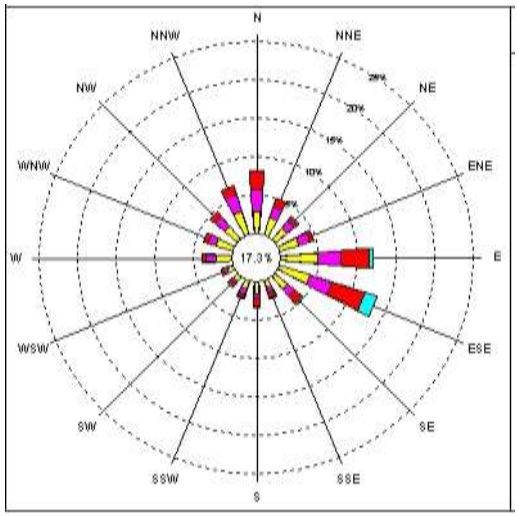

Figure 26: Wind Rose - January.

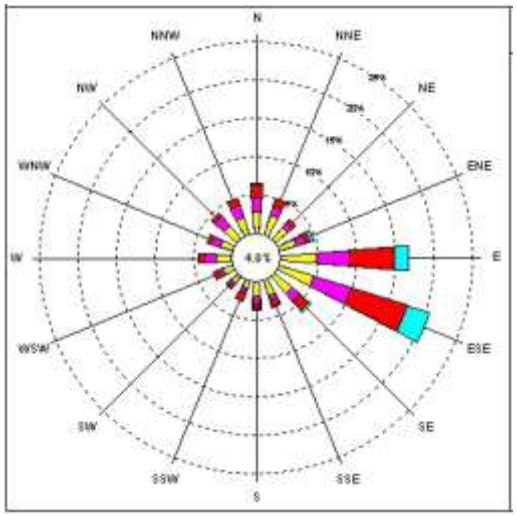

Figure 27: Wind Rose - February.

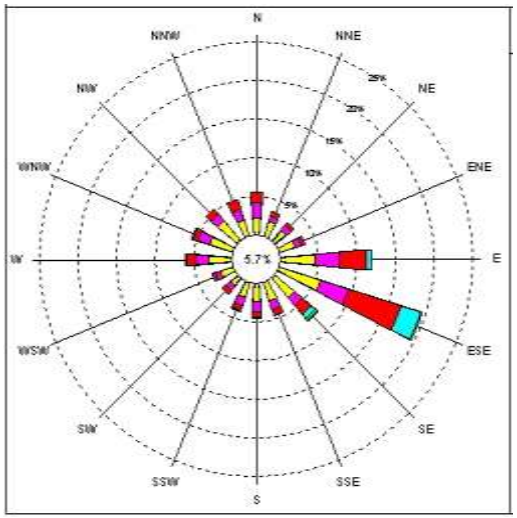

Figure 28: Wind Rose – March.

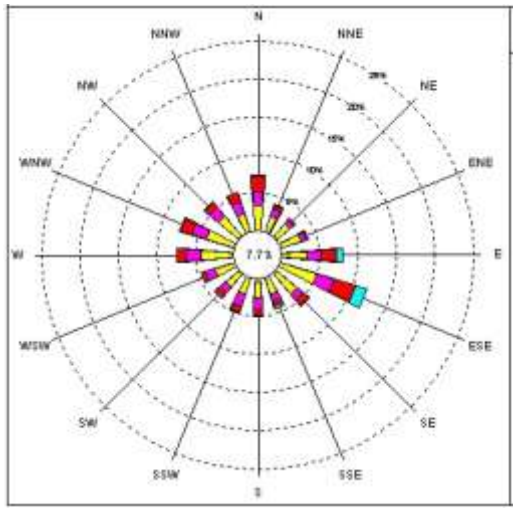

Figure 29: Wind Rose – April.

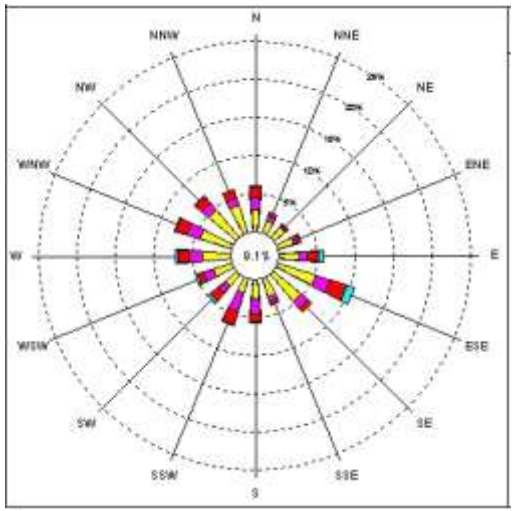

Figure 30: Wind Rose – May.

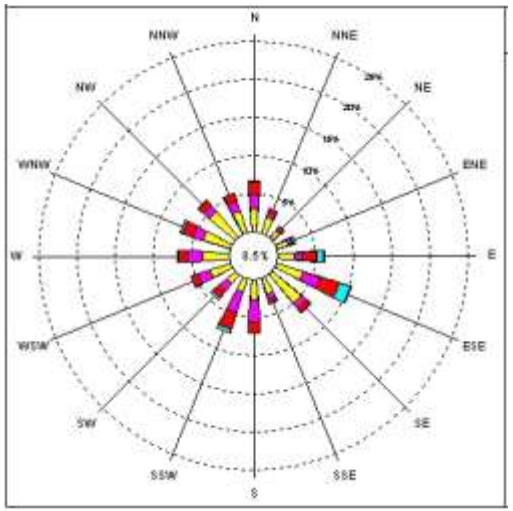

Figure 31: Wind Rose - June.

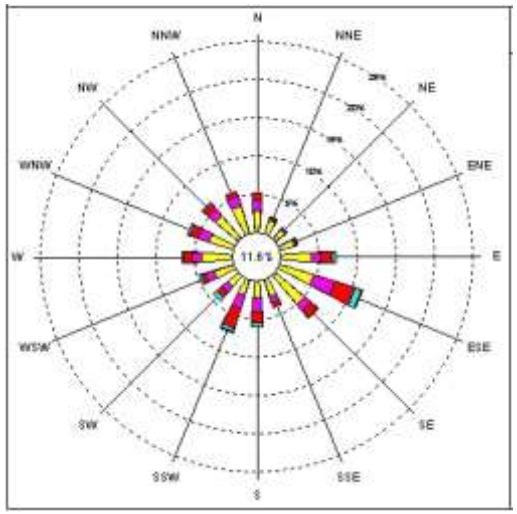

Figure 32: Wind Rose – July.

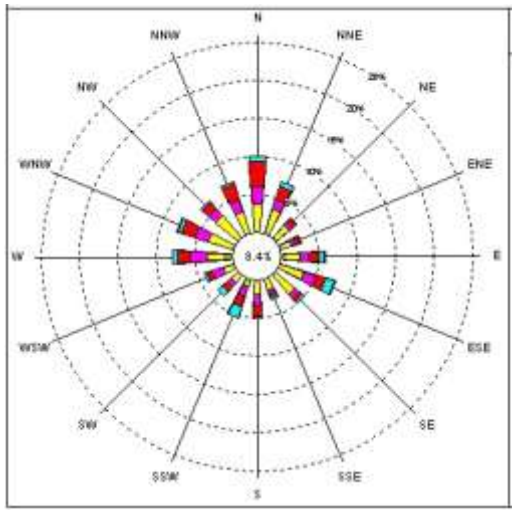

Figure 33: Wind Rose - August.

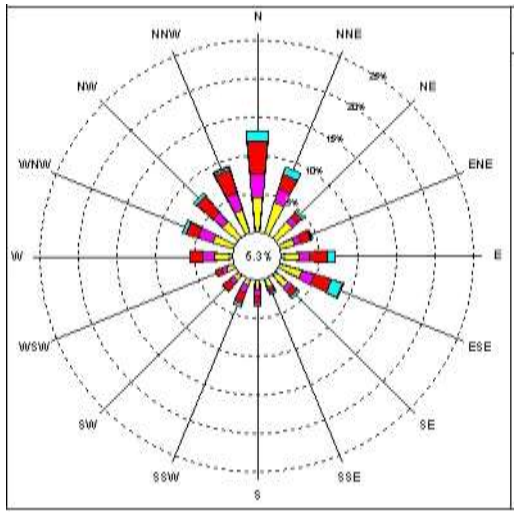

Figure 34: Wind Rose – September

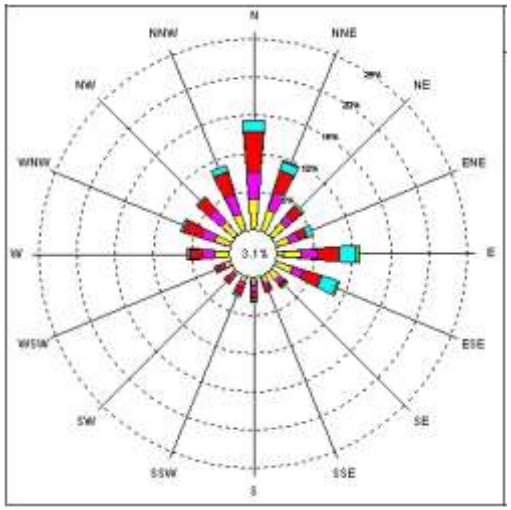

Figure 35: Wind Rose – October.

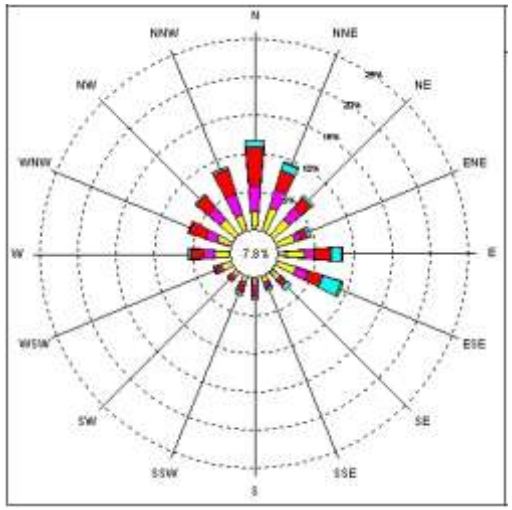

Figure 36: Wind Rose – November.

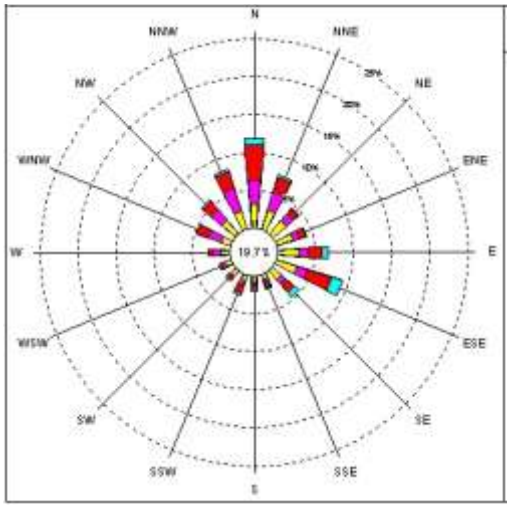

Figure 37: Wind Rose - December.

2.3 Topography

The general topography of the area is flat with a gentle slope of no greater than 5% according to the AGIS Comprehensive Atlas. According to the geotechnical investigation report the site slopes to the south at an average gradient of less than 1% (Johann v.d. Merwe, 2012).

The area is located at approximately 1 598 metres above mean sea level.

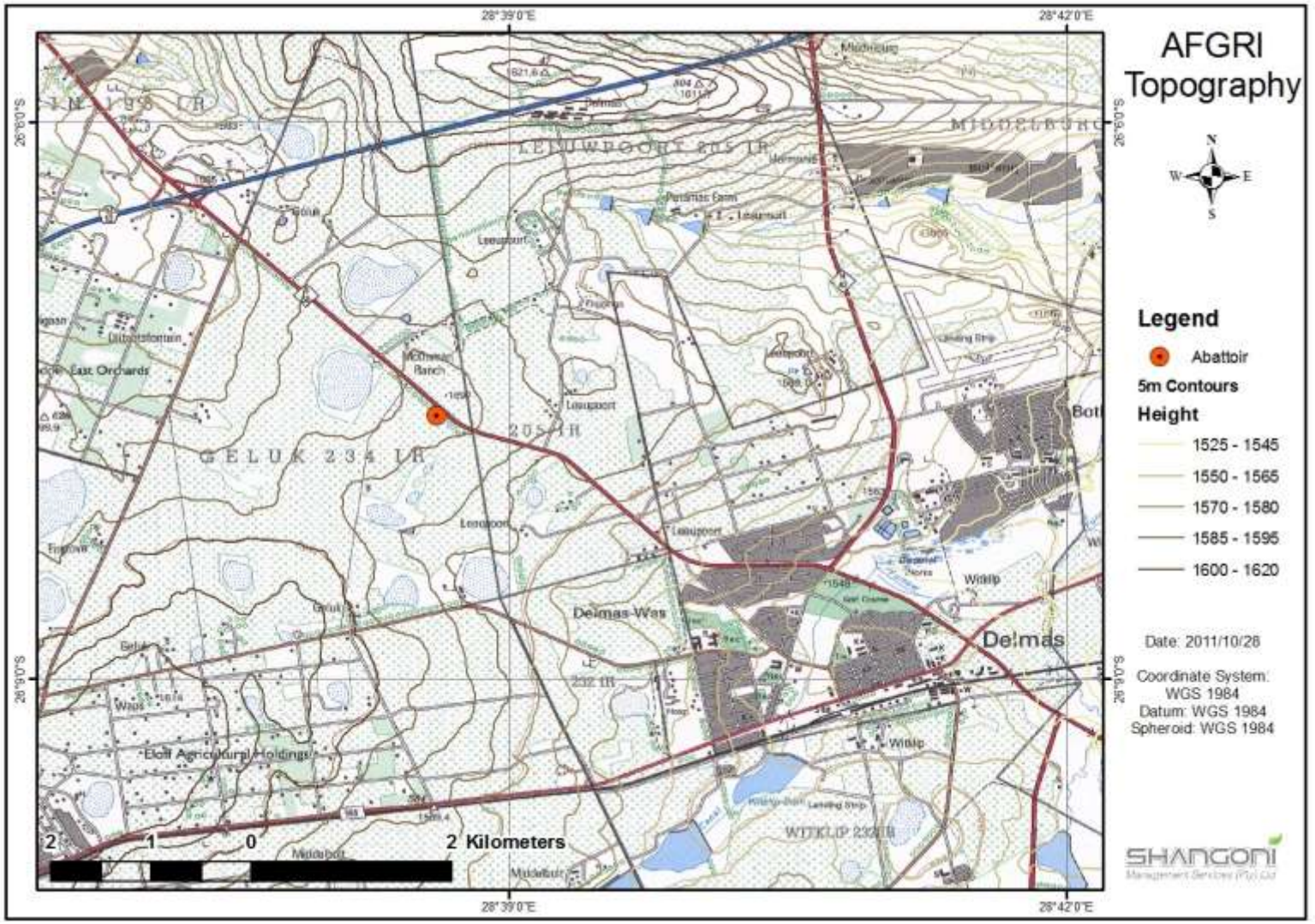

Figure 38: Topography map of the site.

2.4 Soils

The project site has mostly red and/or yellow apedal mesotrophic and/or dystrophic soils, with Hutton (red) soils dominating the area (Laubscher & Lubbe, 2009). The land type of the site is Ba2 according to the AGIS Land Type Survey. These soils have low to medium base status (AGIS Soils) and the soil depth lies in the range of between 450 mm and 750 mm deep (Figure 42). The clay component of the topsoil represents between 15 % and 35 % of the total volume of soil (Figure 43) and these soils have a medium agricultural production potential. According to Figure 39, the soil present on the site is classified as code S2. This means that the soil is structureless and freely drained with favourable physical properties. However, the soil may have restricted soil depth, high erodibility, low natural fertility and excessive drainage.

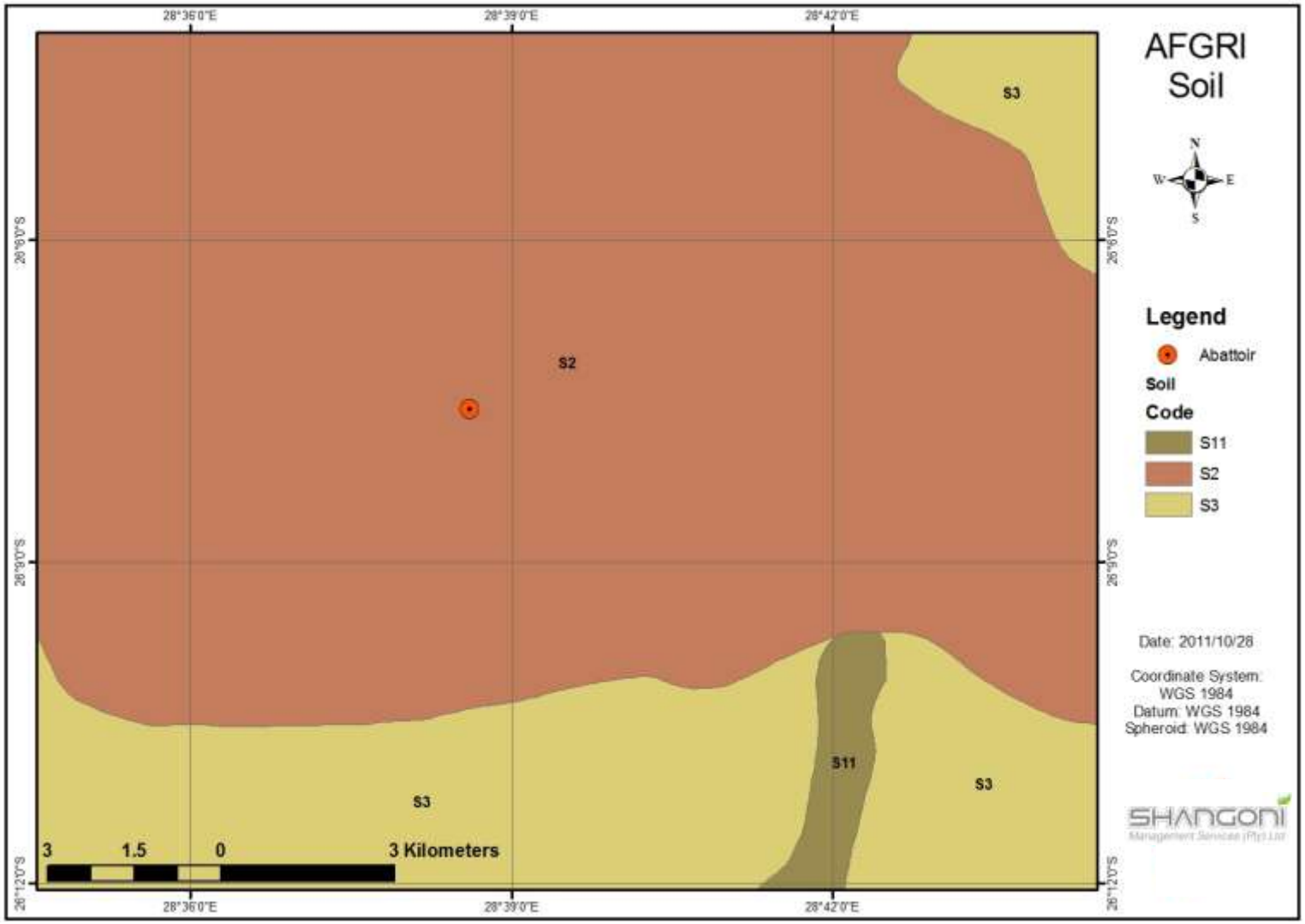

Figure 39: Soil map.

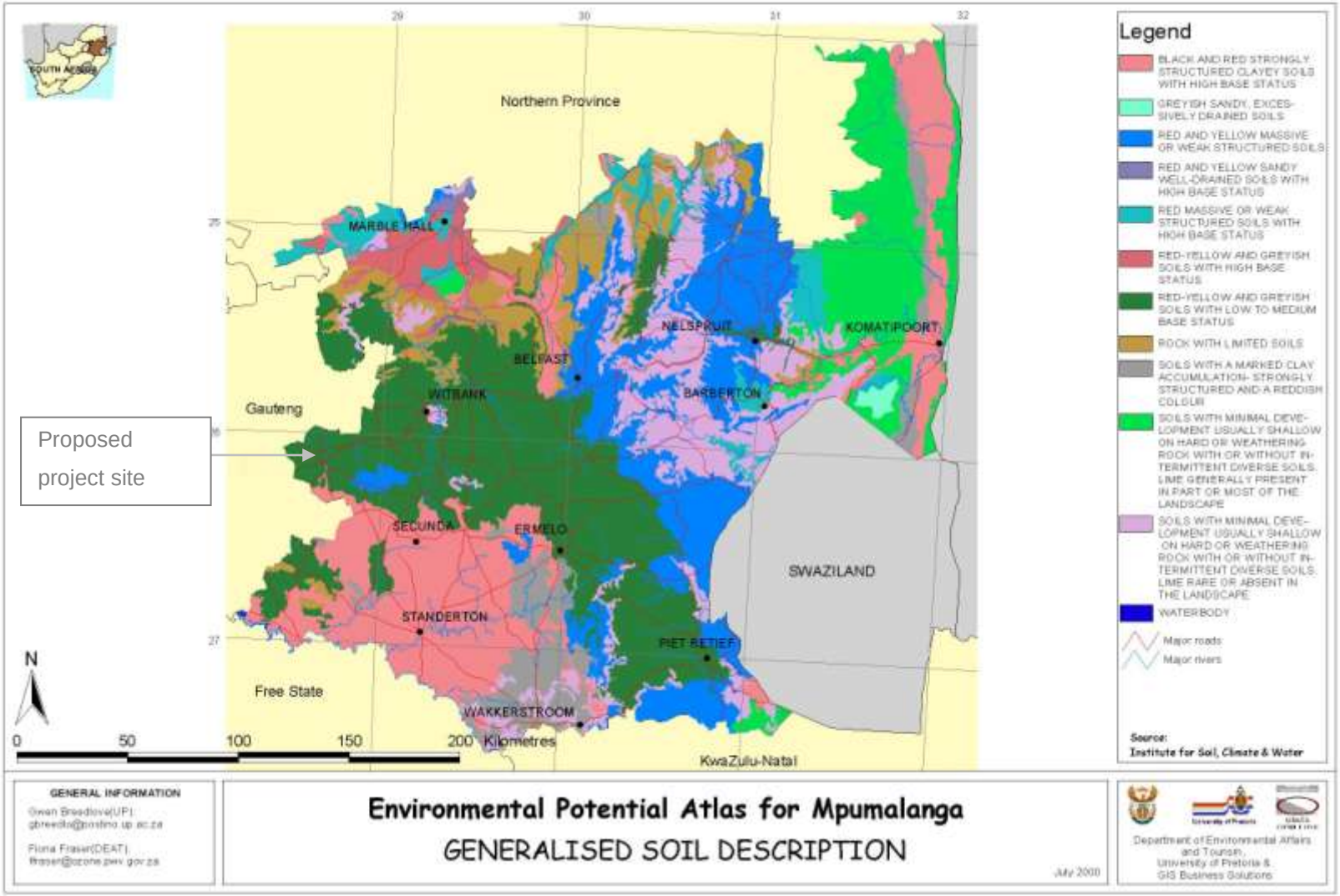

Figure 40: General soil description for Mpumalanga.

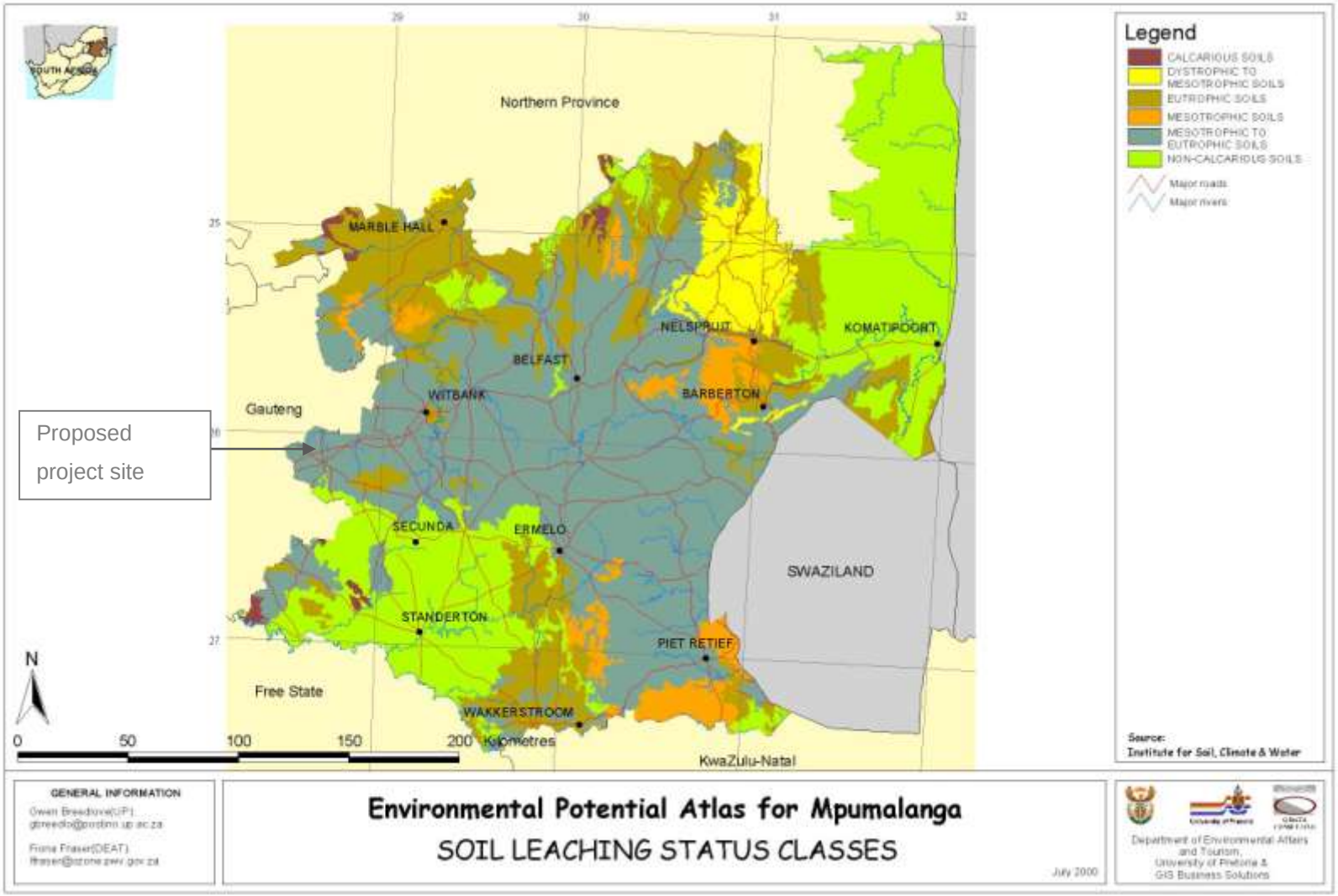

Figure 41: Soil leaching status classes for Mpumalanga.

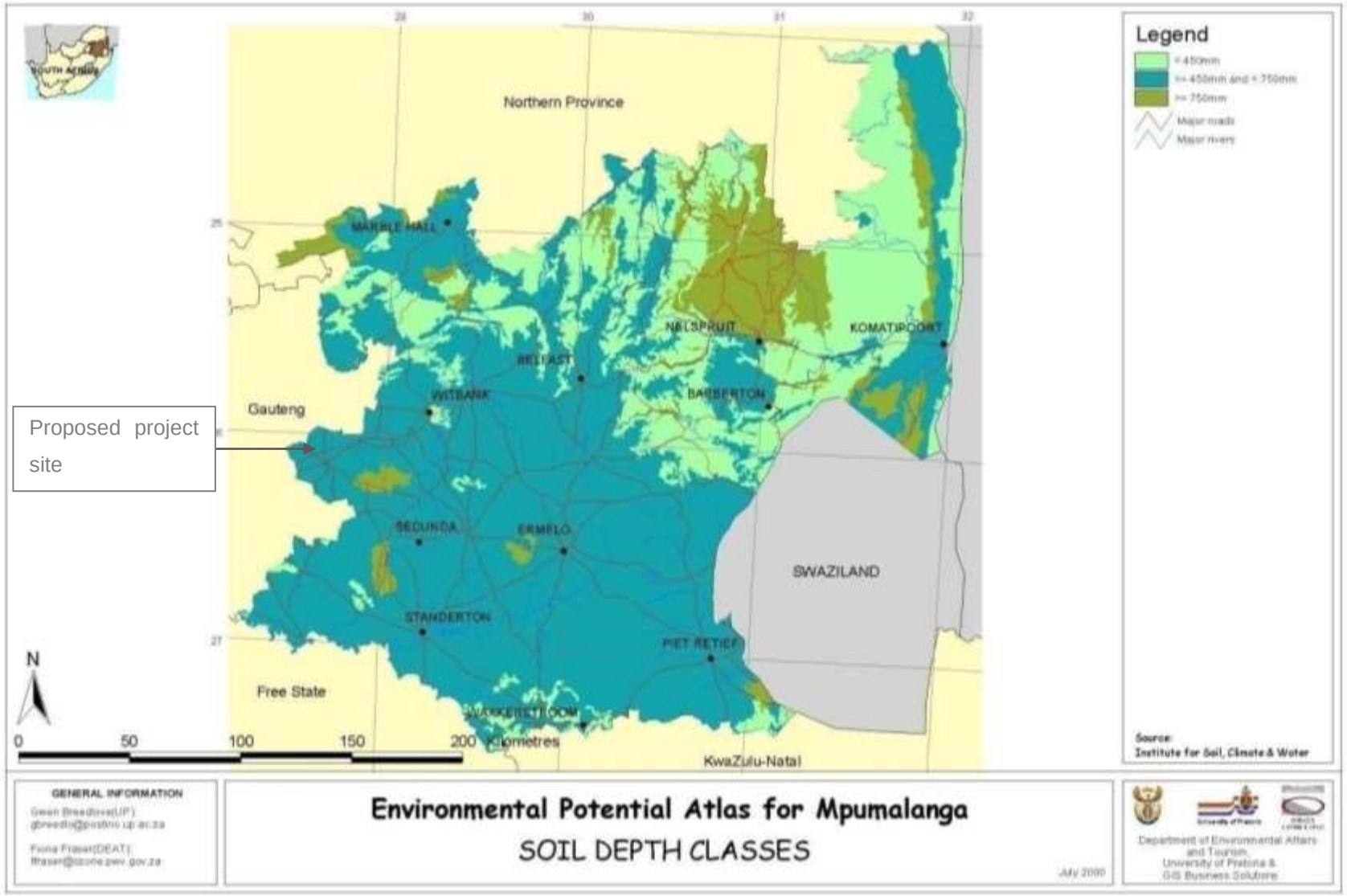

Figure 42: Soil depth in Mpumalanga.

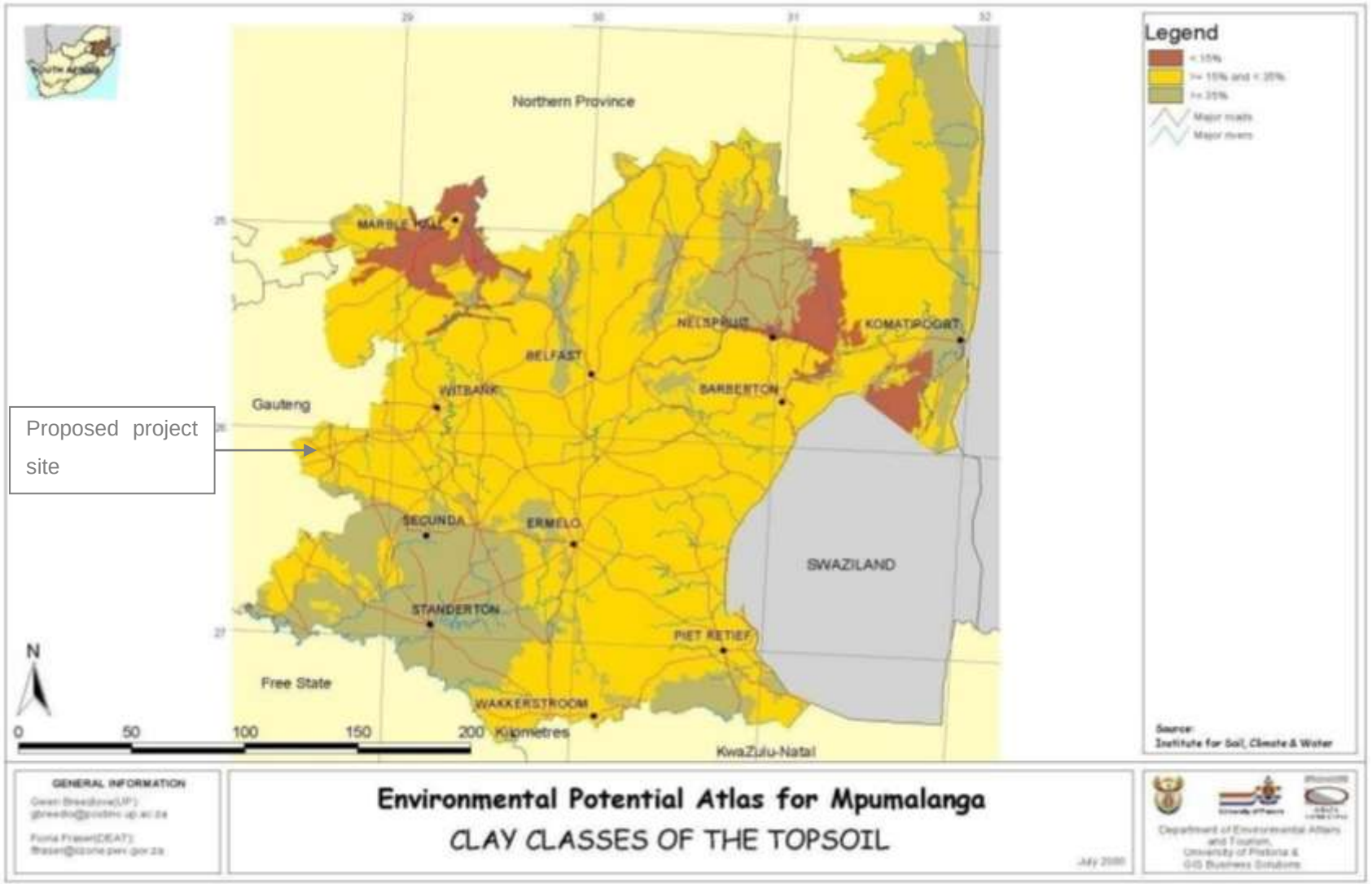

Figure 43: Clay classes of the topsoil for Mpumalanga.

2.5 Land use and land capability

The land is zoned as “Special” zoning and the AFGRI Poultry Delmas abattoir is present on the site. The site is therefore no longer in a natural state. The dominant land use surrounding the site is cultivated land, built-up land and land for which the land use is vacant or unspecified (Figure 44).

According to the AGIS Comprehensive Atlas, land capability of the site is classified as arable land of high potential.

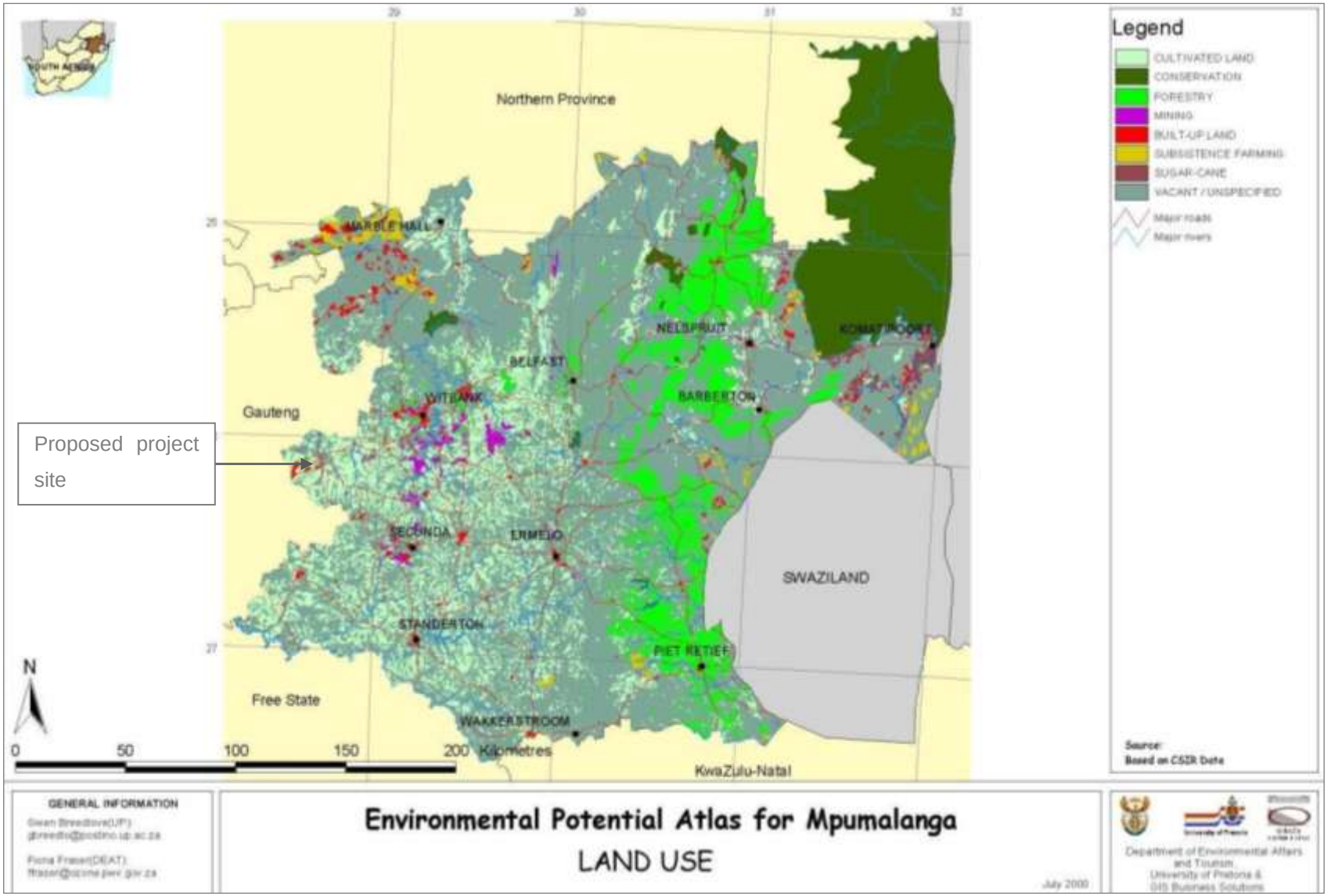

Figure 44: Land uses in Mpumalanga

2.6 Wetlands

A wetland assessment was conducted on the site by Reinier Terblanche in October 2012. This assessment also looked at the ecological (fauna and flora) characteristics of the wetland areas. Below is a summary of the findings of the wetland assessment. The full report is attached under Appendix F.

There are two wetland systems present on the property. A pan depression of natural origin is located to the WNW of the proposed WWTW and a mostly artificial wetland system to the south. It is difficult to determine the original features and historic terrestrial parts of the artificial system. The two wetland systems are shown in the figure below.

Figure 45: Two wetland systems present on the property

2.6.1 Pan depression wetland

This inland pan depression wetland is 40.1ha in size (all zones included), is situated within a cultivated area and has only one inflow. There is diffuse surface flow and temporary containment and storage of water in the wetland. The depression is mainly endorheic as it appears that water exits the wetland mainly through infiltration and evaporation. The following table summarises the main services of the wetland.

Table 6: Services of the wetland

Supporting services	Nutrient cycling and primary production
Regulating services	Collecting water and acting as a buffer to erosion in the cultivated area
Provisioning services	None
Cultural services	Recreational area to appreciate the landscape with its aquatic and wetland biodiversity

The present ecological status (PES) of the wetland, according to DWAF (1999), plots within Category B: “Largely natural with few modifications, but with some loss of natural habitats”. The ecological importance and sensitivity (EIS) of the wetland, according to DWAF (1999) is High: “Floodplains that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers”.

2.6.2 Artificial drainage and dam system wetland

The artificial, inland wetland system is to some extent equivalent to a channeled valley bottom wetland and is 11ha in extent (all zones included). This wetland system is also located within cultivated areas. The following table summarises the main services of the wetland.

Table 7: Services of the wetland

Supporting services	Nutrient cycling and primary production
Regulating services	Collecting water and acting as a buffer to erosion in the cultivated area
Provisioning services	None
Cultural services	Recreational area to appreciate the landscape with its aquatic and wetland biodiversity

The present ecological status (PES) of the wetland, according to DWAF (1999), plots within Category E: “Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive”. The ecological importance and sensitivity (EIS) of the wetland, according to DWAF (1999), is Moderate: “Floodplains that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers”

2.6.3 Summary

The pan depression is a valuable asset for biodiversity conservation at the site and does not form part of the drainage system affected by the proposed WWTW. The release of treated wastewater (general limit qualities for discharge) from the WWTW into the artificial wetland

system will likely have a positive impact on the currently disturbed state of the wetland as well as on the wetland systems downstream (Terblanche, 2012).

2.7 Fauna and Flora

2.7.1 Flora

A general description of the area is given below. This will be followed by a summary of the vegetation found at the two on site wetlands from the following report written by Mr. R. Terblanche in November 2012: Wetland assessment: AFGRI Poultry Delmas Abattoir: Portion 21 of the farm Geluk 234 IR.

This farm falls within the Grass Land biome region and is specifically classified as Eastern Highveld Grassland (GM 12) (Figure 46).

The Grassland Biome is found mainly on the high central plateau of South Africa and the inland regions of KwaZulu-Natal and the Eastern Cape. Frost, fire and grazing maintain the dominance of grasses and prevent the establishment of trees. Fire is a natural factor caused by lightning and regular burning is essential for maintaining the structure and biodiversity of this biome. Grasslands are unique ecosystems with rich and often highly specialized animal life, both above and below ground. Formerly, native grasslands supported vast herds of ungulates such as blesbok, black wildebeest and springbok. Bird densities range from 50 to 380 birds per 100 ha, and include a wide range of species.

South African grasslands essentially comprise of a simple, single-layered herbaceous community of tussocked (or bunch) grasses. It is not generally known that the majority of plant species in grasslands are non-grassy herbs, most of which are perennial plants with large underground storage structures that can live for several decades. The Grassland Biome has an extremely high biodiversity, second only to the Fynbos Biome. At a 1 000 square metre scale, the average species richness of the Grassland Biome is even higher than those of most Fynbos communities, being surpassed only by Renosterveld.

Eastern Highveld grasslands occur in the Gauteng and Mpumalanga Provinces at an altitude of 1 520 – 1 780 metres above mean sea level, but can occur as low as 1 300 metres above mean sea level. The short dense grassland is dominated by species commonly found in grasslands (*Aristida, Digitaria, Eragrostis, Tristachya* and *Themeda* among others). There are small rocky outcrops scattered throughout the grassland where some woody species and wiry, sour grasses occur (*Celtis africana, Acacia caffra, Parinari capensis, Diospyros lycioides* subsp. *lycioides, Protea caffra, P. welwitschii* and *Rhus magalismontanum).*

Important taxa within the Eastern Highveld grasslands are given in the table below.

The natural grasslands are considered endangered with only a small percentage conserved in statutory and private reserves. The target for conservation is 24% (Mucina & Rutherford, 2006).

Table 8: Important taxa within the Eastern Highveld grasslands.

Taxa	Species
Graminoids:	Graminoids: *Digitaria monodactyla, D. tricholaenoides, Brachiaria serrata, Aristida aequiglumis, A. junciformis* subsp. *galpinii, A. congesta, Cynodon dactylon, Eragrostis chloromelas, E. plana, E. sclerantha, E. curvula, E. racemosa, Heteropogon contortus, Microchloa caffra, Monocymbium ceresiiforme, Loudetia simplex, Setaria sphacelata, Themeda triandra, Sporobolus africanus, S. pectinatus, Alloteropsis semialata* subsp. *eckloniana, Andropogon appendiculatus, A. schirensis, Trachypogon spicatus, Bewsia biflora, Tristachya leucothrix, T. rehmannii, Diheteropogon amplectens, Ctenium concinnum, Eragrostis capensis, E. patentissima, E. gummiflua, Rendlia altera, Harpochloa falx, Schizachyrium sanguineum, Panicum natalens, Setaria nigrirostris* and *Urelytrum agropyroides.*
Herbs:	*Haplocarpha scaposa, Berkheya setifera, Justicia anagalloides, Acalypha angustata, Pelargonium luridum, Chamaecrista mimosoides, Euryops gilfillanii, E. transvaalensis* subsp. *setilobus, Dicoma anomala, Ipomoea crassipes, Senecio coronatus, Pentanisia prunelloides* subsp. *latifolia, Helichrysum aureonitens, H. callicomum, H. caespititium, H. rugulosum, H. oreophilum, Selago densiflora, Wahlebergia undulata* and *Vernonia oligocephala.*
Geophytic Herbs:	*Haemanthus humilis* subsp. *hirsutus, Ledebouria ovatifolia, Gladiolus crassifolius* and *Hypoxis rigidula* var. *pilosissima.*
Succulent Herbs:	*Aloe ecklonis.*
Low Shrubs:	*Stoebe plumosa* and *Anthospermum rigidum* subsp. *pumilum.*

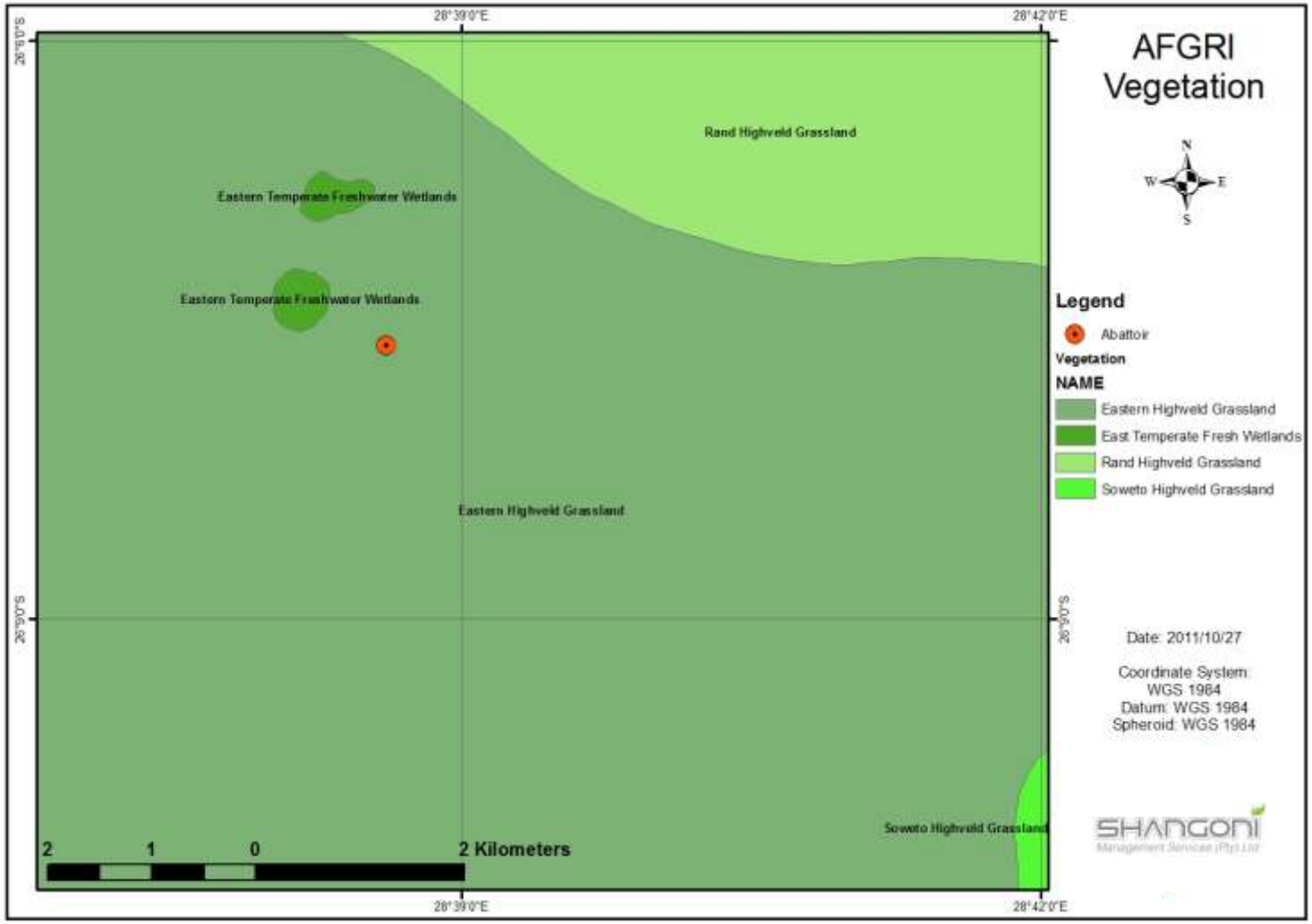

Figure 46: Vegetation type of the site.

The following information has been extracted from Mr. Terblanche's specialist report:

Pan depression wetland

At the pan depression to the WNW of the proposed WWTW, the marsh vegetation is arranged concentrically around the centre of the depression. Indigenous grass and sedge species dominate, while megagraminoids like *Typha capensis* and *Phragmites australis* are rare or absent. At the outskirts of the seasonal zone indigenous grasses, such as cotton wool grass (*Imperata cylindrica*) and indigenous herbs, such as *Monopsis decipiens* and *Helichrysum aureonitens* are present. In the seasonal zone, wild rice grass (*Leersia hexandra*) dominates, while sedges species of the *Eleocharis* and *Fuirena* genus are also present. The central part of the permanent zone lacks vegetation. It is unlikely that any threatened plant species are present at the wetland.

Artificial drainage and dam system wetland

At the artificial drainage and dam system to the south of the proposed WWTW, the vegetation consists of exotic trees, *Eucalyptus*, many exotic weeds and exotic kikuyu grass. At the edges of the permanent zone there are patches of the megagraminoid *Typha capensis* (bulrush) (Terblanche, 2012).

2.7.2 Fauna

During the site visit, it was noted that the absence of trees in the area precludes a number of bird species from occurring (lack of nesting habitat). Vegetation cover onsite is conductive to foraging and nesting habitat for a variety of smaller mammals and birds. Very view faunal species were encountered on site.

A desktop assessment of the area was undertaken to get a better understanding of the potential impact that the proposed development might have on the fauna of the site and the surrounding area. Table 9 gives an indication of the fauna species that are commonly found in the area. Thereafter, a summary of the fauna at the two on site wetlands is given from the specialist report compiled by Mr. R. Terblanche in November 2012, namely "Wetland assessment: AFGRI Poultry Delmas Abattoir: Portion 21 of the farm Geluk 234 IR".

Table 9: Fauna species of general occurrence.

Vertebrates	Invertebrates
Mammals: Porcupine Hedgehog Springhare Ground Squirrel Giant Rat Suricates	**Lower Invertebrates:** Garden Snail (*Helix aspersa*) Common Earthworm (*Lumbricus terrestris*) Wood Lice (Order *isopodra*) Large Centipedes (Order *scolopendromorpha*) Earth Centipedes (Order *geophilmorpha*) Stone Centipedes (Order *lithobiomorpha*)
Amphibians: Guttural Toad (*Bufo gutturalis*) Bushveld rain frog (*Breviceps adsperus*) Bubbling Kassina (*Kassina senegalensis*) Common Caco (*Cacosternum boettgeri*) Natal Sand Frog (*Tomopterna natalensis*)	**Insects:** Fishmoths (Order *thysanura*) Skimmer Dragonflies (Family *libellulidae*) Darner Dragonflies (Family *aeschnidae*) Damselflies (Suborder *zygoptera*) Common Termites (Family *termitidae*) Cockroaches (Order *blattodea*) Earwigs (Order *dermaptera*) Grasshoppers (Family *acrididae*) Bush Crickets (Family *tettigoniidae*) Horseflies (Family *tabanidae*) House flies (Family *muscidae*) Social Wasps (Family *vespidae*) Social Bees (Family *apidae*) African Monarch (*Dannaus chryssipus*) Garden Acraea (*Acraea horta*) Foxy Charaxes (*Charaxes jasius*) Common joker (*B. ilithyia*) Gaudy Commodore (*Precis octavia*) Garden Commodore (*Precis archeria*) Painted Lady (*Vanessa cardui*) Common Blue (*Leptotes pirithous*)
Reptiles: Brown House Snake (*Lamprophis fuliginosus*) Common Slugeater (*Duberria lutrix*) Rinkhals Spotted Sand Lizard (*Pedioplanis lineoocellata*)	

During the site visit conducted by Mr. Terblanche in October 2012, it was noted that the pan depression to the WNW of the proposed WWTW hosts a rare habitat specialist butterfly (*Metisella meninx*) and a number of water-loving birds, including the white-faced duck (*Dendrocygna viduata*) and the grey-headed gull (*Larus cirrocephalus*). A number of water-loving birds were also observed at the artificial drainage and dam system to the south of the proposed WWTW. These included the greater flamingo (*Phoenicopterus ruber*), the lesser flamingo (*Phoeniconaias minor*), which is near threatened globally, and the glossy ibis (*Plegadis*

falcinellus). It is unlikely that any threatened animal species are resident at the wetlands on site, however, the artificial wetland system may be an important biodiversity conservation area for more widespread species such as the otter (Terblanche, 2012).

Very few habitats will be lost as a result of the activity. With proper mitigation measures applied, the proposed development will have a low impact on the fauna and flora of the surrounding area.

2.8 Water

2.8.1 Surface water

The site is mainly drained by means of surface run-off, but no streams are present close to the site (within a 5km radius of the site). Further to the east and west, there are second order streams that form tributaries of the Bronkhorstspruit to the North. The rivers in the area are shown in Figure 47.

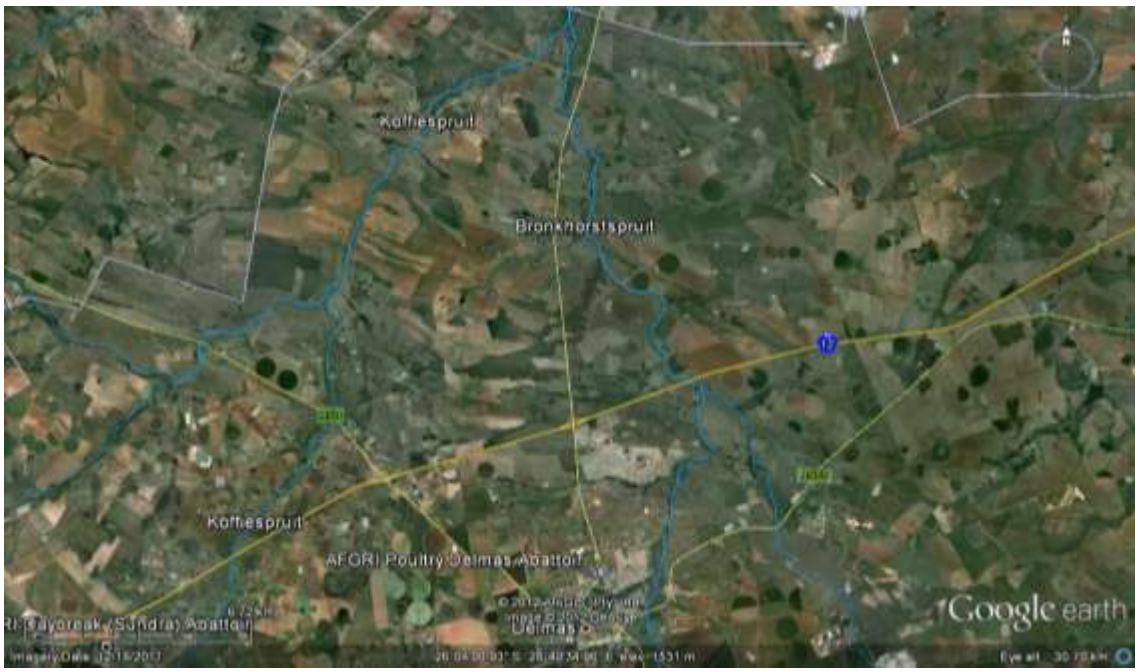

Figure 47: Google earth image of rivers in the area.

2.8.2 Catchment areas

The primary catchment areas for the Mpumalanga Province are indicated on Figure 49. The catchment areas have a typically Highveld topography, mild to flat areas and are 94% rural. The flat areas are well cultivated.

The property falls within the B20A and B20B quaternary catchment areas of the Olifants River catchment, as shown in Figure 48. The project site is situated in the upper basin or Highveld region of the catchment (de Lange *et al.*, 2003). This part of the Olifants River is underlain by sandstone and shale, which is covered by deep, red to yellow, sandy soils. Rich coal deposits are found in these areas (DWAF, 2001). The mean annual runoff for this region of the basin is 466 million m^3 with a range of between 134 million m^3 and 1233m^3 per annum (DWAF, 2002).

Figure 48: Google earth image of quaternary catchments

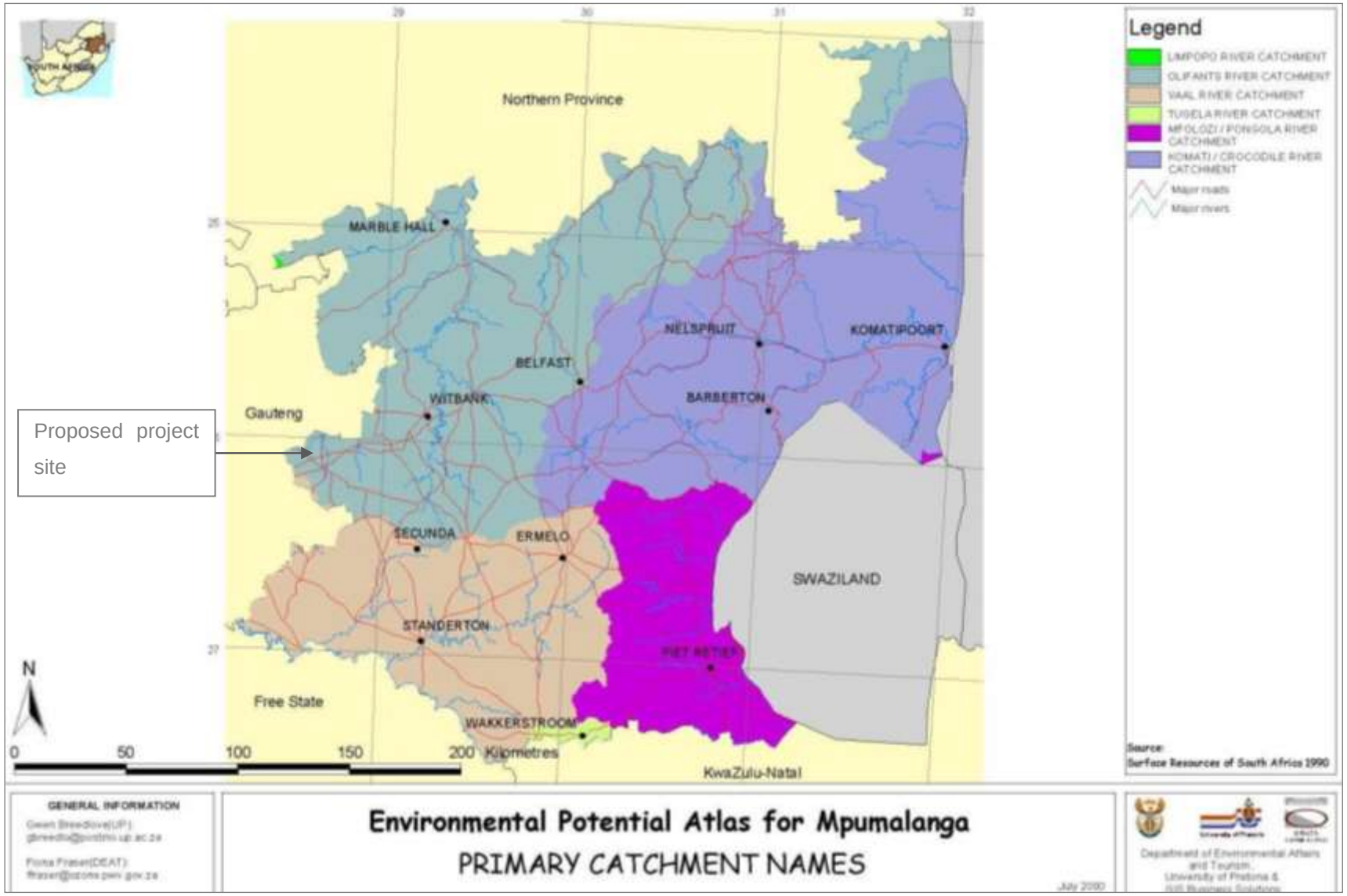

Figure 49: Primary catchments in Mpumalanga.

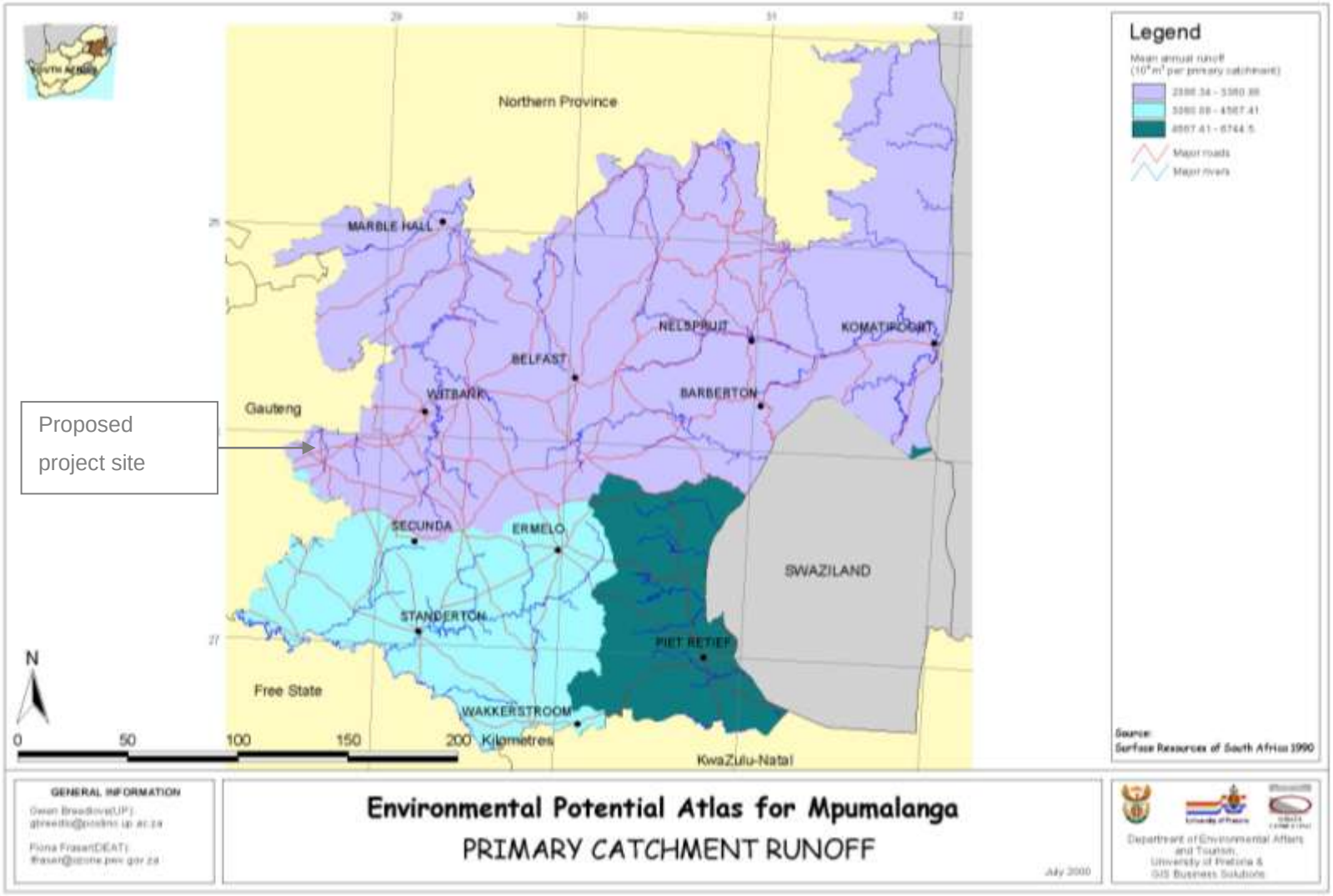

Figure 50: Primary Catchment Runoff for Mpumalanga.