-	n= -	73	340	n=1181
Calcium	Ca	mg/l	240	35.19		161	38.25	
			5.1	19.1	n=41	5.2	23.14	n=1212
Magnesium	Mg	mg/l	211	26.82		79.3	33.94	
			8.2	16.2	n=41	3.6	18.18	n=1212
Potassium	K	mg/l	-	-		13.45	7.83	
			-	-	n= -	0.43	5.3	n=1212
Sodium	Na	mg/l	57.8	34.65		983	252	
			3	20.5	n=27	5.41	33.23	n=1210
T Alkalinity	Tal	mg/l	182	180		496	289	
			170	176	n=2	20.7	138	n=1211
Chloride	Cl	mg/l	85	29.2		639	203	
			3	18	n=59	1.5	25.34	n=1217
Fluoride	F	mg/l	0.5	0.4		4.66	1.76	
			0.05	0.3	n=49	0.05	0.34	n=1211
Silica	Si	mg/l	-	-		12.82	9.62	
			-	-	n= -	0.2	6.42	n=1213
Sulphate	SO4	mg/l	1360	86.5		1501	175	
			5	38	n=65	2	44.5	n=1215
Ammonia	NH4(N)	mg/l	7.5	0.55		10	0.1	
			0.05	0.3	n=65	0.015	0.04	n=1213
Nitrate	NO3(N)	mg/l	1.6	0.59		5	0.27	
			0.05	0.1	n=65	0.005	0.04	n=1237
Phosphate	PO4(P)	mg/l	3.4	0.3		2.6	0.15	
			0.05	0.05	n=64	0.003	0.05	n=1237
Total Phosphate	TP	mg/l	-	-		3.56	0.34	
			-	-	n= -	0.015	0.16	n=860

- ***Expected Macroinvertebrate Species***

A list of macro invertebrates expected to occur in the study area or indicating the possibility of occurrence was determined for the major drainage lines (**Table 6.10; Figure 6.25**). Each taxon was allocated a rating score of either 1, 3 or 5: a rating of 5 indicates

that the specific taxon has been sampled within that sub-quaternary (SQ) reach and is likely to be sampled; a rating of 3 indicates that the taxon has not been sampled in the SQ reach but has been sampled in a similar SQ reach and the probability of occurrence has been extrapolated; a rating of 1 indicates that the taxon has not been sampled in the SQ reach or any other similar SQ reach but is thought to be potentially present taking into account the available habitat, water quality and associated land use activities. Only one relatively sensitive taxon is expected to occur within the study area, namely Leptophlebiidae, which has a sensitivity score of 9 out of a possible 15 (Gerber & Gabriel, 2002), representing a taxon that is moderately intolerant to alterations in water quality (pollution).

Table 6.10: Macroinvertebrate species expected to occur, or indicating the possibility of occurrence, in the different sub-quaternary reaches located within the study area. Taxa in red are considered sensitive taxa.

ID		A	B	C
	SS	Leeuspruit	Tributary of Leeuspruit	Tributary of Vaal
Turbellaria	3	1	1	1
Oligochaeta	1	1	1	1
Hirudinea	3	1	1	1
Potamonautidae	3	1	1	1
Atyidae	8	1	1	1
Hydracarina	8	1	1	1
Baetidae > 2 Sp.	12	1	1	1
Caenidae	6	1	1	1
Leptophlebiidae	**9**	**1**	**1**	**1**
Coenagrionidae	4	1	1	1
Aeshnidae	8	1	1	1
Gomphidae	6	1	1	1
Libellulidae	4	1	1	1
Belostomatidae	3	1	1	1
Corixidae	3	1	1	1
Gerridae	5	1	1	1
Hydrometridae	6	1	1	1
Naucoridae	7	1	1	1
Nepidae	3	1	1	1
Notonectidae	3	1	1	1
Pleidae	4	1	1	1
Veliidae/Mesoveliidae	5	1	1	1
Hydropsychidae 1 Sp.	4	1	1	1
Hydroptilidae	6	1	1	1
Leptoceridae	6	1	1	1
Dytiscidae	5	1	1	1
Elmidae/Dryopidae	8	1	1	1
Gyrinidae	5	1	1	1
Hydrophilidae	5	1	1	1
Ceratopogonidae	5	1	1	1
Chironomidae	2	1	1	1
Culicidae	1	1	1	1
Muscidae	1	1	1	1
Simuliidae	5	1	1	1
Tabanidae	5	1	1	1
Ancylidae	6	1	1	1
Physidae	3	1	1	1
Planorbinae	3	1	1	1
Corbiculidae	5	1	1	1
Sphaeriidae	3	1	1	1

SS = Sensitivity Score (Dickens & Graham, 2001)

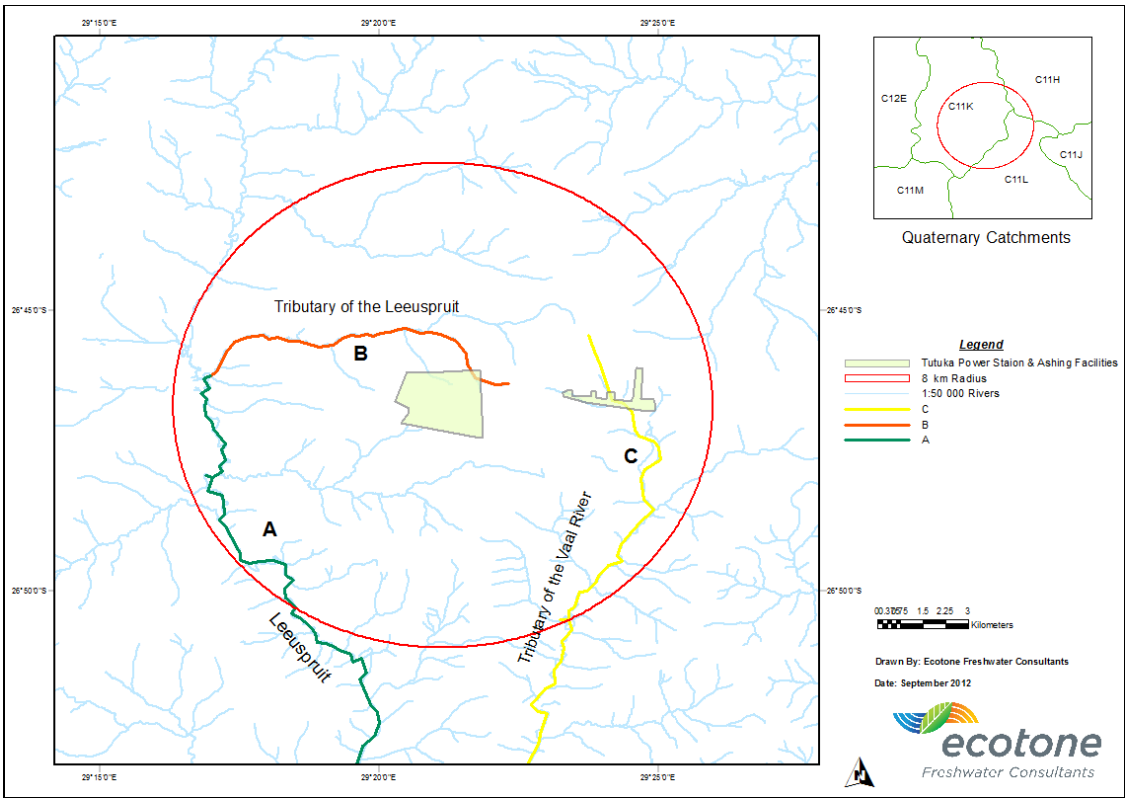

Figure 6.24: Sub-quaternary catchments related to the expected macroinvertebrate species list (Chief Directorate – Surveys and Mapping, 2629; Pers.Comm. Mrs. Christa Thirion, 2012).

- ***Expected Fish Species***

A summary of the expected fish families, species and IUCN conservation status is provided in **Table 6.11**. The study area provides potential refuge for four fish families represented by approximately 12 species (Kleynhans et al., 2007; IUCN, 2012), none of which have conservation status and are listed as Least Concern (LC) by the IUCN (2012). Barbus neefi (Kleynhans et al., 2007) and Barbus pallidus (IUCN, 2012) are expected to occur in the study area and both species are moderately intolerant to alterations in water quality making them good indicators of ecosystem health.

Table 6.11: Fish species expected to occur, or indicating the possibility of occurrence, in the river systems located within the 8 km radius

Family	Genus and Species	Common Name	IUCN Status
Austroglanididae	*Austroglanis sclateri*	Rock Catfish	LC
Cyprinidae	*Barbus anoplus*	Chubbyhead Barb	LC
Cyprinidae	*Barbus neefi*	Sidespot Barb	LC
Cyprinidae	*Barbus pallidus*	Goldie Barb	LC

Family	Genus and Species	Common Name	IUCN Status
Cyprinidae	*Barbus paludinosus*	Straightfin Barb	LC
Clariidae	*Clarias gariepinus*	Sharptooth Catfish	LC
Cyprinidae	*Cyprinus carpio*	Common Carp	EX
Cyprinidae	*Labeobarbus aeneus*	Smallmouth Yellowfish	LC
Cyprinidae	*Labeo capensis*	Orange River Labeo	LC
Cyprinidae	*Labeo umbratus*	Moggel	LC
Cichlidae	*Pseudocrenilabrus philander*	Southern Mouthbrooder	LC
Cichlidae	*Tilapia sparrmanii*	Banded Tilapia	LC
LC: Least Concern; EX: Exotic			

- ***Expected Odonata (dragonflies) Species***

Approximately 60 Odonata species are expected to occur in the study area. All species are listed as LC according to the IUCN database (IUCN, 2012).

- ***Expected Mollusca (snails, limpets) Species***

A total of 10 mollusc species are expected to occur in the study area, of which nine species are listed as LC. Only one species, namely *Burnupia caffra, is listed as Data Deficient (DD)* due to taxonomic uncertainty. Burnupia caffra are frequently unobserved during sampling surveys due to their extremely small size (2 - 4 mm). The genus Burnupia needs taxonomic revision as the numbers of species are extremely uncertain (Appleton et al., 2010).

Further detail can be obtained from the Surface Water Specialist Report in **Appendix Q**.

6.3.10 Groundwater

The Department of Water Affairs (DWA) have produced a series of 1:500 000 scale hydrogeology maps (General Hydrogeology Map Series), that cover the whole of South Africa. Analysis of median borehole yields and aquifer types has allowed DWA to classify the aquifers of the country according to an alphanumeric code incorporating aquifer type and borehole yield, as presented in **Table 6.12** below.

Table 6.12: General Hydrogeology Map classification of South Africa

Aquifer Type	Borehole Yield Class (L/s)				
	Class "1" 0 - 0.1	Class "2" 0.1 - 0.5	Class "3" 0.5 - 2.0	Class "4" 2.0 - 5.0	Class "5" >5.0
Type "a": Inter-granular	A1	A2	A3	A4	A5
Type "b": Fractured	B1	B2	B3	B4	B5
Type "c": Karst	C1	C2	C3	C4	C5
Type "d": Inter-granular and fractured	D1	D2	D3	D4	D5

The DWA 1:500 000 scale hydrogeology map of the area (Sheet 2526 Johannesburg) shows that the area within an 8 km radius of the Tutuka power station is entirely classified as "D2", suggesting the underlying aquifer is inter-granular and fractured and the average borehole yield ranges between 0.1 and 0.5 litres per second (L/s). There are no major groundwater abstractions shown on the hydrogeological map within 8 km of the site.

An extract of the hydrogeological map is presented in **Figure 6.25**.

- ***Quaternary Catchment Area***

The area within an 8km radius of the Tutuka power station is located in quaternary catchment C11K (GRA2), within the Upper Vaal Water Management Area. The GRA2 data for the quaternary catchment C11K is summarized in **Table 6.13** below.

Table 6.13: Summary of the GRA2 Data

QUATERNARY CATCHMENT	C11K
Area (km^2)	340
Average water level (meters below ground level)	7.61
Volume of water in aquifer storage (Mm^3/km^2)	258.96
Specific Yield	0.003
Harvest Potential (Mm^3/a)	7.41
Contribution to river base flow (Mm^3/a)	1.82
Utilizable groundwater exploitation potential in a wet season (Mm^3/a)	2.44
Utilizable groundwater exploitation potential in a dry season (Mm^3/a)	1.58

The Groundwater Harvest Potential Map of South Africa (Baron et al, 1998) classifies the study area as having an estimated groundwater harvest potential of 15 000 to 25 000 m^3/km^2/year (i.e. relatively low). It also suggests that the average borehole yield is > 0.4 litres per second (L/s), and the total dissolved solids concentration of the (unpolluted) groundwater is between 200 and 300 mg/l (i.e. relatively fresh).

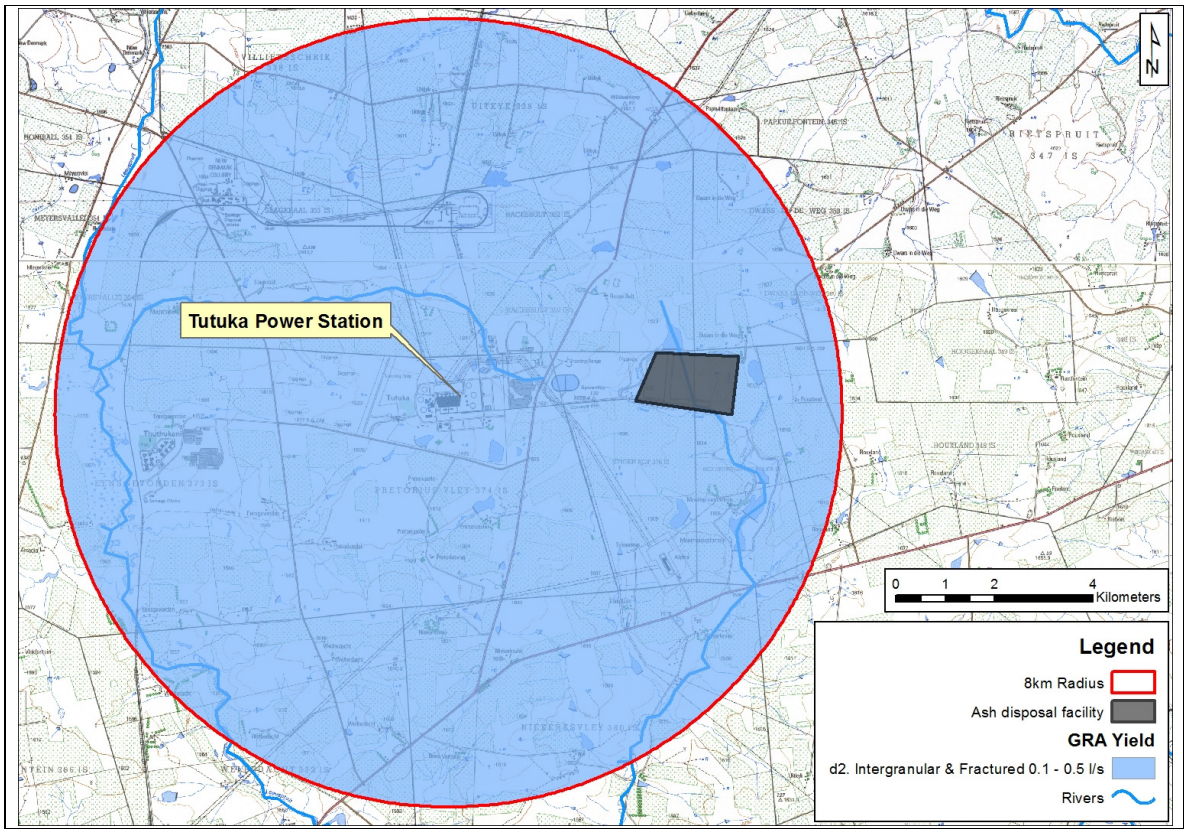

Figure 6.25: An overview of the hydrogeology of the study area.

Further detail can be obtained from the Groundwater Specialist Report in **Appendix N**.

6.3.11 Sites of Archaeological, Historical and Cultural Interest

The cultural landscape qualities of the region essentially consist of a rural setup. In this the human occupation is made up of a pre-colonial element consisting of limited Stone Age occupation and a Late Iron Age occupation, as well as a much later colonial (farmer) component.

- ***Stone Age***

No information about Stone Age habitation of the area is available. There might be two reasons for this. Firstly, it is unlikely that Stone Age people would have occupied the area specifically, as it would have been too cold and no shelters or caves exists locally that could be used to shelter in. Secondly, no systematic survey of the area has been done and, as a result, no sites have been reported.

- ***Iron Age***

Iron Age people started to settle in Southern Africa AD 300, with one of the oldest known sites at Silver Leaves, south east of Tzaneen dating to AD 270. However, Iron Age

occupation of the eastern highveld area (including the study area) did not start much before the 1500s. Some sites dating to the Late Iron Age is known to exist to the north, south and west of the study area.

- ***Historic period***

The historical period in this area starts with the arrival of early missionaries, hunters and traders, followed later by the Voortrekkers, who settled permanently and started to farm in the area and developed a number of towns. The town of Standerton was founded in 1878 and attained municipal status in 1903 (Raper 2004). During the Anglo Boer War (1899-1902), some skirmishes took place in the region (Cloete 2000).

Building of the Tutuka Power Station commenced in 1980 and the first unit was put in commercial use on 1 June 1985 and the last unit on 4 June 1990 (www.eskom.co.za).

The farm, Pretorius Vley 374IS on which the power station was developed, was first granted to a certain Mr Pretorius in 1875. A house and farm buildings, approximately in the vicinity of the current farmstead to the southwest of the power station exists.

- *Farmsteads*

  Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

  By the early 19th century white settlers took up farms. An investigation of the Title Deeds of most of the farms in the region indicates that they were surveyed as early as the 1860s, implying that they would have been occupied by colonists since then.

  Many farmsteads in the region were destroyed during the Anglo Boer War. As a result most structures date to the period after that. The architecture of these farmsteads can be described as eclectic as they were built and added to as required over a period of time. In some cases outbuildings would be in the same style as the main house, if they date to the same period. However, they tend to vary considerably in style and materials used.

- *Cemeteries*

  Apart from the formal cemeteries that occur in municipal areas (towns or villages), a number of these, some quite informal, i.e. without fencing, occur sporadically all over. Many also seem to have been forgotten, making it very difficult to trace the descendants in a case where the graves are to be relocated.

  Most of these cemeteries, irrespective of the fact that they are for land owner or farm labourers (with a few exceptions where they were integrated), are family orientated.

They therefore serve as important 'documents' linking people directly by name to the land.

- *Infrastructure and industrial heritage*
  In many cases this aspect of heritage is left out of surveys, largely due to the fact that it is taken for granted. However, the land and its resources could not be accessed and exploited without the development of features such as roads, bridges, railway lines, electricity lines and telephone lines. A variety of bridges (**Figure 6.26**), railway lines and other features that can be included in this category occur near the study area.

Figure 6.26: An old bridge across the Leeuspruit.

Further detail can be obtained from the Heritage Specialist Report in **Appendix O**.

6.3.12 Visual Aspects

The study area for the visual assessment is focused to a 8 km radius from the Tutuka Power Station within the Lekwa Local Municipality.

There are no major towns in the immediate area. Standerton lies approximately 20 km to the south. A number of farms and homesteads occur throughout the study area, and in close proximity to the power station.

The visual character of Tutuka Power Station and its surroundings is shaped by a unique combination of the following features:

- An undulating topography with low lying ridges to the east;
- Non-Perennial streams and isolated dams;
- Cultivated land;
- The Tutuka Power Station (being a visually dominant feature in the area);
- An ash disposal facility situated east of the power station;
- Coal mines (situated 5 km and 10 km north of the power station);

- A substation;
- Dispersed farmsteads, and
- Roads - arterial routes (R30, R38, R546) and a number of access roads to farms in the region.

The closest towns are Standerton (20 km south west) and Charl Cilliers (20 km north west), both of which are situated beyond the zone of visual influence of the Ash Disposal Facility.

Cultivated land, coal mines and the Tutuka Power Station are the main form giving elements in the landscape, together with farmsteads dispersed through the region. The visual quality of the landscape is described as medium to low. The Tutuka Power Station and associated infrastructure has generally been accepted as a feature within the landscape, with its own inherent visual qualities.

Visibility of an object is one of the primary attributes by which visual impact can be concluded. This is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words "how much" or "which part" of an object is visible to the observer. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total. Visibility can be modelled by making use of a digital terrain model (DTM), created from contour data, and performing a viewshed analysis using GIS software. It must be noted that the viewshed analysis only accounts for topographical influences, and that the screening effect of vegetation is not included. This indicates a worst-case scenario, where the possibility of visual exposure is mapped, from which possible sensitive viewer locations can be identified.

In addition to viewshed analyses as described above, a proximity analysis is required to incorporate the effect of reduced visibility over distance. By integrating the two types of analyses, an index of possible visual impact is generated, as shown on the map in **Figure 6.27**.

The map indicates a core area of high visibility and a high degree of visual exposure within 6 km from the ash disposal facility. The continuous ashing in an eastern direction is expected to increase its visibility and possibly impact on a number of sensitive receptors within 3 km from the site. Permanent residents within this 3 km radius need to be identified and requirements with regard to mitigation measures investigated during the EIA phase.

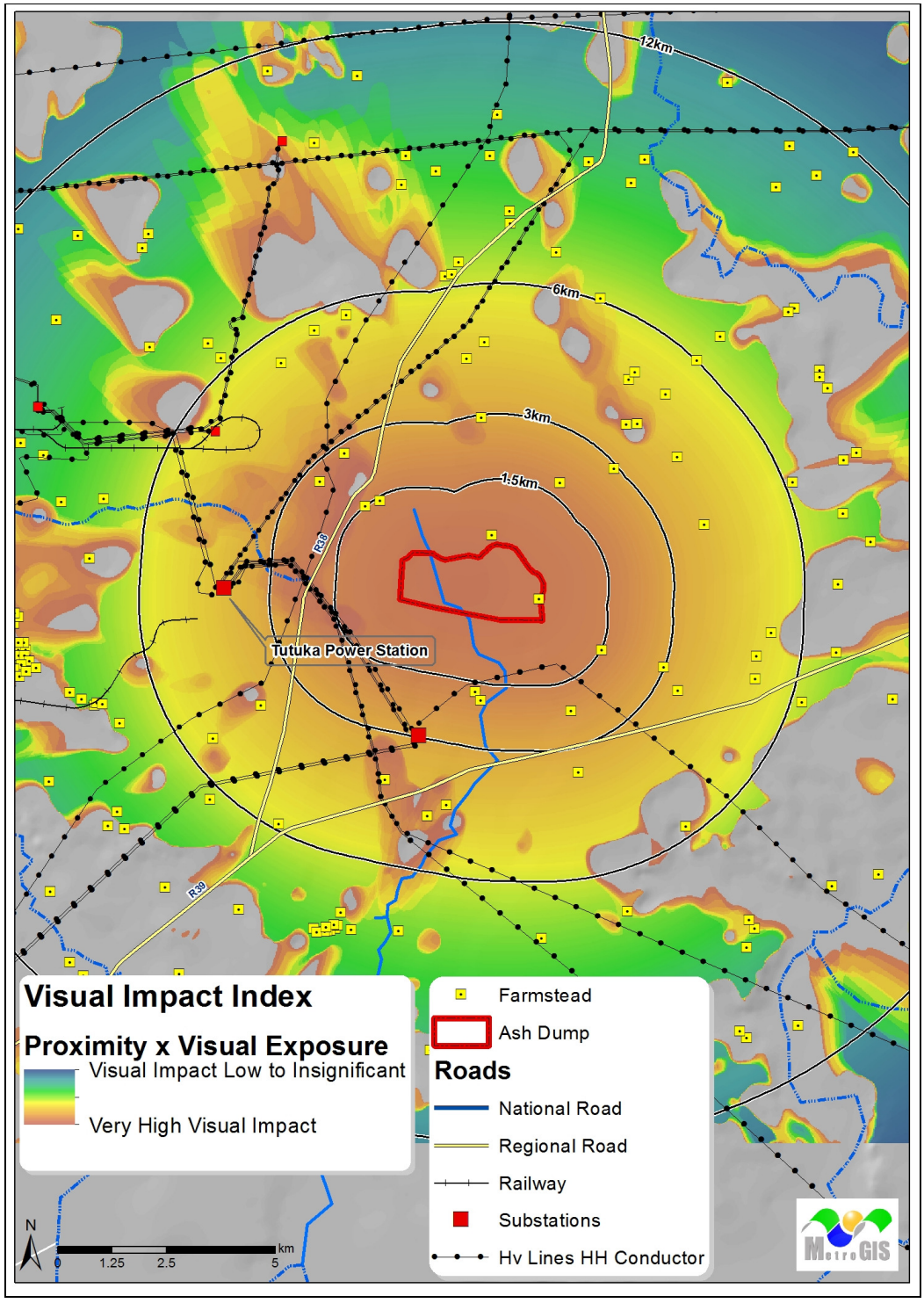

Figure 6.27: Integrated proximity and visual exposure index.

Further detail can be obtained from the Visual Impact Specialist Report in **Appendix S**.

6.3.13 Ambient Air Quality

The Department of Environmental Affairs (DEA) operates an air quality monitoring network over the Highveld region at the residential areas of Hendrina, Ermelo, Middleburg, Secunda and eMalahleni. The closest monitoring station to the proposed operations is located at Secunda. The highest daily and PM_{10} and $PM_{2.5}$ concentrations for the period December 2011 (period for which there is information available) is given in **Figure 6.28**.

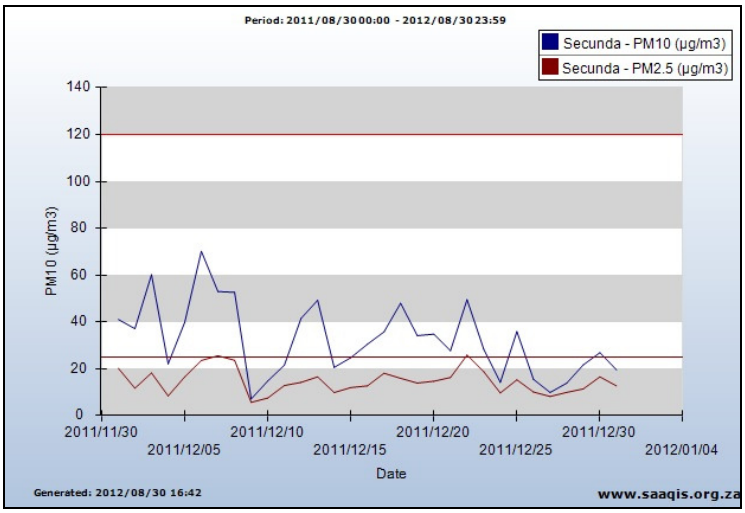

Figure 6.28: Daily measured PM_{10} and $PM_{2.5}$ ground level concentrations (µg/m³) at the Secunda DEA monitoring station (for the period December 2011) (as downloaded from the SAAQIS website)

No exceedances of the National Ambient Air Quality Standard (NAAQS) for PM_{10} and $PM_{2.5}$ were observed for the short monitoring period available. It should be noted however, that the monitoring period is for 1 month only and may exceed the NAAQS if a full monitoring period is assessed.

The ambient measured daily PM_{10} concentrations from the Eskom Grootdraai dam monitoring site is provided in **Figure 6.29** for the period 2009 to 2011 with measured frequency of exceedance of NAAQS provided in **Table 6.15**. The ambient PM_{10} measurements should be evaluated in context with the data availability of the monitored data. As the data availability at Grootdraai dam is relatively poor for the period 2009 to 2011, the predicted frequency of exceedance of the National Ambient Air Quality limits for PM_{10} may be even higher than actual measured values.

High ambient particulate concentrations have been found to coincide with low ambient temperatures and low rainfall (Burger, 1994). Increases in domestic coal burning and poor atmospheric dispersion potentials, together with persistent industrial emissions, combine to produce elevated ambient concentrations during winter months. High concentrations during summer months are usually associated with increases in fugitive dust emissions. Rainfall events result in a reduction of airborne concentrations due to

reductions in the potential for fugitive dust emissions and due to the removal of particulates in the atmosphere by raindrops. Other sources of particulates in the vicinity of the Tutuka power station include domestic fuel burning in the residential communities of Standerton, coal mining near the power station, agricultural activities for example ploughing of fallow fields prior to planting and the production of synfuels in Secunda.

Table 6.14: Measured daily ambient PM_{10} concentrations at Eskom's Grootdrrai dam monitoring station for the period 2009 to 2011

Monitoring Period	Data Availability (%)	Number of Exceedances of the NAAQ limit of 120 µg/m³ (applicable immediately)	Exceedance of the NAAQS (applicable immediately) (Y/N)	Number of Exceedances of the NAAQ limit of 75 µg/m³ (applicable 2015)	Exceedance of the NAAQS (applicable 2015) (Y/N)
2009	53	9	N	60	N
2010	31	0	Y	4	Y
2011	19	0	Y	16	N

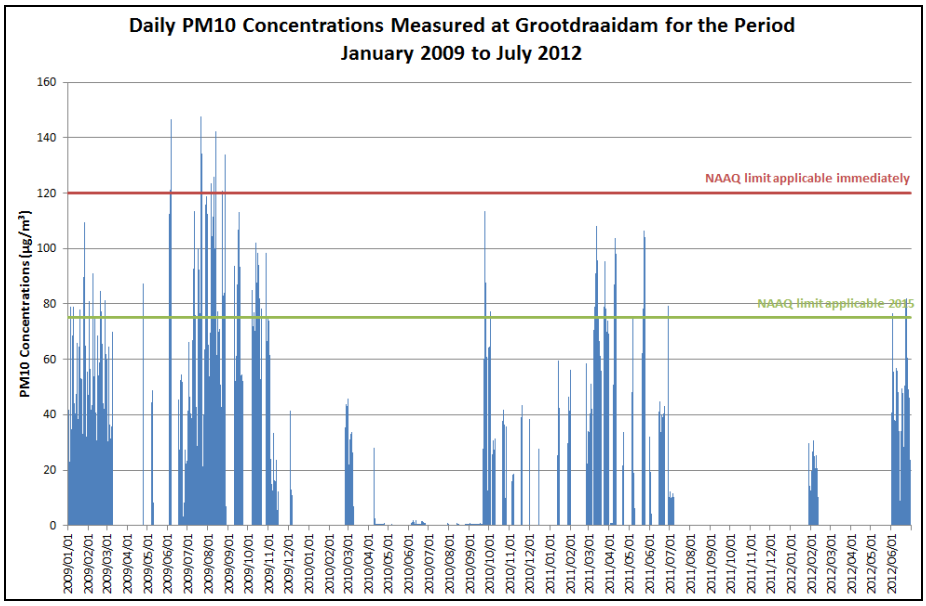

Figure 6.29: measured daily PM_{10} concentrations for the Eskom Grootdraai dam monitoring station.

Further detail can be obtained from the Air Quality Specialist Report in **Appendix I**.

6.3.14 Social Environment

Tutuka Power Station is situated in the Mpumalanga Province and within the Lekwa Local Municipality area of jurisdiction. The Lekwa Local Municipality is situated in the south-western part of the Gert Sibande District Municipality. The municipality is surrounded by the following local municipalities, Pixley ka Seme and Msukaligwa on the east, Dipaleseng on the west and Govan Mbeki on the north. In the south the municipality shares the boundary with Phumelela Local Municipality which is in the northern part of the Free State Province.

Lekwa Local Municipality has Standerton as its major urban node, whilst Morgenzon which is 45km north east of Standerton serves as a satellite node.

The town of Standerton was named after Adrian Hendrik Stander who was the owner of the farm on which the town was established. Standerton is a large commercial and agricultural town lying on the banks of the Vaal River which specialises in cattle, dairy, maize and poultry farming. The town is situated 1 540 meters above sea level. The tenth largest dam in South Africa namely "Grootdraai Dam" is just 12 kilometers out of town and is one of the town's major tourism attractions.

Another area of some spatial importance to Lekwa Local Municipality is Morgenzon, some 45km north-east of Standerton. This is historically a local service centre that served (and still does) the surrounding commercial farming areas with basic needs. Despite its potential due to its location along a major route (R35) to Volksrust via the N11 from Bethal, it is still largely under-developed as a service centre due possibly to the competition offered by the more attractive business centres of Ermelo, Bethal and even Standerton itself.

Thuthukani is located some 18km North-East of Standerton and it began essentially as a workers village for the Tutuka Power Station which is situated about 3km east of the village. It is divided into two main sections namely, the eastern section belonging to Eskom and the western section owned by New Denmark Mining Company.

The socioeconomic analysis is specifically aimed at spatially related matters, i.e. demographics, employment and income and economic profile.

- ***Demographics***

The Lekwa Local Municipality (Lekwa) has a population of about 117 833, representing approximately 12% of the Gert Sibande District. It comprises of about 11 communities and approximately 32 241 households. The area primarily consists of urban residential settlements, significant farmland communities and quite significant industrial communities in different areas and towns across the municipalities. The Municipality spans an area of approximately 4 603km^2 which equates to 14% of the overall Gert Sibande District (+/-31

970km^2). The average density of the region 26 persons/km (the area estimates are calculated using Planet GIS data).

The main areas are concentrated around Standerton, Sakhile, Rooikoppen, Sivukile, Azalea Thu-Thukani and Meyerville. Other areas include Stanfield Hill, Morgenzon and the outlying areas of rural Lekwa.

Table 6.15 below gives an indication of the population numbers per ward within the Lekwa Local Municipality.

Table 6.15: Ward Population Numbers

Description	Population Stats Sa 1996	Population Stats Sa 2001	Population Dwa 2008	Population Global Insight 2008
Ward 1	5930	6796	7822	7755
Ward 2	3971	4551	5238	5193
Ward 3	8420	9650	11106	11011
Ward 4	4042	4632	5332	5286
Ward 5	5277	6048	6961	6901
Ward 6	4013	4599	5293	5248
Ward 7	5898	6759	7780	7713
Ward 8	3602	4128	4751	4710
Ward 9	13271	15209	17505	17355
Ward 10	6573	7533	8670	8596
Ward 11	6816	7811	8991	8914
Ward 12	7561	8665	9973	9887
Ward 13	10789	12365	14231	14109
Ward 14	3942	4518	5200	5155
Total	**90105**	**103264**	**118853**	**117832**

Table 6.16 below includes the settlement summary for Lekwa Local Municipality.

Table 6.16: Lekwa Settlement Summary

SETTLEMENT NAME	POPULATION				HOUSEHOLDS				HH Size
	Urban - Formal Town	Industrial	Farming	**Grand Total**	Farming	Industrial	Urban - Formal Town	**Grand Total**	
Azalea	389	0	0	**389**	0	0	111	**111**	3.5
Azalea Ext 1	4840	0	0	**4840**	0	0	1381	**1381**	3.5
Early Bird Farm	0	0	287	**287**	82	0	0	**82**	3.5
Meyerville	4063	0	0	**4063**	0	0	1160	**1160**	3.5
Morgenzon	1765	0	0	**1765**	0	0	504	**504**	3.5
Rooikoppen	14876	0	0	**14876**	0	0	4246	**4246**	3.5
Rural Lekwa	0	0	16011	**16011**	3177	0	0	**3177**	5.0
Sakhile	26788	0	0	**26788**	0	0	7646	**7646**	3.5
Sakhile Ext 5	900	0	0	**900**	0	0	257	**257**	3.5
Sakhile Ext 6	834	0	0	**834**	0	0	238	**238**	3.5
Sivukile	882	0	0	**882**	0	0	252	**252**	3.5

Sivukile Ext 1	1549	0	0	**1549**	0	0	442	**442**	3.5
Sivukile Ext 2 & 3	3758	0	0	**3758**	0	0	1073	**1073**	3.5
Sivukile Ext 4	1302	0	0	**1302**	0	0	371	**371**	3.5
Standerton	8210	0	0	**8210**	0	0	2343	**2343**	3.5
Standerton Ext 1	0	644	0	**644**	0	184	0	**184**	3.5
Standerton Ext 3	2788	0	0	**2788**	0	0	796	**796**	3.5
Standerton Ext 4	5219	0	0	**5219**	0	0	1490	**1490**	3.5
Standerton Ext 6	12326	0	0	**12326**	0	0	3518	**3518**	3.5
Standerton Ext 7	3657	0	0	**3657**	0	0	1044	**1044**	3.5
Stanfield Hill	1257	0	0	**1257**	0	0	359	**359**	3.5
Thu-Thukani	5488	0	0	**5488**	0	0	1567	**1567**	3.5
Grand Total	**100891**	**644**	**16298**	**117833**	**3259**	**184**	**28798**	**32241**	**3.7**

- ***Age and Gender Profile***

The age and gender profile of the Municipality can be defined as generally young (**Figure 6.30**). This is denoted by a representation of approximately 40% of the population below the age of 20 years, yet overall 59% is below the age of 30 years. The balance of the population is made up of approximately 26% between 30 – 50 years and up to 11% above 50 years.

The age related analyses show that the main development areas for the Lekwa Local Municipality should focus on initiatives to address areas such as education, socio-economic development, skills and entrepreneurship.

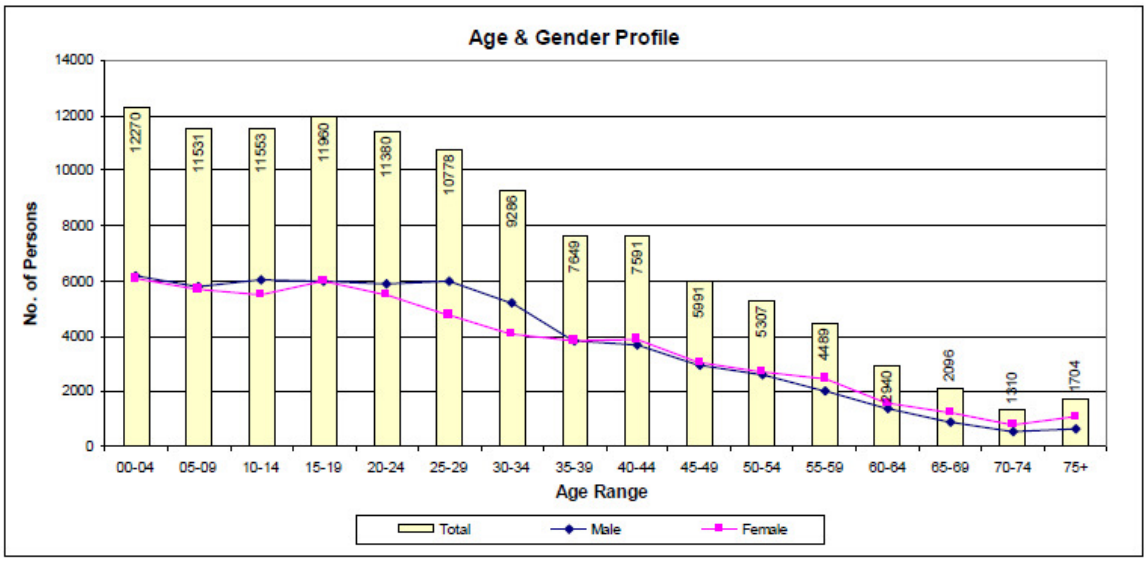

Figure 6.30: Age and Gender Profile

- **Socio-Economic Summary**

The following provides a summary of the socio-economic profile of the Lekwa Local Municipality:

- Approximately 85% of the population is settled in urban areas and less than 14% in rural areas of Lekwa.
- The largest settlements include Standerton and Sakhile representing a combined total of 49% of the total population.
- The average household density across Lekwa is between 3.5 to 3.7 persons per household. The urban settlements with approximately 3 – 4 persons per household and in the rural areas with almost 5 persons per household.
- Other income related observations indicate that more 11% of the population earn below R1 000 and 23% of the total population earn below R1 500.
- A large number of people in Lekwa may be considered relatively poor with an estimated 42 687 people living in poverty. The estimated number of indigent households is expected to be more than 7 000 households with coverage of between 25 000 to 40 000 people as beneficiaries. This makes the Municipality economically vulnerable because only less than 35% of the population earn income that subsidise services to the larger population of the Municipality.
- There are significant differences in level of income inequality due several factors including that a large segment of the population is either economically inactive (45%) or unemployed (17% of the total).
- A significant number of the population (19.5%) are also social grant recipients and the largest contribution for all grants is "child support grants" (13% of total population).