

The image shows a coastal scene with prominent horizontal rock layers in shades of brown and tan. In the foreground, there is a dense patch of coastal plants with green and reddish-brown leaves and small yellow flowers. Two birds are perched on a rock ledge in the middle ground. The background shows more of the layered rock formations and some sparse vegetation.

# Section B

## STATUS QUO ASSESSMENT

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## Section B: Status Quo

### 1. INTRODUCTION

The success of the EMF is largely determined by the level of spatial detail contained in the Status Quo assessment. Two aspects determine the applicability of the system, namely;

- Level of detail with respect to the operating scale,
- How current is the baseline information.

Existing information was utilised from various sources, and very little new data was generated as far as possible. Certain critical data sets such as land use was generated largely from aerial photography interpretation, as well as referencing existing land use and land cover data spatial datasets. Landscape Character and faunal habitats were additional data sets generated from field assessment, and not from existing information. The data sources are included in the Data Matrix appended.

Baseline information was obtained from numerous existing sources, as well as specialist studies done for the project. The existing data was found to be largely adequate in content. Most statistical data was obtained from the 2001 census. More recent statistical data was obtained from a socio economic study conducted by the University of Stellenbosch during 2006. This information was however a small representative sample, which was statistically extrapolated for use in this assessment.

Brink 1981, was used as the source for geological data due to its descriptive text and applicable engineering geology sections. The Knysna State of the Environment Report, 2005 was used extensively, due to its integration of numerous relevant resources and relatively current information. The Eden

Municipality District 2007, was consulted for demographic and economic data, but as stated earlier most of the information was obtained from the 2001 Census. Where possible current information was used.

The most prominent Biodiversity features and wonders of the Garden Route EMF area are summarised by the The Garden Route Biodiversity Sector Plan For The George, Knysna And Bitou Municipalities 2009 as follows :

“Wilderness Lakes are globally important and classified as a Ramsar site because of the abundance of water birds. The Knysna Estuary – ranked number one in South Africa for its conservation importance. Its biodiversity is rich, accounting for 43% of South Africa's estuarine plant and animal species (Allanson, 2000).

Ruitersbos Ericaceous Fynbos occurs in the Outeniqua mountains and is vital in ensuring good quality water and reliable stream flow. Knysna Forest high diversity of tree and shrub species, providing habitat which supports true forest animals, such as the nationally protected and Vulnerable leopard. Outeniqua Mountains – this range forms a natural scenic backdrop to the town of George, and serves as a landscape corridor which increases resilience against climate change. Tsitsikamma Ericaceous Fynbos – grows in the mountains and is vital in ensuring good quality water and reliable stream flow.

Grysbok – an Endangered buck that inhabits thick scrub and bush, as well as fynbos. Groenvlei-Swartvlei mouth dunes include the Groenvlei Dunefields, east of Swartvlei mouth. This dune area is an area of high conservation value (Clark & Lombard, 2007). Martial Eagle (*Polematius bellicosus*) - the largest eagle in Africa with a preference for uninhabited stretches of thicket and open plains. It is nationally protected and is Vulnerable. Knysna Seahorse (*Hippocampus capensis*) is an Endangered fish species endemic to South Africa, with the smallest geographical range of any seahorse. It lives in the Knysna Estuary, Swartvlei, Keurbooms and Klein Brak”.

## 2. GEOLOGY

### 2.1. Geology and Soils

The regional geology of the Knysna area consists largely of the Table Mountain and Uitenhage Group<sup>1</sup>, which form part of the larger Cape Supergroup<sup>2</sup>. The underlying common element is quartzitic sandstone. The oldest geological formation in the study area is the Table Mountain Group, consisting of hard quartzitic sandstone<sup>3</sup>, which is only visible at the Heads<sup>4</sup>. The sandstone weathers to produce a shallow layer of sandy silt. In the vicinity of Knysna, the Uitenhage Group is characterised by mudrock, conglomerates and sandstone formations, with characteristically clayey soils.

Deposition of sediments began approximately 480 million years ago in a shallow basin extending from the Western Cape across the entire length of the southern Coast<sup>2</sup>. The first sediments were light coloured, partially feldspathic sands and grits formed from areas north of the basin, which were deposited in deltas and barrier-bars<sup>2</sup>. The rocks are normally cross-bedded quartzitic sandstones with minor mudrock horizons. Deposition in the Western Cape became deeper after the deposition of the bulk material from the Peninsula Sandstone Formation<sup>2</sup>.



Photo: Eroded fossilised dune



Photo: Fossilised dune

<sup>1</sup> Encyclopaedia of Earth, 2007

<sup>2</sup> Brink, 1981

<sup>3</sup> <http://www.environment.gov.za/Enviro-info/nat/geol.htm>

<sup>4</sup> SRK, 1985 in Knysna Municipality, 2005

A short period of glaciation formed the diamictite of the Pakhuis Formation, which is still visible on Table Mountain<sup>1</sup>. It is also during this period that a geosyncline formed which subsided, which brought about a marine incursion. The resulting deposition of alternating deep and shallow areas brought about the alternating mudrocks and sandstones<sup>1</sup>. The sandstones become thinner towards the south, and areas south of Caledon and Riversdale have mainly mudrocks<sup>2</sup>.

According to Brink, (1981), "it becomes somewhat difficult to distinguish between rock types here, for the shales become more arenaceous and the sandstones more argillaceous. In the Cape Fold Belt the Bokkenveld mudrocks exhibit "intensive slaty cleavage" as a result of folding<sup>1</sup>.

After the Cretaceous period a significant marine regression exposed the coastal margin over a width of 50km. This exposed area cuts randomly across the rocks of the Table Mountain Group. During the early Tertiary periods isolated areas were uplifted about 200 to 300m above sea level<sup>1</sup>. The later Neogene upliftments, uplifted and tilted the platform, causing existing rivers to deepen their beds, to form numerous gorges, such as the Kaaimans, Bobbejaan, Bloukrans and Groot rivers<sup>1</sup>.

During the Pleistocene, the sea level dropped due to glacio-eustatic factors. This led to the development of the characteristic steep sea cliffs, which indicate the extent of the Neogene upliftments<sup>1</sup>. Following the retreat of the sea during this upliftment, rivers cut through the deposits stranding marine sands and gravels. The Platform maintains a fairly uniform elevation from west of George to east of Port Elizabeth, and variations are the result of minor tectonic movements<sup>1</sup>.

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<sup>1</sup> Brink, 1981

The Tertiary and Quaternary marine deposits have resulted in the Knysna Formation, a wave-cut platform inland from the present shoreline. Exposure of the Knysna Formation is found to the north and east of the town and represents a sequence of sandy estuarine deposits<sup>1</sup>. Other deposits characterising the Knysna area are fixed dunes and dune rock, overlain by unconsolidated sand dunes, as well as alluvial deposits, consisting mainly of silt and fine sand mixed with shell fragments<sup>1</sup>.

### 2.1.1. Weathering of Rocks

Folding and faulting have had a profound effect on the engineering response of the rocks in the Table Mountain Group. Near the planes of large-scale normal faults there has been conspicuous drag folding giving the impression, according to Brink, (1981), that faulting occurred reluctantly. Every conceivable pattern of jointing, cleavage and fracture is exhibited within the folded rocks. The “nature and disposition” of these discontinuities can cause problems with deep excavations in these rocks. Therefore adequate strengthening is necessary. This can be done by carrying out fissure consolidation and grouting to seal them<sup>2</sup>.

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<sup>1</sup> Dennis Moss in Encyclopaedia of Earth, 2007

<sup>2</sup> Brink, 1981





Photo: Fossilised Dunes at Gericke's Point

### 2.1.2. Kaaimans Group

These rocks, known also as pre-Cape rocks, are the oldest geological formation in the study area and cover the major portion of the coastal platform, comprising sediments which have metamorphosed into quartzite, schists, phyllite and shale due to folding and the intrusion of the Cape granite<sup>1</sup>. This formation has been subdivided into some seven different rock types which generally occur in a series of bands wrapped around the Cape granite pluton<sup>1</sup>.

Soils associated with this group can vary widely, but in general are of a duplex nature on the coastal plateau due to clay subsoil at approximately 400mm depth. Shafer (1991) states that the soils are often poorly drained, acidic and

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<sup>1</sup> Hill Kaplan Scott, 1976  
environment & tourism





have low biological activity. Often a thin iron concretionary gravel horizon occurs directly over the clay.

The rocks are likely to cause slope instability problems in steep cuts due to their schistose and generally sheared nature. The clay horizon can cause perched water tables and limit subsurface drainage resulting in waterlogged ground conditions in flat areas. Hydromorphic soils are also known to occur in some areas limiting access to lands during wet periods. Excavations into these predominantly soft rocks are often possible with normal mechanical equipment and minor ripping.

### **2.1.3. Cape Granite**

The Cape granite also forms part of the pre-Cape rocks and is restricted to the coastal platform in the area of the Woodville pluton, with a sheet also situated on the escarpment behind the village of Wilderness. These rocks are highly gneissic, indicating some metamorphosis in the past and generally deeply weathered with few outcrops visible.

The weathering of granite usually results in stiff shattered clay subsoils which are impermeable and difficult to drain, making them unsuitable for building purposes. Furthermore, the clays have a propensity to swell under changing moisture contents<sup>1</sup>.

According to Hill Kaplan Scott (1976) slope stability problems are likely to occur in deep cuts and temporary waterlogged conditions may result from a perched water table, particularly in flat areas.

### **2.1.4. Table Mountain Group**

These rocks consist of thickly bedded white to pink hard quartzite and sandstone. Interestingly there is a shear zone running along the contact with the pre-Cape

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<sup>1</sup> Department of Constitutional Development and Planning, 1983

rocks, resulting in a band of hard quartzite responsible for such attractive features as 'Pepsi-pools' in the west near Saasveld and 'Drup-kelders' in the east near Rheenendal. Some shale bands are present in the TMG.

Folding and faulting have had a profound effect on the engineering response of the rocks in the Table Mountain Group. Near the planes of large-scale normal faults there has been conspicuous drag folding giving the impression, according to Brink, (1981), that faulting occurred reluctantly. Every conceivable pattern of jointing, cleavage and fracture is exhibited within the folded rocks, which can cause problems with deep excavations.

Soils derived from the sandstones are normally shallow, light textured and acidic. Rocky well drained soils tend to form on northern slopes while poorly drained, sometimes peaty soils occur on the southern slopes, especially at higher altitudes<sup>1</sup>. According to Hill Kaplan Scott (1976) in some mountainous areas sandstone and quartzite are exposed with little or no soil cover present, and scree slopes are common.

The TMG strata are stable, except where steep cuts are made into dip slopes (south slopes). Surface and subsurface drainage is good, and good subgrade conditions occur. Blasting would be required on deep excavations into this material, while satisfactory aggregates and basecourse can be sourced from these areas<sup>2</sup>. According to Brink (1981) the sandstones of the Table Mountain Group are good aquifers, with a low pH level (pH=4 to 5) although the water is usually confined to fractures and fissures and is found at depth exceeding 700m.

In shear and fault zones, and even bedding planes, kaolinite is formed by the weathering of feldspars in sandstones. Kaolinite is known for its soft and expansive consistency when wet and can cause rockslides in folded and

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<sup>1</sup> Shafer, 1991

<sup>2</sup> Hill Kaplan Scott, 1976

inclined strata<sup>1</sup>. While the quartzitic sandstones are relatively unaltered, feldsparic horizons often become friable due to kaolinisation of the feldspars<sup>3</sup>. The leaching of the kaolinite clay may even result in a collapsible soil structure normally associated with residual granite<sup>3</sup>. Weathering in the Table Mountain Group is extremely erratic<sup>3</sup>. This means that defining rock hardness at specific depths become increasingly difficult, complicating Engineering<sup>3</sup>.

### 2.1.5. Enon Formation

The Enon formation occurs in patches along the coastal areas throughout the southern Cape, but in this study area it is restricted to the Knysna estuary basin with a thin band also occurring in the Goukamma river valley. This formation consists mainly of round pebbles of quartzite occurring in a matrix of silt and sand. Minor clay horizons also occur as lenses and bands in these layers<sup>1</sup>.

The soils derived from this formation are very unstable<sup>2</sup> and inclined to be dispersive. However, cuts into the substrata are likely to be stable as the material is sufficiently well compacted to have near vertical slopes, as is evident along the western entrance to Knysna. The topography associated with this formation is generally steep which should provide good surface and sub-surface drainage<sup>1</sup>.

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<sup>1</sup> Brink, 1981

<sup>2</sup> Dept. Constitutional Development and Planning, 1983



Photo: Coastal dune slump in Enon Formation

The pebble beds and sand should provide good subgrade while excavation of the material will for the mostly be possible with heavy mechanical equipment.

### 2.1.6. Tertiary Deposits

As mentioned earlier, the recent Aeolian deposits adjacent to the coast have predominantly been responsible for the development of the lakes and estuaries for which the area is well known. The younger deposits are found mainly adjacent to the coast in the west near Wilderness while the older deposits, which in places have covered some of the plateau geology, tend to occur inland and to the east. Lignite-bearing layers have also been found in isolated patches, but these are not exploited<sup>1</sup>.

The soils associated with this formation vary widely with the younger deposits consisting of unconsolidated, sand through to consolidated dune rock in certain

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<sup>1</sup> Hill Kaplan Scott, 1976  
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areas, and the older deposits developing podzols which in some instances are strongly consolidated. Poorly developed Calcrete and calcareous nodules are also sometimes present in the younger soils<sup>1</sup>.

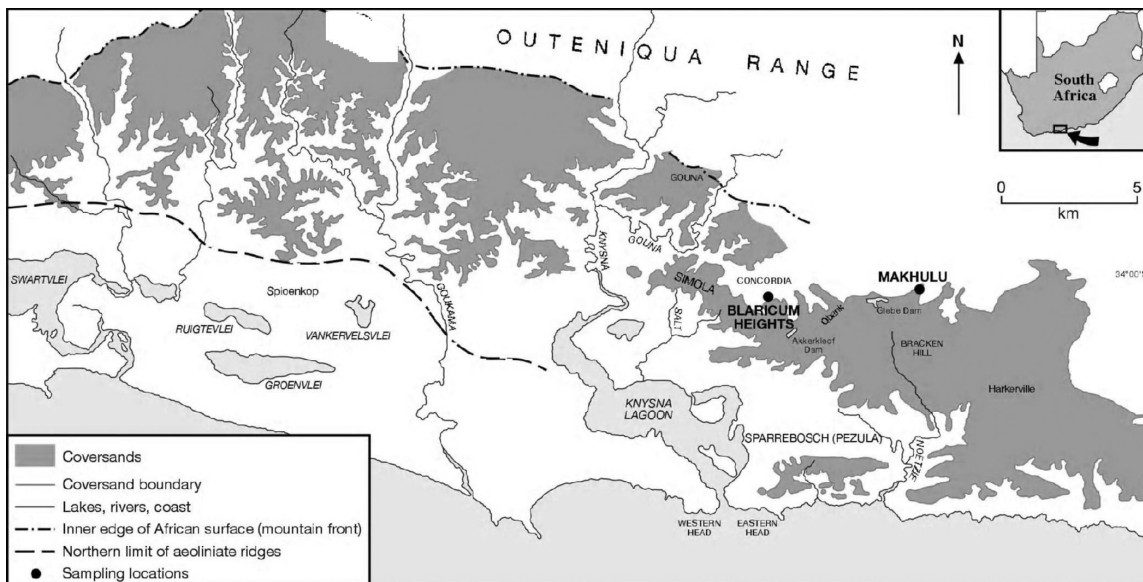
These loose sands are windblown and thus susceptible to wind and water erosion, and must accordingly be protected against such during earthworks. Slumping of steep cuts can be expected, especially if they are underlain by an impervious horizon such as clay. Subsurface drainage is good, except in the vicinity of low lying alluvial materials, and excavation can be carried out with normal mechanical equipment<sup>1</sup>.

Alluvial deposits, consisting mainly of silt and fine sand mixed with shell fragments also occur in association with these Aeolian deposits within the Wilderness – Knysna embayment<sup>1</sup>.

### **2.1.7. Aeolian Coversands**

The structure of underlying soils of the Swartvlei and Knysna Estuaries, in the Southern Cape, are quite different from those found in the aeoliant dune ridges, which are comprised of Tertiary ignites found in the Wilderness embayment and sands of the Knysna Formation *sensu stricto* (Holmes & Marker, 2002). Coversands have a medium to fine grain texture and are found up to a depth of six meters, on the remnant Africa surface of the coastal platform (Holmes & Marker, 2002 in Holmes *et al*, 2007). Over a distance of six to eight kilometers, they gradually thin out to a depth of less than half a meter (Holmes & Marker, 2002). Coversands also extend into headwater catchments and occur as a component of flood plain and estuary deposits (Holmes & Marker, 2002). The coversands that that are located under vegetation cover remain intact and stable, after the soils become disturbed or the vegetation is removed, the sands become highly mobile and slide down slope thus posing and hazard to anything in their path(Holmes & Marker, 2002).





Map indicating the extent of coversands in the Garden Route region (Source: Holmes *et al*, 2007).

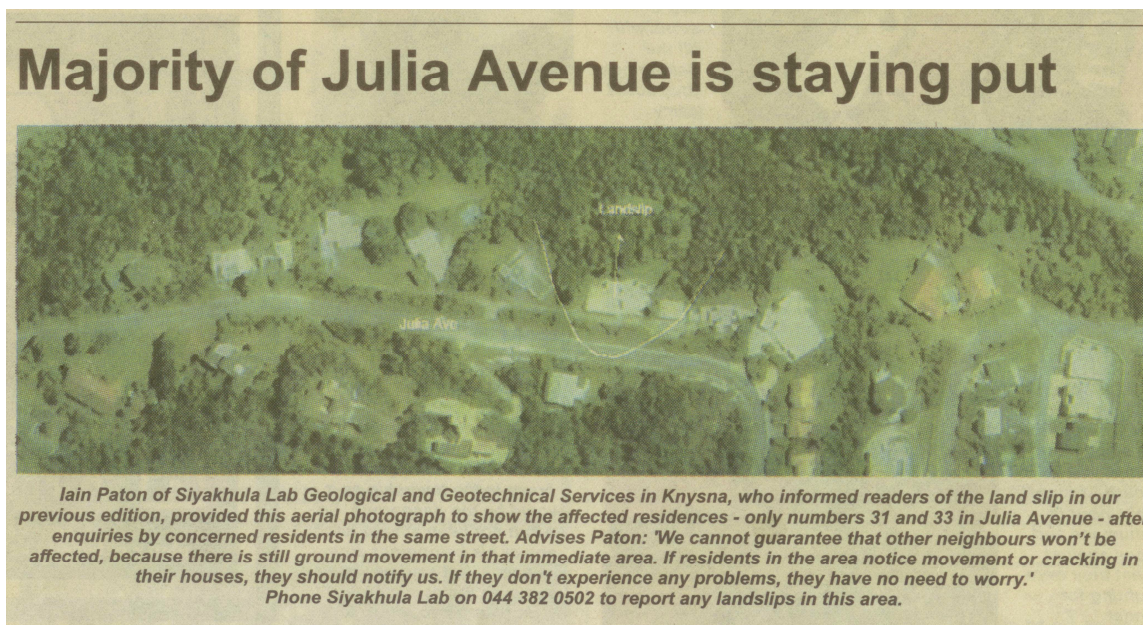


Photo: Aerial photograph of coversands that have become mobile leading to a landslide in a residential area (Source: Knysna Herald newspaper, May 28, 2008)

## 2.2. Dune systems

The maritime zone of South Africa, and south of the equator is known to have the greatest diversity of types of dunes<sup>1</sup>. “Dunes range through six coastal geographic regions and eight biomes, from extreme desert, sub desert, shrub land, winter rainfall heathland, Afrotropical forest, arid subtropical thicket, to grass land, moist savannas and tropical rainforest on the eastern coasts” (Tinley, 1985(a)). There are seven factors that influence dune development of primary fore dunes:

- Wind conditions
- Sand supply
- Degree of deflection and exposure of winds on the coastal area
- Rainfall regime
- Plant colonization
- Sea wave action and longshore drift
- River mouth dynamics, such as change flow and sand input

“Coastal dunes tend to form where parallel and onshore winds strike beaches which are continuously replenished with sand from waves or longshore currents”<sup>1</sup>. Fluvial input of sand is the most common source, followed by erosion of sandy foreshores<sup>2</sup>. Sand grain size of beach and river mouth sediments is an important contributing factor. Beaches that are subject to winnowing of the fine sands by heavy wave action and strong onshore winds tend to have coarse sands and steep beaches.

According to Tinley, (1985), the Garden Route region is characterised by parabolic type dunes along most of its coast. Parabolic dunes are characterised by U-shaped or V-shaped “blowout” or “tongue” of advancing sand with its sides and leading leeward slipfaces partially stabilised by vegetation. The leading

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<sup>1</sup> Tinley, 1985(a)

<sup>2</sup> Tinley, 1985



edge is a concave mound of sand forming a steep rounded nose that migrates slowly downwind<sup>1</sup>.

“Parabolic dunes vary greatly in size”<sup>1</sup>. They have one common factor during their formation – a gap or opening in vegetation cover on the dune, which allow the wind to break through this area<sup>1</sup>. Parabolic dunes also originate in areas with bare or sparse vegetation, such as Fynbos, with openings between the vegetation. “Sand slumping on steep slopes or wind thrown canopy trees create gaps in the dune forest or thicket canopy. Here further enlargements are caused by salt spray ‘burning’ of the once protected vegetation and these allow blowout to be initiated in the gaps”<sup>1</sup>.

Large areas of older dunes, which are often found above aeolianites cliffs, occur at Agulas, Stilbaai and Wilderness<sup>1</sup>. In deeply weathered dunes lateral underground pipe drainage occurs, which results in massive slumping and the development of ravine dongas or amphitheatre shaped erosion cirques<sup>2</sup>. These dunes become cemented by downward percolation of calcium carbonate enriched water, derived from weathered shell fragments. These dunes are identifiable by their unique current or cross bedding which is fossilised by cementation or dune rock. Dune rock is distributed at intervals along the south coast and northwards up the eastern coast<sup>1</sup>. The largest most extensive and massive of aeolianites or dune rocks occur in the Wilderness Lakes area, which was formed during the previous rise in sea level during Flandrian to recent times.

“The headlands, cliffs and points formed by aeolianites represent the remnant fringe of originally much greater expanses of aeolianites submerged or destroyed by transgressive waves<sup>3</sup>. Dune rock on the foreshore is subject to Karst weathering, which forms sharp pinnacles and jagged ridges, with scattered

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<sup>1</sup> Tinley, 1985(a)

<sup>2</sup> Buckle 1978, in Tinley, 1985

<sup>3</sup> Tinley, 1985(a)



potholes and small pools. This also gives rise to caverns and caves with geyser fountains such as found in Rietvlei.



Photo: Dune system near Gericke's Point



Photo: Dune Slump in dune due to erosions

Figure 1: Geology Map

### 3. HYDROLOGY

The study area is situated mainly along the coastline and most the hydrological features fall within the Knysna Municipal Area (KMA). The KMA has a many rivers, including the Knysna, Gouna, Noetzie, Karatara, and Goukamma, Kaaimans and Rivers. All rivers originate within the municipality and flow southwards, forming lakes and estuaries before reaching the coast<sup>1</sup>.



Photo: Kaaimans river mouth



Photo: Knysna River

“Estuaries occur at the interface between freshwater systems and the sea, and are among the most dynamic and productive natural systems.”<sup>2</sup> Estuary dynamics are determined by the interaction between the river and sea. There is much variability in estuarine systems, ranging from ebb and flow tide to extreme floods and droughts<sup>2</sup>.

“The most significant estuaries are managed by SANParks and are found in the Knysna National Lakes area and Wilderness National Lakes area”. The KMA encompasses four estuaries, namely the Knysna, Swartvlei, Noetzie and Goukamma estuaries<sup>3</sup>. The Wilderness National Lakes Area is comprised of two river systems, the Touw and Duiwe rivers. The Knysna estuary is the largest

<sup>1</sup> Knysna Municipality, 2005

<sup>2</sup> SANParks & FF, 2003

<sup>3</sup> SANParks, 2003

estuarine bay on the south coast. Swartvlei and Groenvlei form part of the Wilderness Lakes Area, which is comprised of a string of six lakes that stretches from Wilderness in the west to the Goukamma River in the east.



Photo: River catchment area



Photo: Noetzie Valley

Groenvlei is also the only freshwater lake in the region. The Glebe Dam is the only major dam in the municipal area. Knysna estuary is considered unique in that it is one of the largest salt march estuaries in South Africa.

### 3.1.1. Terrestrial Rivers

The Kaaimans River on the western boundary of the study area rises in the Outeniqua Mountains at George and enters the sea to the west of Wilderness through a small, constrained estuary. The river ecosystems around Wilderness are characterised by the important coastal lake systems of Wilderness, Groenvlei and Swartvlei<sup>1</sup>. The Touw River flows into the Wilderness Estuary, while the Serpentine River connects the estuary to Onder Langvlei ("Island Lake"), which in turn is connected to Bo Langvlei and Rondevlei. The Diep, Hoëkraal and Karatara rivers drain into Swartvlei Lake, which enters the sea close to the town of Sedgefield. Groenvlei receives water via run-off and seepage from surrounding dunes while the Goukamma River enters the sea near the holiday resort town of Buffelsbaai, west of Knysna<sup>1</sup>. The Knysna and Gouna rivers drain into the Knysna estuary, which enters the sea through the Knysna Heads.





Photo: Gouna River Intake



Photo: Touws River

All the main rivers in the study originate in the Outeniqua Mountains and flow southwards, incising the coastal platform and forming lakes and estuaries in the Wilderness-Knysna embayment before reaching the coast.

### 3.1.1.1. Water Sources

Table 1: Water sources for Knysna (Source Engineering Department Knysna Municipality (2005) In Knysna Municipality , 2005)

Water source	Daily abstraction (litres)
Knysna River	7257600
Gouna River	29937600
Karatara River	2231000
Glebe dam	500000
Hornlee Spring	500000
Goukamma River	230000

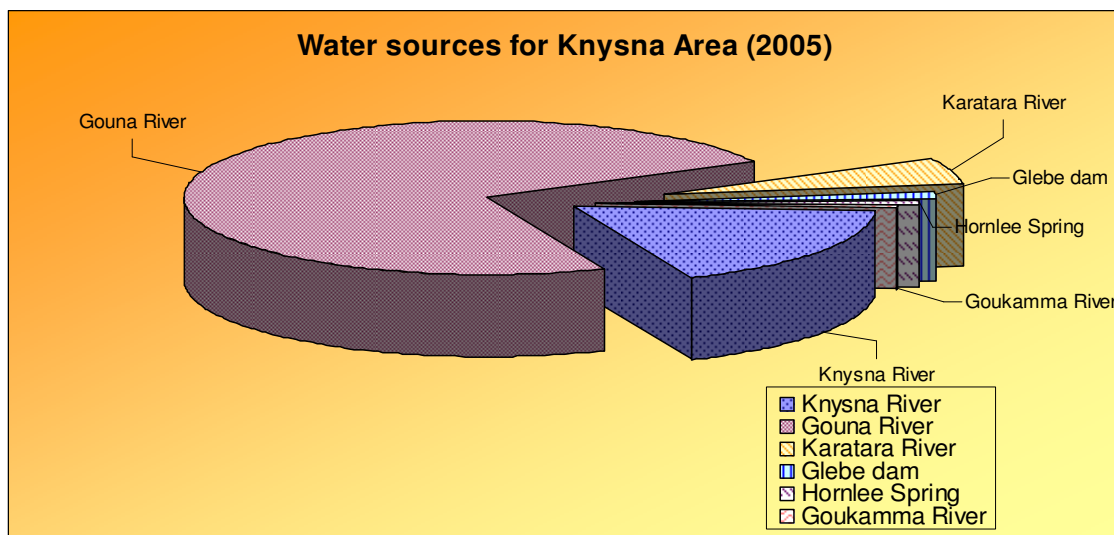


Figure 2: Pie chart indicating distribution of water sources in Knysna (Source Engineering Department Knysna Municipality (2005) In Knysna Municipality )

### 3.1.1.2. Water Demand and Supply

Approximately 13.7 megalitres of water is abstracted for the Knysna municipal water supply per day (Figure 2 & Table 2). Knysna Municipal extracts 96 900 litres per year or daily abstraction of 265 litres per capita for the estimated 51 500 people who lived in the KMA in 2001 (*Statistics South Africa 2001 in Knysna Municipality, 2005*). Water consumption in Knysna in 2001 was higher than that in Cape Town in 2000 to 2002 during water restrictions<sup>1</sup>.

“There is a large range of human activities that require safe and clean water, and the lack of access to safe water and sanitation presents a fundamental obstacle to improving people's health, alleviating poverty and promoting sustainable development. Water availability, or lack thereof, may ultimately prove to be a limit to growth in the KMA”<sup>2</sup>.

The Knysna municipality is located in a region that experiences rainfall all year round (CSIR, 2003 in Knysna Municipality, 2005). The average rainfall in the area is

<sup>1</sup> CoCT 2002 and 2003, in Knysna Municipality, 2005

<sup>2</sup> Knysna Municipality, 2005



700 to 900 millimetres per year<sup>1</sup>, which is above South Africa's average annual rainfall of 452 millimetres<sup>2</sup>.

### **3.1.1.3. Pressure on Water resources**

Water resources in the Garden Route are under severe threat and indications are that water demand is unsustainable and poses a risk to the integrity of this sensitive coastal ecosystem. DWAF's Internal Strategic Perspective for the Gouritz Water Management Area (WMA) indicates a shortfall of 43 million cubic metres per annum for the Garden Route when water requirements and water availability are reconciled (the area assessed is significantly larger than, but includes, the study area). A significant proportion of this shortfall is attributed to the impact of the ecological reserve on yield (34 million cubic metres per annum), but does not account for the estuarine reserve requirements, which are expected to be far higher.

Current climate change predictions suggest a change in rainfall patterns for the area, with more intense rainfall events and increased runoff over shorter durations, reducing aquifer recharge and water available for run-of-river abstraction. Excessive water abstraction (for residential estates and other developments), however, continues unabated despite frequent water shortages and restrictions. During December 2005, water supplies to Sedgefield, George and Plettenberg Bay reached critically low levels.

Reconciliation interventions such as Water Conservation and Demand Management need to be effectively implemented and adhered to if the use of water resources is to be sustainable. The Western Cape Guidelines for Golf Courses, Golf Estates, Polo Fields and Polo Estates<sup>3</sup> also suggests that meeting water demand from sources other than natural systems (i.e. rivers, streams,

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<sup>1</sup> CSIR, 2003; Allanson, 2004 in Knysna Municipality, 2005

<sup>2</sup> Knysna SoER, 2005

<sup>3</sup> DEA&DP, 2005

wetlands, and groundwater) must be considered as a first option, particularly for irrigation purposes. Alternative water sources could include desalinisation and water re-use options.

#### **3.1.1.4. Floods : A Force of Nature**

The study area is regarded as a prime holiday destination in the country. Annually, thousands of tourists visit the region for its coastal landscapes and holiday resorts, and impressive coastal lakes, indigenous forests and mountains<sup>1</sup>. The recent flood damage to this area has disrupted tourism services and required significant funds for repair to infrastructure, diverting several local and district municipalities' resources from service delivery<sup>1</sup>. In the last three years, unusual weather patterns have resulted in severe droughts and floods in the region while it is expected that climate change will probably increase the frequency of flood events. Flood damage is intensified by the loss of wetlands, floodplains and natural watercourses which can attenuate severe flooding<sup>1</sup>.

The August 2006 floods followed closely on two extreme floods (December 2004 and January 2005). The entire southern Cape experienced torrential rains, with most of the region registering approximately 300 mm of rain within 48 hours<sup>1</sup>. These floods caused significant damage to local infrastructure (undermined railway lines, exposed or burst water supply pipes in certain areas, burst dams, overflowed septic tanks, collapsed stormwater pipes, collapsed bridges, scoured and widened river beds and roads that were washed away or pitted with potholes and deep gullies)<sup>1</sup>. In addition, water resources in rural areas were contaminated during the floods. The most notable damage occurred on the N2 near Kaaimans River. Estimated costs of the August 2006 flood damage were R350 million<sup>1</sup>.

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<sup>1</sup> Knysna SoER, 2005  
 environment & tourism

Much of the damage caused by floods was more severe as a result of land-use practices where developments have altered runoff characteristics for a catchment, or where they have been poorly sited or below the 1-in-50 year flood lines. Revegetation and rehabilitation of areas where alien vegetation has been removed from riparian zones is often slow and causes further erosion and runoff. In addition, where alien trees had been felled, the trunks are often not cleared from the area, with the result that debris is swept down rivers causing destruction to infrastructure downstream. To prevent such extensive damage in the future, more attention should be paid to aspects such as the planning and construction of new developments, and in particular their stormwater management.

#### **3.1.1.5. River Health**

Due to the fact that many physical, chemical and biological factors influence the health of river, the River Health Programme (2007) uses a number of River Health Indices to establish the ecological status. These indices include:

- **Index of habitat integrity:** assesses the impact of human disturbance on riparian and in-stream habitats;
- **Geomorphology index:** reflects the channel condition and stability;
- **Riparian vegetation index:** measures riparian vegetation modification from its natural state;
- **South African Scoring System (SASS):** considers the range of invertebrate families found;
- **Fish index:** expresses the degree to which a fish assemblage differs from its undisturbed condition; and
- **Water Quality:** indicates the suitability of water for aquatic ecosystems.

Added to the above, the River Health Programme also assesses ecological importance and sensitivity which indicates the level of protection a river should receive, as well as providing an indication of the present health and desired health, which is influenced by the viability of improving the present state.

For the Knysna River catchment, which has so far only partly been assessed using SASS 5, rivers or river stretches in the upper catchment are expected to have a higher average score per taxa, or species, and thus better water quality, than the lower reaches of a stream<sup>1</sup>. It is known that the upper reaches of the stream flow is located near forests and protected areas, which have little negative impact on water quality, while the lower reaches flow near urbanised areas, which has a greater impact<sup>2</sup>.

The river flow in the study area is usually not strong<sup>3</sup>. The only hydrological gauging stations in the catchment area, are continuous recorders at a causeway on the Gouna River in Concordia Plantation, and a gauging weir on the Knysna River at Laer Steepbos<sup>4</sup>.

Based on the above indices the River Health Programme has determined the status of the rivers in the study area and reflects them as follows (Table 2):

Table 2: Ecological indicators (River Health Programme, 2007)

River Name	Eco Status	Habitat Integrity	Geomorphology	Vegetation	SASS	Fish Index	Water Quality	Importance	Sensitivity	Desired state
Kaaimans	G	N-G	G	G	N	N	N	VH	H	N
Lower Touw	G	G-G	G	N	N	N	N	H	H	G
Upper Touw	G	N-G	G	GN	N	N	N	VH	H	N
Duiwe	G	G-G	G	G	G	P	G	H	H	G
Upper Diep	G	N-G	G	G	N	N	N	VH	H	N
Middle Diep	F	G-F	F	F	G	P	G	H	H	G

<sup>1</sup> Allanson, personal communication in Knysna Municipality, 2005

<sup>2</sup> Knysna Municipality, 2005

<sup>3</sup> Day et al., 1952 in Ewisa, 2008

<sup>4</sup> Ref 2 in Ewisa, 2008

Wolwe	F	F-F	F	P	F	F	F	H	H	G
Klein Wolwe	P	P-P	P	P	F	G	F	H	H	G
Upper Hoëkraal	N	G-N	N	N	N	N	N	VH	H	N
Lower Hoëkraal	G	G-G	G	F	F	G	G	H	H	G
Lower Karatarra	G	G-F	G	F	G	G	G	H	H	G
Homtini	G	N-N	N	G	N	G	N	VH	H	N
Lower Knysna	G	G-F	F	F	G	N	G	H	H	G
Gouna	G	N-G	G	G	N	N	N	H	H	G

Legend: N = Natural, G = Good, F = Fair, P = Poor, H = High, VH = Very High

### 3.1.1.6. Major Impacts & Management Actions for rivers

Invasive alien vegetation shades the river, which reduces the sunlight available for maintaining aquatic biodiversity (e.g. indigenous plants, invertebrates and fish). It further reduces water availability in this water stressed area, reduces riparian habitat diversity, destabilizes river banks and causes incised river channels that reduces the channel carrying capacity and increases water flow rates<sup>1</sup>.

Alien fish such as small- and largemouth bass have been widely introduced into rivers of the Garden Route. Indigenous fish lack natural defences against the large specialised predators, while the predators themselves have no natural controls higher in the food chain. Consequently the indigenous fish have been quickly eliminated from many areas and now survive only in refuge reaches of rivers that are beyond the reach of introduced predators. Other introduced species such as mosquito fish compete with indigenous fish for food and space,

<sup>1</sup> SRK 1985, in Knysna Municipality, 2005

as well as prey on their larvae. The cumulative impact of alien fish, together with habitat destruction, is likely to place the indigenous fish populations into an extremely vulnerable position<sup>1</sup>.

Water abstraction and flow modification (new developments, golf courses and polo fields, irrigated agriculture and extensive alien vegetation encroachment) is a major threat to the health of these rivers. Water is abstracted from the rivers in the Garden Route for a variety of uses. There are a large number of farm dams, particularly in the catchment of the George area, while water for domestic purposes is acquired largely through run-of-river abstractions with off-channel storage. The cumulative effect of these water abstractions has modified river flow, and particularly the impact on low flow is more severe, with some rivers (Duiwe River) ceasing to flow throughout the year. This results in water quality problems and fragmentation of habitat, which reduce the value of the goods and services that these rivers can provide<sup>1</sup>.

Agricultural practices and urban development into floodplains and wetlands have reduced water quality and habitat diversity in the lower reaches of many rivers. Alien vegetation encroachment, vegetation clearing, pastures and developments in riparian zones have reduced the riparian zone's buffering function from surrounding land-use impacts, thus reducing its ability to remove nutrients and stabilise riverbanks. The recent flooding caused significant damage where the riparian habitat had been degraded<sup>1</sup>.

Water quality in the lakes and rivers of the Garden Route is generally good. Exceptions relate to higher suspended solids during times of floods, and elevated nutrient levels. There is some concern that ongoing forestry, agriculture and urbanisation (silt and suspended solids, run-off of fertilisers and pesticides, stormwater discharges, septic tanks, sewage treatment plant releases and general littering), together with a reduced surface water flow, could result in a

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<sup>1</sup> SRK 1985, in Knysna Municipality, 2005

deterioration of water quality. Microbial contamination from wastewater discharges or the absence of adequate sanitation services pose a high risk to human health, particularly in those river reaches downstream of human settlements and treatment works<sup>1</sup>.

In order to address the above concerns the River Health Programme proposes the following management actions be implemented<sup>1</sup>:

- Implement a systematic alien vegetation eradication programme;
- Remove invasive alien plants where necessary to improve biodiversity and water supply;
- Improve the regulation of abstractions from these rivers;
- Encourage efficient water use throughout the area;
- Remove alien fish where possible, to allow for natural recovery of indigenous fish;
- Stock dams with indigenous fish (in consultation with CapeNature);
- Rehabilitate riparian zones to act as a buffer between the river and surrounding agricultural areas;
- Improve wastewater and stormwater management from developed areas;
- Ensure integrated stormwater planning in urban areas;
- Re-evaluate floodlines to cater for the impact of climate change and reduce flood damage on new developments; and
- Motivate for higher conservation status of the Salt River at national and international level.

### **3.1.1.7. The Importance of Healthy Riparian Vegetation<sup>1</sup>**

Indigenous riparian vegetation performs the following important functions:

- Binds riverbanks with their roots and prevents erosion;
- Traps sediment and pollutants, and helps protect water quality;
- Provides habitat and food for animals, fish and aquatic insects;
- Reduces the effects of floodwaters;

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<sup>1</sup> SRK 1985, in Knysna Municipality, 2005



- Provides cover to rivers thus influencing water temperatures;
- Slows runoff in the groundcover, increasing bank storage and the absorption of water, particularly during flood conditions;
- Maintains elevated flows after flood flows have receded;
- Provides an aesthetically pleasing environment; and
- Contributes to species richness and biodiversity.

Generally, only perennial and seasonal streams have sufficient water to support riparian vegetation, where a natural and variable flow regime is necessary to maintain the vegetation zonation and diversity in the riparian zones that provide these vital functions.

Estuaries<sup>1</sup>.

### 3.1.1. Groundwater Resources

The geological formations occurring in the area naturally give rise to two aquifers types. Those found on conglomerate, sand and limestone's porosity allows water to infiltrate freely into to pores of the rock, which can then be extracted, these are called primary aquifers. The sandstone of the Table Mountain Group possesses little porosity and groundwater movement and storage are therefore limited by fractures such as bedding planes, joints and fault zones, which naturally occur in the rocks. Such formations are termed secondary aquifers<sup>1</sup>.

According to Brink, (1981), the sandstones of the Table Mountain Group are good aquifers, with a low pH level (pH=4 to 5). The water is usually confined to fractures and fissures and is found at depth exceeding 700m<sup>2</sup>. Care must be taken when drilling in these aquifers as core recoveries are usually poor. In the interbedded shale layers, double or triple core barrels will be required to ensure maximum core recovery<sup>3</sup>. Also koalinite can produced from the fluid flushing and scouring effect on the rock, See "2.1.4 Table Mountain Group".

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<sup>1</sup> SRK 1985, in Knysna Municipality, 2005

<sup>2</sup> Brink, 1981

<sup>3</sup> Brink, 1981

### 3.1.2. Lakes & Estuaries in the Study Area

Estuaries occur where seawater and river water mix in the lower sections of a river. They are important nursery and feeding areas for fish and provide many goods and services to humans<sup>2</sup>. A diversity of estuarine types occur along the Garden Route, including: temporarily open/closed systems (Goukamma) with little river inflow; large permanently open estuarine bays (Knysna); and estuarine lakes (Swartvlei) that are at times closed off from the sea<sup>1</sup>.

“When river inflow decreases in estuary areas, sediment that is constantly imported into the estuary is not flushed out by wave action”<sup>1</sup>. Marine sediment therefore can accumulate at the estuary mouth and in time block the estuary off, such as Swartvlei. Without management intervention this sand bar would reach a height of four meters above sea level. Only when a flood of sufficient size occurs can the sandbar be broken and allow water to flow out, renewing the cycle”<sup>2</sup>.

The Garden Route estuaries have been ranked in terms of their conservation importance out of 247 estuaries in South Africa. This ranking, based on estuary size, habitat, zonal type rarity and biodiversity importance, for the study area is as follows (Table 3)<sup>2</sup>:

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<sup>1</sup> SANParks & ff.,2003

<sup>2</sup> CSIR *et al.*, 2007

Table 3: Estuary Conservation Rank

Estuary	Rank
Knysna	1
Wilderness	24
Goukamma	68
Kaaimans	199
Noetsie	223

The coastal lakes of the Garden Route are small and shallow and are ideal for recreational activities<sup>1</sup>. The Wilderness, Swartvlei and Groenvlei lakes are three separate and distinctly different systems<sup>2</sup>.

The Wilderness Lakes, classified as a RAMSAR site, were formed by the natural damming of water between two dune ridges<sup>2</sup>. These lakes include Island Lake, Langvlei and Rondevlei and are connected to each other by small shallow channels, as well as to the Touw River Estuary<sup>2</sup>. They receive freshwater via the Touw and Duiwe rivers and underground seepage, as well as seawater from the Touw Estuary and possibly seepage through the barrier dunes. As a result, the lakes have salinities that vary and an estuary mouth that is open for about 30% of the time<sup>2</sup>.

Groenvlei is a freshwater coastal lake that has been separated from the sea for 4000 to 7000 years and is also the only freshwater lake in the region<sup>2</sup>. It is an endorheic system that is completely dependent on groundwater. The lake still harbours some relic estuarine species, such as Estuarine roundherring, which contributes to its unique character<sup>2</sup>.

<sup>1</sup> SANParks & ff.,2003

<sup>2</sup> Knysna Municipality, 2005



Photo: Groenvlei

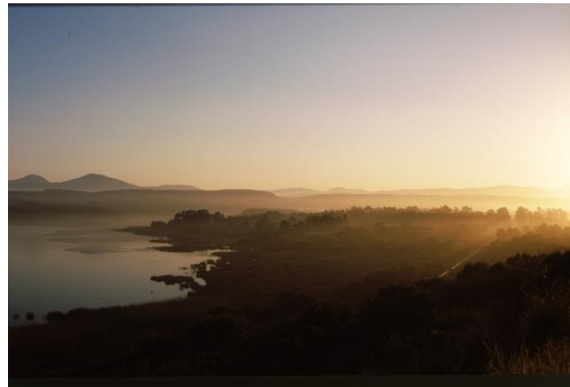


Photo: Swartvlei

Swartvlei is the largest and deepest of the estuarine lakes in the southern Cape. It consists of a lake and estuary, and has four inflowing rivers, namely; Diep, Klein-Wolwe, Hoëkraal and Karatara. Its major characteristic is that it is usually stratified into different densities caused by tidal water exchange and river inflow, and has an estuary mouth that is open about 55% of the time. Inflow from the catchment is far greater than Swartvlei's volume and future water abstraction in the catchment is an important consideration in the management of this lake<sup>1</sup>.

The Knysna Estuary sustains the richest estuarine biodiversity in the Cape. In terms of South African estuaries, the Knysna Estuary has unique features, and is the only estuarine bay on the Cape south. Salinity in the estuary is therefore also similar to that of seawater since the mouth is permanently open and there is reduced freshwater inflow from the catchment due to land-use activities. There are three islands in the lagoon, namely; Leisure Isle, Thesen's Island and Rex Island. The overall habitat accounts for the remarkable diversity of species. If left unchecked, residential and recreational development and the associated effects and by-products will change the natural and rural character of this estuary. This poses a threat to many of the more sensitive estuarine biota such as

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<sup>1</sup> CSIR *et al.*, 2007



the Knysna seahorse. The management of the Knysna Estuary falls within the mandate of DEAT and SANParks<sup>1</sup>.



Photo: Knysna Estuary

Due to the fact that the Knysna Estuary has a high biodiversity value and high development potential, it was selected as one of the six priority estuaries of the Cape Action for People and the Environment (C.A.P.E.) Estuaries Programme. The aim of the programme will be to develop an Estuary Management Plan that is implemented locally. Building local managerial capacity is seen as being paramount to the effective conservation and management of this natural resource<sup>1</sup>.

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<sup>1</sup> Knysna Municipality, 2005



### 3.1.2.1. Knysna Estuary Research

The Knysna estuary lies in the southern Cape where its catchment basin drains a small forested area. The estuary is considered to be a “youthful stage”<sup>1</sup>. It is 17 km long and a permanent, rock-bound tidal inlet connects the estuary with the sea<sup>2</sup>. A low influx of sediment, consisting mainly of sand, enters the estuary<sup>1</sup>. The mud is isolated near identifiable sources and in some cases the mud has resulted in “shoals” forming thus leading to stagnant water in some areas<sup>1</sup>. The content of skeletal Calcium Carbonate in the sediment gradually decreases up-estuary from the inlet whereas the content of organic material increases up-estuary<sup>1</sup>. Sediment in the estuary has three source areas<sup>1</sup>: (i) the sea from where it enters through the inlet; (ii) the catchment basin; and (iii) Brenton dune on the southern bank of the estuary. The dominant sediment source is Brenton dune<sup>1</sup>. “If erosion of the partly consolidated sand on the dune were to accelerate it would cause large volumes of sand to be deposited in the estuary; this would lead to undesirable shoaling”<sup>1</sup>.

“The Tidal prism (The volume of water between low and high water of spring tide which enters the Knysna estuary), is estimated to be 19 million cubic metres of water”<sup>2</sup>. Tidal water exchanges occur near the area with the greatest urban development. Future development on Brenton dune and its environs should be designed to prevent harmful erosion<sup>1</sup>. Other areas such as the middle lagoon, Rail bridge and White bridge further up in the estuary retain some of the tidal water. This exchange has prevented the build-up of nutrient enrichment and therefore limited the growth of phytoplankton or algae and can be described as “oligotrophic”.

The levels of toxic materials in the water column such as heavy metals, while showing some change with respect to copper and zinc in stormwater outflows

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<sup>1</sup> Reddering & Esterhuysen, 1987

<sup>2</sup> Allanson *et al.*, 2000

from the industrial area and Thesen Island, have not changed overall since the 1982 surveys of Dr R.J. Watling and his co-workers. Hydrocarbons in the form of polynuclear aromatic hydrocarbons<sup>1†</sup> (PAH's)<sup>†</sup> and polychlorinated biphenyls (BCP) were undetectable in the water column during the tenure of the KBP programme. However, very recent investigations by the CSIR in relation to the proposed Thesen Islands development have reported traces of PAH in the water column of the marine embayment<sup>2</sup>.

PAHs<sup>†</sup> bond more easily with oil than water. Because of these properties, PAHs in the environment are found primarily in soil, sediments and binds easily to oily substances<sup>2</sup>. Natural crude oil and coal deposits contain significant amounts of PAHs, as do most oils<sup>3</sup>. PAHs are one of the most widespread organic pollutants. Toxicity varies from nontoxic to extremely toxic, depending on the complexity of the molecule. PAH are often associated with other urban pollutants and carcinogens<sup>2</sup>.

The increasing rate of urbanisation of greater Knysna will in turn increase the volume of sewage treatment plant effluent and stormwater flow<sup>1</sup>. This will increase the loading of nutrients and toxic materials, if not throughout the estuary, then certainly in the Ashmead Channel<sup>1</sup>. The potential for large, unsightly growths of floating macroalgae such as *Enteromorpha* and *Ulva* is increasing and, if not attentively checked, will interfere with navigation and most certainly destroy the feeding grounds of the waders and decrease the visual appearance of the Channel.<sup>1</sup> In addition, increased boating traffic will undoubtedly accompany the urbanisation and marina developments. Such increased aquatic activities will add to the pollution hazard. Suspended solids pollute water sources, and thus must be to avoid damage to wetlands<sup>1</sup>.

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<sup>†</sup> Note: Polynuclear aromatic hydrocarbons, are often referred to as Polycyclic aromatic hydrocarbons (PAH's) (Wikipedia, 2008).

<sup>2</sup> Allanson *et al.*, 2000

<sup>3</sup> Wikipedia, 2008



Photo: Town of Knysna on the Estuary



Photo: Knysna Jetty

“The Knysna Estuary remains the most light transparent along the Cape South coast, if not throughout the entire coastline of South Africa”<sup>1</sup>. This implies that there is always sufficient photosynthetic radiation passing through the water to allow for the growth of extensive eelgrass meadows both below and above the level of low water of spring tide<sup>1</sup>. Above the eelgrass meadows is a rich assemblage of saltmarsh plants which are variously submersed and exposed during the tidal cycle<sup>1</sup>. The plant species diversity and distribution of these intertidal wetlands have been most carefully recorded and described by Bronwyn Maree, so that a firm baseline exists from which to assess future change and alert management authorities to corrective action<sup>1</sup>.

### **3.1.2.2. Estuarine Goods and Services**

Estuaries provide many goods and services to society. This includes food and bait collection, nurseries and refuges for birds, fish and crustaceans, tourism and recreation, cultural and spiritual activities and craft materials. Human activities such as wastewater discharges, water abstraction and storage, over-exploitation of fish, and the destruction of estuarine habitat impact on estuaries and influence their ability to provide these goods and services. Developments in the catchment of these estuaries and lakes reduce the freshwater contributions to

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<sup>1</sup> Allanson *et al.*, 2000  
environment & tourism





these unique systems and increase the sediment and nutrient loads to the systems<sup>1</sup>.

### 3.1.2.3. Estuarine Health

The nature and quality of an estuary is determined by numerous factors such as; the input of fresh water from its parent river, the exchanges with the adjacent ocean, and the manner in which these waters mix<sup>2</sup>. The dominant input of water in estuaries in South Africa is from tidal systems, even if the wave amplitudes are small seldom exceeding 2 m<sup>3</sup>.

The influence of these tides are increased by the small input of fresh water, which in most rivers along the South African south coast is less than 1m<sup>3</sup>s<sup>-1</sup>, increasing only during occasional rain and floods. Longer period sea level change in the weather band from about 2 to 10 days is also important, and along the south coast of South Africa it is known as barotropic coastal trapped waves (CTWs)<sup>3</sup>.

In addition to the coastal trapped waves, storms at sea can generate large surface gravity waves, which also cause a setup of sea level at the coast. Zhang et al. (1995 in Schumann, 2000) reported on a situation in the Gamtoos Estuary to the west where significant erosion occurred when a peak of a coastal trapped wave coincided with a spring high tide and a large wave setup. Such effects are often termed "storm surges" common to the Agulhas Bank<sup>3</sup>.

The Agulhas Bank forms a wide continental shelf area off the Knysna Estuary, where it has been established that there is a marked seasonal variation in the oceanic temperature structure, with intense thermoclines established during the

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<sup>1</sup> National Spatial Biodiversity Assessment – NSBA 3

<sup>2</sup> Schumann *et al.*, 1999 in Schumann, 2000

<sup>3</sup> SAN, 1998 in Schumann, 2000

summer<sup>1</sup>. Westward-component winds are then responsible for upwelling conditions and very cold water can enter the estuaries.

In terms of South African estuaries, the Knysna Estuary has unique features, and is the only estuarine bay on the Cape south coast<sup>2</sup>. The influx of sediment from both the catchment area and the sea is low and the two headlands and deep mouth ensure that tidal fluctuations in the lower reaches are similar to the marine environment; this also results in the regular replacement of estuarine water in the lower and middle reaches.

#### **3.1.2.4. Pressures on Estuaries**

Direct pressures on estuaries include<sup>3</sup>:

- habitat alteration, for example due to the construction of marinas and jetties
- changes in mouth dynamics, such as the manipulation of mouths to maintain constant water levels or prevent flooding of holiday homes
- overexploitation of estuarine resources such as fish
- sedimentation of estuaries due to bad catchment or mouth management<sup>3</sup>
- recreational disturbance, which is known to have a major impact on avifauna and fish
- pollution, for example release of sewage into Knysna estuary
- Climate change (NSBA Vol4, p88)
- Mining (NSBA Vol4, p88)
- Alien invasive plants (NSBA Vol4, p88)

Pressures on freshwater inputs include:<sup>3</sup>

- Reductions in freshwater inputs due to upstream abstraction or afforestation
- Increase in freshwater inputs due to agricultural or sewage return flows
- Reductions in water quality, including turbidity, due to bad catchment management, polluted return flows and effluent disposal<sup>3</sup>.

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<sup>1</sup> Schumann & Beekman, 1984; Swart & Largier, 1987 in Schumann, 2000

<sup>2</sup> Whitfield & Wooldridge, 1994 in Schumann, 2000

<sup>3</sup> National Spatial Biodiversity Assessment – NSBA 3



Photo: Knysna River and estuary



Photo: Informal settlements in water catchments

The immediate danger to the wetland lies in the repeated ingress and accretion of suspended material (largely silts and clays delivered by the Salt River and the stormwater drains as well as anthropogenic disturbance of these areas. Sixty percent of the supratidal has already been lost to development in the last 54 years. According to Allanson, et al, (2000) sufficient evidence has been presented in his scientific report to underline the great importance of managing the urban and stream catchments. River flooding, continuous leakage of water with suspended solids must be prevented from entering the estuary during raining periods<sup>1</sup>.

If not properly managed the estuary water quality will deteriorate since the numerous wetlands that maintained the water quality in the intertidal zone have been lost. Once uniform salinities are established near to that of seawater, the Juncus wetlands would become replaced by less productive saltmarsh and, overall, the biological character of the estuary above the White Bridge would change. In times of severe drought the salinity will rise above that of seawater, creating a hypersaline environment which is detrimental to many estuarine taxa.

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<sup>1</sup> Allanson *et al.*, 2000



Remnants of once productive wetlands are found in small isolated pockets around the estuary; for example, the wetland between George Rex Drive and Howard Street which has been partly obliterated by sawdust deposits.

Future pressures on estuaries in the study area are considered to be particularly high due to fresh water supply and demand<sup>1</sup>. According to the NSBA's list of significant species Knysna Estuary has 91.4% of all the total species, while the wilderness area contains 85.6%. It is therefore critical that these areas be protected. The NSBA Vol4, p88-89, shows indicates that extraction of marine resources, coastal development and pollution will have the greatest future impact on estuaries.

Another potential threat is climate change, associated with rising sea levels and temperatures caused by Carbon Dioxide emissions. Increased sea levels could lead to increased erosion of the coast and to a change of salinity levels in the estuaries, which will have a negative impact on biodiversity. Demand for water is expected to rise due to the ongoing urban and recreational development in the KMA and the Garden Route<sup>2</sup>.

### **3.1.2.5. Coastline & Estuary Protection**

The coast can be defined in many ways. This report adopts the definition of the White Paper for Sustainable Coastal Development in South Africa, 2000<sup>1</sup>. Thus, the 'coast' includes the:

- **coastal waters**, which reach from the low water mark into the sea to where water is no longer influenced by land-associated activities;
- **coastline**, between the low and high water mark; and
- **coastlands**, which lie above the high water mark but still influence the coastal waters.

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<sup>1</sup> National Spatial Biodiversity Assessment – NSBA 3

<sup>2</sup> Knysna Municipality, 2005

The coast of the Knysna Municipal Area is approximately 50 km long and characterised by a rocky shoreline interspersed with bays, sandy beaches, dunes, rivers, estuaries and lakes. The study area's estuaries fall under the Agulhas Inshore/Offshore Bioregion<sup>1</sup>.

The coastal and estuarine zone could be considered to reach approximately 10 kilometres inland, to encompass the estuaries and lakes as well as the coastal towns of Knysna, Brenton, Belvidere, Buffalo Bay and Sedgefield. In that case, the size of the coastal and estuarine zone inland is approximately 500 kilometres squared or 50 000 hectares<sup>1</sup>.

The coast and estuaries are of great importance for the Study area, as they attract tourists and provide space for recreation; the fishing and mariculture opportunities provide food and employment; and the natural processes associated with the coast and estuaries influence development opportunities in the coastal zone<sup>1</sup>.

Tables 4 and 5 indicate that a significant portion of the KMA's coastline is protected. Nevertheless, significant amounts of the coastline remain under development pressure<sup>2</sup>. Continued enforcement of the protection status is also vital to secure those specific areas are conserved<sup>1</sup>. Coasts and estuaries are highly vulnerable and in danger of transformation and degradation, as the region becomes more attractive for tourists, new residents and developers<sup>1</sup>.

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<sup>1</sup> NSBA vol4, p25 in Knysna Municipality, 2005

<sup>2</sup> Knysna Municipality , 2005

Table 4: Nature Reserves located in Knysna Municipal Area<sup>1</sup>

Reserve Name	Type of Reserve	Proportion of reserve in Knysna Municipality	Land area located in KMA (hectares)
Sinclair	DWAF Forest Nature Reserve	75%	892
Wilderness National Lakes Area	National Park	67%	1864
Knysna National Lakes Area	National Park	100%	1914
Goukamma (terrestrial reserve)	Provincial Nature Reserve	100%	2283
Featherbed	Private Nature Reserve, National Heritage Site	100%	57

Table 5: Estuary Protection in the KMA<sup>1</sup>

Estuary	Protection Status	Administrator
Knysna estuarine bay	Medium - 36ha protected	SANParks
Swartvlei estuarine lake system	Medium - parts of estuary protected	SANParks
Goukamma temporarily closed estuary	High - Most of estuary protected	CNC
Noetzie temporarily closed estuary	No Data	

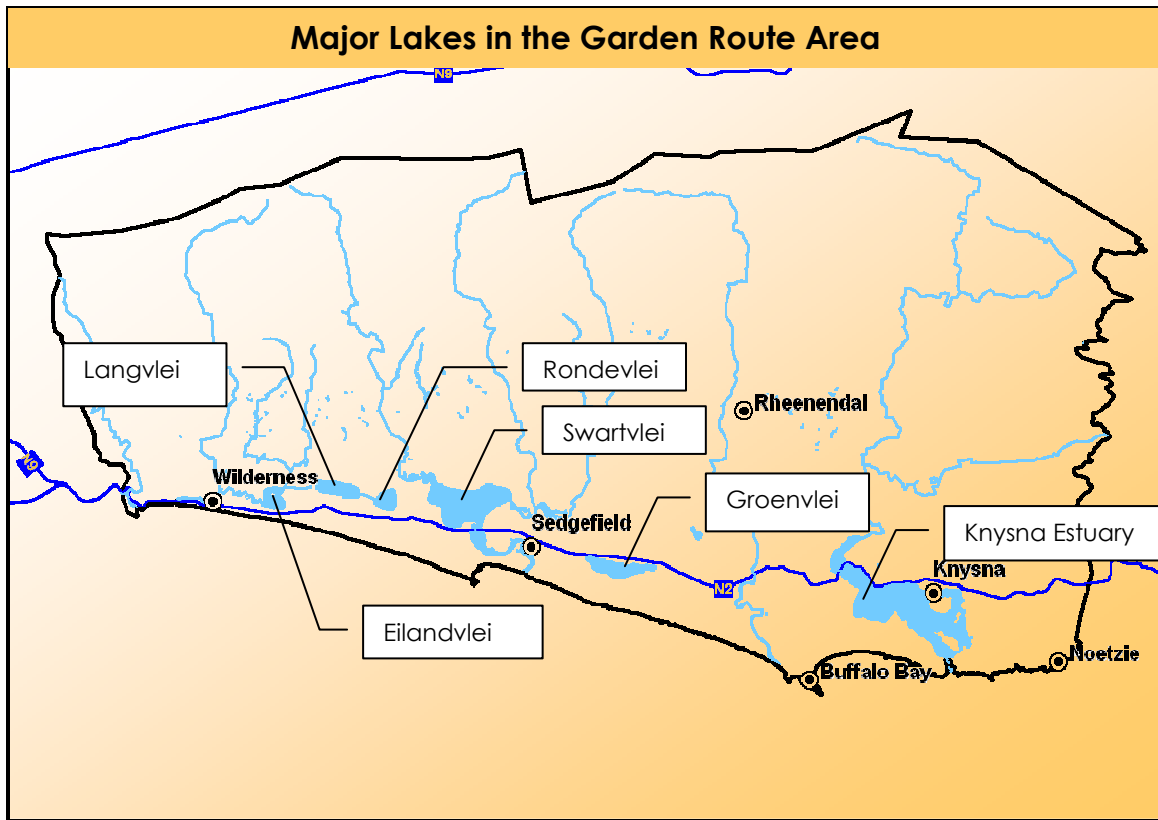


Figure 3: Map indicating the names of the significant lakes in the Study area



Figure 3a: Hydrology

## 4. CLIMATE

Knysna has a temperate, coastal climate with summer temperatures averaging up to 28°C whilst winter temperatures average up to 13°C (Figure 4). The climate is typically characterised by hot, humid summers and cool, rainy winters. Knysna falls within a 'uniform rainfall zone', and receives rainfall throughout the year. The average annual rainfall lies between 700 and 900 millimetres per annum, with relatively high rainfall figures in March-April and September- October.

Rainfall increases over the higher areas of the KMA to as much as 1 400 millimetres per year. The average annual relative humidity is 88%. Knysna experiences moderate wind conditions throughout the year. Prevailing winds come from the west and north-west during the winter months and from south-east and south-west during the summer months<sup>1</sup>.

George, being in close proximity to Knysna has a similar climate, with moderately hot summers, and mild to chilly winters. It has a high rainfall pattern, occurring mainly in the winter months, brought by the humid sea winds from the Indian Ocean.

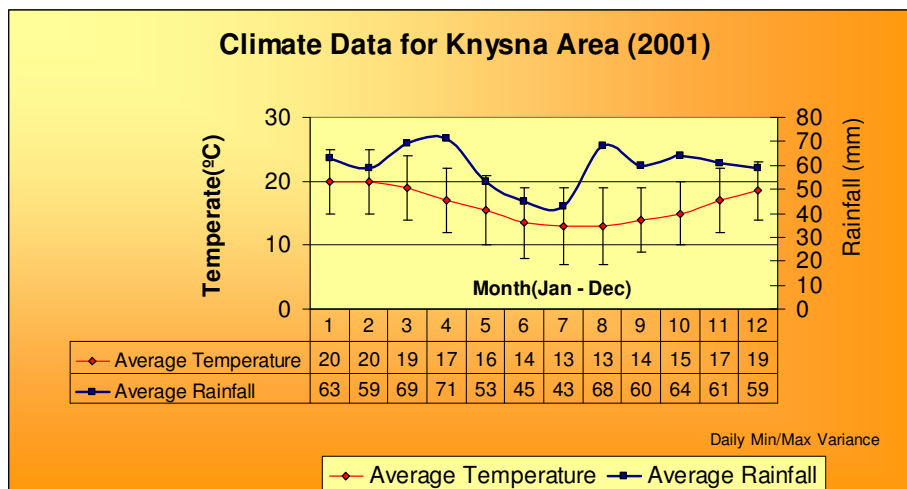


Figure 4: Climate data for Eden District (source data: Knysna Municipality, 2005 )

## 5. BIODIVERSITY, FLORA AND FAUNA

### 5.1. Fauna

The area is characterized by a great range in altitude from 1100 -1500 m along the Outeniqua Range, with the Cradock's Berg the highest reaching 1509 m, descending stepwise down to sea level over a distance of 20 – 30 km. Together with the relatively high precipitation along the mountain range, this has resulted in an incised topography with rivers flowing along steep sided valleys down to the sea.

The topography is very varied with the Outeniqua Mountains in the north, descending steeply to a wide undulating, incised plain, with deep valleys and gorges along the foothills opening onto the sandy coastal plain. Soils are shallow to deep with sandy sandstone and granite derived soils along the tops of the spurs above the clayey shale derived soils present along the drainage lines.

This plain or plateau descends steeply to a narrow sandy coastal plain interspersed by three east-west rows of dunes, terminating in the steep dunes along the seashore.

In the area between Kleinkrans and Knysna these dunes rise steeply from the sea reaching a height of 201 m above Groenvlei Lake, the highest in South Africa (Tinley 1985b). Many of the dunes along the seashore are comprised of fossil dune rock or aeolionite, which are weathered in the most peculiar shapes by wind and saltspray.

The rivers and streams which descend from the catchments along the Outeniqua range are fast flowing along the upper reaches forming deep ravines and valleys but slow down on reaching the coastal plain before opening out in estuaries, the most prominent and extensive of which are the Swartvlei and

Knysna Lagoons, which form extensive salt marshes in their upper reaches. Dunes along the coastal plain have blocked the course of several of these rivers from direct access to the sea with the result that lakes have formed in depressions, some linked by reed lined channels.

Differences in suites of species are found between the fauna along the Outeniqua Mountains, the plateau and the coastal plain respectively. For example, birds such as the Cape Sugarbird *Promerops cafer* and Cape Rockjumper *Chaetops frenatus* occur primarily along the mountain slopes, while Cape Bulbul *Pycnonotus capensis*, Orange-throated Longclaw *Macronyx capensis* and Fiscal Flycatcher *Sigelus silens* are found mostly along the coastal plain. Similarly The Cape Golden Mole *Chrysochloris asiatica* and Dune Golden Mole *Chlorotalpa duthiae* occur respectively on the plateau below the Outeniqua Mountains and on the sandy coastal plain. The Long-tailed Forest Shrew *Myosorex longicaudatus* occurs mostly within Afrotropical Forest of the plateau and the Cape Dune Mole *Bathyergus suillus* only occurs in the sandy soils of the coastal plain. The Ocellated Sand Lizard *Pedioplanis lineo-ocellata*, Cape Cobra *Naja nivea* and Leopard Toad *Bufo pardalis* only occur along the coastal plain. The Plain Rain Frog *Breviceps fuscus* occurs in forest along the plateau while the Cape Crag Lizard *Pseudocordylus microlepidotus*, Cape Mountain Lizard *Tropidosaura gularis*, Common Mountain Lizard *T. montana* and Montane Rain Frog *Breviceps montanus* occur along the upper slopes of the Outeniqua Mountains.

The varied topography and altitude provide a wide range of faunal habitats including cliffs, ravines, rocky outcrops, overhangs, rivers and streams, forest, fynbos, and thicket with soils ranging from loam along the tops of the ridges and spurs and derived from the decomposition of sandstone and granite to clay in the valleys due to the underlying shale, with sand along the coastal plain. The Outeniqua Mountains are primarily sandstone and quartzite.

Due to the range of habitats present, the area is rich in fauna despite the length of human occupation of the area and associated impacts. Many species are locally extinct and many others are rare as a result. With the exception of human commensals, many species are on the decline due to human encroachment resulting from habitat destruction, direct persecution and indirect impacts such as roads, the latter even forming barriers to the movement of fauna. For instance, over an eight year period National Parks Board staff recorded 24 species of fauna killed on roads, mostly on the N2, in the vicinity of Rondevlei (unpubl. records, SANParks).

#### 4.1.1 Birds

Of the vertebrate fauna, birds are the most prolific with 265 species having been recorded from the GREMF area (derived from Boshoff 1991). More recently Randall, Randall & Kiely (2007) recorded 262 species for the Wilderness National Park. However this excludes the montane areas above 195 m. and areas outside of the borders of the park. Combining both of these lists a total of 295 species have been recorded within the GREMF area but still excluding the following mostly montane species (Sinclair, Hockey & Tarboton, 1993; Hockey, Dean & Ryan, 2005):

Rock Bunting	<i>Emberiza tahapisi</i>
White-throated Canary	<i>Serinus albigularis</i>
Protea Canary	<i>Serinus leucopterus</i>
Cape Canary	<i>Serinus canicollis</i>
Mountain Chat	<i>Oenanthe monticola</i>
Cape Rockjumper	<i>Chaetops frenatus</i>

As well as the following species:

Southern Masked Weaver *Ploceus velatus*

This brings the total number of species occurring or likely to occur to 302. Many of these are now regarded as rare or threatened (Table 1).

### Rare and threatened bird species

Twenty-seven Red Data Book bird species listed as Endangered, Vulnerable or Near Threatened (Barnes 2000) have been recorded from the GREMF area. Many of these species such as the Pink-backed Pelican *Pelecanus rufescens*, Secretarybird *Sagittarius serpentarius*, Cape Vulture *Gyps coprotheres*, Striped Flufftail *Sarothrura affinis*, Black-rumped Buttonquail *Turnix hottentotta*, Denham's Bustard *Neotis denhami* and African Grass Owl *Tyto capensis* have only been infrequently recorded in the area and some are considered vagrants (Table 1). Randall et al (op cit) recorded 14 Grass Owl road killed along the N2 across Swartvlei over a 14 year period, where it now appears to be absent, despite the suitability of the habitat for these birds indicating possible local extinction. A pair of Grass Owls was recorded breeding in a relatively small area of grassland (ca 2ha) adjacent to a stream on Wilderness Heights but the nest was later destroyed, presumably predated (pers obs, 2005). This grassland has now been overgrown by a woody forb *Conyza scabrida*, precluding any further nesting attempt.

In addition some of these species such as the Lesser Kestrel *Falco naumanni*, are migrants, and others are at the periphery of their distribution and are rare. The Martial Eagle *Polemaetus bellicosus* is one of the latter, which is also on the decline in the area with few records in recent times (R. Randall pers comm.).

The grasslands and wetlands flanking the lakes provide optimum habitat for the African Marsh Harrier *Circus ranivorus* which is a common breeding resident of the wetlands surrounding the Lakes and Serpentine River (Randall et al 2007)

The habitat requirements of the Knysna Warbler include dense thickets of brambles *Rubus* spp. and Lantana *Lantana camara* along watercourses, along the margins of forest or amongst alien vegetation (Hockey, Dean & Ryan 2005,



Randall et al 2007) and has also been recorded in dense coastal dune scrub in the Sedgefield area (pers obs. 2005).

The African Finfoot *Podica senegalensis* has also only been infrequently recorded from the GREMF area with a small localized population along rivers flowing into the lagoon at Knysna. According to Barnes (op cit), populations along the east and south coasts are becoming increasingly isolated and fragmented presumably by urban expansion. It appears also to occur within the Wilderness-Sedgefield Important Birding Area (IBA) (Barnes op cit) but is regarded as a vagrant within the Wilderness National Park (Randall et al op cit).

Species regarded as Near Threatened are also incorporated in Table 1. These include both Greater Flamingo *Phoenicopterus ruber* and Lesser Flamingo *Phoenicopterus minor*, the former nomadic and the latter vagrant to Swartvlei and Rondevlei. The Black Oystercatcher *Haematopus moquini* is confined to littoral zone along the coast and Swartvlei Estuary within the GREMF. The Half-collared Kingfisher *Alcedo semitorquata* frequents rivers and estuaries and has been recorded along the Touw River and on rare occasions also the Gatbosspuit, a small tributary of the Touw River (pers. obs).

According to R, Randall (pers comm.), Crowned Eagles *Stephanoaetus coronatus* occur within all of the major Afrotropical Forests in the area. The endemic Knysna Woodpecker *Campethera notata* appears to be widely distributed in indigenous forest and thicket vegetation in Wilderness Heights, Pinedew, Wilderness National Park and elsewhere.

The presence of many rare and threatened species has resulted in the Wilderness-Sedgefield area being listed as an Important Birding Area (IBA) (Barnes 1998), while Rondevlei is a Ramsar site, indicating the importance of this area in terms of avifaunal species richness, migrants and abundance.

#### 4.1.2 Mammals

Many mammal species were present within the GREMF area in the past, but most of larger species have been hunted to local extinction, those remaining, primarily comprised of small to medium sized species such as Bushbuck *Tragelaphus scriptus* and Bushpig *Potamochoerus porcus*, many occupying dense largely impenetrable habitat.

A total of 65 mammal species have been recorded within the Garden Route EMF area (Smithers 1993, Stuart & Stuart 2001, Friedmann & Daly 2004). Of these, the Scrub Hare *Lepus saxatilis*, appears to be marginal (Table 2).

#### Rare and Threatened Mammal Species

Twelve species are incorporated in the latest Red Data Book (Friedmann & Daly (eds) 2004) but only the White-tailed Mouse *Myodomys albicaudatus* is listed as Endangered and the Blue Duiker *Philantomba monticola* is considered Vulnerable (Table 1). The former is rare, occurring mostly in grassland and fynbos areas, occupying holes or crevices in the ground. According to the available information, populations of the latter are fragmented and becoming increasingly isolated. Although considered typically a forest species there are unconfirmed reports of the presence of this antelope in dune thicket within a walled in residential area at The Garden Route and at the Sedgefield Camp site where it occurs in an area heavily infested with Rooikrans *Acacia cyclops* (R. Randall pers comm., 2 April 2008). The possibility exists that remnant populations may be present within suitable thicket vegetation along the coastal dunes between these two areas. However, according to Hylton Herd (SANParks, pers comm., 2 April 2008) the species is present in most of the remaining afrotemperate forests in the southern Cape.

Apart from the White-tailed Mouse and the Blue Duiker, 10 other mammal species are considered near threatened (Table 2), that is, if current impacts are not controlled, the species will become threatened. Some of these such as the Honey Badger *Mellivora capensis* have been recorded from time to time within the area, the latest of which was a sighting in Wilderness Heights during February

2008 (pers obs). The species has wide habitat tolerances but tends to be uncommon wherever it is found.

The Long-tailed Forest Shrew *Myosorex longicaudatus* is endemic to the southern Cape species, occurring in forest areas with marginal intrusions into grassland and marshy fynbos (Friedmann & Daly, 2004).

The Fynbos Golden Mole *Amblysomus coriae* occurs primarily within Fynbos in the southern Cape, but has also been recorded in gardens. It is a restricted species, nearly endemic to the southern Cape with a narrow distribution range extending marginally into the Eastern Cape in suitable habitat.

Another near endemic species, Duthie's Golden Mole *Chlorotalpa duthiae* is limited to sandy soils of the coastal plain from George to Port Elizabeth, the animals foraging into the littoral zone along the sea shore. Although currently listed as of Least Concern, based on the assumption that the population is stable, the status would be upgraded to Near Threatened or even Vulnerable, should this not be the case (Friedmann & Daly op cit).

Most of the bats listed in Table 1 require caves, extensive overhangs or crevices in which to take refuge. Such habitats are available along river gorges which are therefore important habitats within the Garden Route EMF for bats and many other fauna.

The Water Rat *Dasymys incomtus* occurs primarily in dense grassland and reedbeds along rivers, streams and wetlands such as occur around the lakes and along the Serpentine channel. Its distribution in the southern Cape is disjunct from the main range of the species in Transkei, Kwazulu-Natal, Mpumalanga and Limpopo Provinces. If recognized, the subspecies *D. i. capensis* is endemic to the Western Cape (Meester, Rautenbach, Dippenaar & Baker 1986, Friedmann & Daly 2004).

### 4.1.3 Herpetofauna

Herpetofaunal species richness of the GREMF area is moderate, mostly a result of environmental conditions. Nineteen amphibian species and 48 reptile species occur within the GREMF area, the latter including eight tortoises, terrapins and turtles, 17 lizards and 23 snakes (Table 3), (Branch 1998).

### Rare and Threatened Herpetofauna Species

Four threatened reptiles, the Leatherback Turtle *Dermochelys coriacea*, Green Turtle *Chelonia mydas*, Loggerhead Turtle *Caretta caretta* and Hawksbill Turtle *Eretmochelys imbricata* all listed as either Vulnerable or Endangered on an international scale but Vulnerable locally (Branch 1988), have been recorded along the coast of the GREMF area, mostly juveniles but even adults of the Green Turtle have been seen (Branch 1998, SANParks unpubl. obs., Randall pers. comm. 2008). They are considered to be vagrants along the south coast, which may be forced onshore during inclement weather and by onshore sea currents. A single amphibian, the Knysna Leaf-folding Frog *Afrixalus knysnae*, a south-eastern Cape endemic, listed as Endangered (Minter et al 2004) has been recorded occurring in clearings, glades, roadside pools and boggy areas in forest and fynbos from Groenvlei eastwards to Covie beyond the confines of the GREMF area.

#### 5.1.4. The Knysna Seahorse – *Hippocampus capensis*

The Knysna seahorse is known for its beauty and rarity. Specimens are 70mm long on average and occur only in the Knysna Estuary systems. They are only found in areas where dense vegetation is present, such as Keurooms, Swartvlei, Knysna Estuaries. It is listed as on the IUCN's Red list as an endangered species (SANParks (b), 2008).

Sea horses are able to alter their body colouration to blend with the surrounding environment. They have 2 independently moving eyes, much like a chameleon, with a strong prehensile tail, which is used to anchor itself to objects such as plant material. They are classified as true fishes, since they have a backbone, gills, swim bladder and fins. For protection their bodies are covered in bony plates. The dorsal fin is used for propulsion, while the pectoral fins are used to steer and for stabilization. Seahorses are therefore slow swimmers, and therefore are

vulnerable to crabs, larger fish and harvesting by humans. They are also susceptible to parasites, fungal and bacterial infections. Seahorses feed on zooplankton, by using their sucking mouthparts while attached to a hold-fast (SANParks (b), 2008).

Pregnancy occurs in the male and seahorses are known to mate for life. The Knysna Seahorse becomes sexually mature after six to nine months, depending on water conditions. The mating ritual takes three days to complete. The female places her ovipositor in the males pouch. She has no further contact with the young and the male delivers the offspring in about two days. Birth rates vary between 5 and 150 offspring, all are about 10mm in length (SANParks (a), 2008).

#### 4.1.5 Invertebrates

With the possible exception of butterflies, the invertebrate fauna of the area is relatively poorly researched. The wide range of available habitats is indicative of substantial species richness including rare and threatened species such as the Brenton Blue Butterfly *Orachrysops niobe* which appears to have a very limited distribution and is endemic to the GREMF area (Woodall 2005). According to Woodall (op cit) 93 butterfly species have been recorded from the area, including some with restricted distributions, such as the nominate race of the Knysna Skolly *Thestor b. brachycerus* which is confined to the Knysna Heads and the Outeniqua Blue *Lepidochrysops outeniqua* which is only known from the Outeniqua Mountains at Avontuur, but which may also occur within the GREMF area.

#### 4.1.6 Impacts

Most of the area has been subjected to anthropogenic impacts over the past 300 years. First was the destruction of most large game species together with

much of the former Afrotropical forests in the area, the latter harvested for wood and timber. This was followed by the clearing of forest and fynbos for forestry and agricultural purposes, and the introduction of alien vegetation. The third phase of impact is currently in progress with excessive demands for land, mostly along the coast for housing and recreational purposes. Many of these properties are being fenced off preventing passage to the fauna. A concomitant increase in the number of cats and dogs will exacerbate the impact on the fauna of the area. Uncontrolled dogs have been recorded killing bushbuck and chasing monkeys on Wilderness Heights for example.

Together such developments are fragmenting most of the remaining indigenous vegetation and faunal habitats along the Garden Route, resulting in isolated pockets of species. This is especially marked along the coastal plain and 'plateau' or incised plain along the foot of the Outeniqua Mountains. Coastal resort towns within the GREMF such as Knysna, Sedgefield and Wilderness are expanding rapidly, separating blocks of land in between. Together with the restrictions in movement imposed by traffic on the N2, such blocks are becoming increasingly isolated. With the exception of areas such as the Wilderness National Park and Goukamma Nature Reserve most of the remaining areas are privately owned and therefore likely to be developed. Lack of continuity would lead to 'island populations' with a concomitant loss of biodiversity.

The effect of the N2 on the fauna of the area must be severe considering that SANParks personnel recorded 54 animals of 24 species dead on road (DOR) (Table 4) mostly in a short section of road between Sedgefield and Rondevlei, particularly prior to the turnoff to the Pine Lake Marina and Rondevlei. Amongst the birds, owls were the most affected, especially the African Grass Owl. Of the most recorded mammal mortalities was the Striped Polecat *Ictonyx striatus*, which according to R. Randall (pers comm. 6 June 2008) has not been seen at Rondevlei in recent times. This species is particularly vulnerable when crossing roads as it is nocturnal and relatively slow moving. Extensive mortalities of this species on roads throughout South Africa are evidence of this. It highlights the impacts of such a road on the fauna in the area, as these observations were



mostly limited to a small section of the N2. Such highways, with increasing traffic volumes, become barriers to the movement of species. In time this is likely to expand to other roads in the area. It is therefore clear, that where possible, areas along the coast should be linked by corridors parallel to the N2, to facilitate faunal movement with links to the hinterland unfortunately limited to underpasses along river valleys.

## 5.2. Flora

The area of the Garden Route Environmental Management Framework lies within the Eastern Fynbos – Renosterveld Bioregion which encompasses two biomes, Fynbos and Forest as well as Azonal Vegetation Communities along the coast (Mucina & Rutherford 2006). Within these biomes, as a result of the varied geology and topography within the area under discussion, 11 vegetation types have been described (Mucina & Rutherford op cit). A more in depth assessment of the vegetation is currently in progress under the auspices of the Garden Route Initiative but is as yet unpublished. In addition it does not link up with that of Mucina & Rutherford (op cit) and is therefore difficult to reconcile with this. As a consequence a summarized description of the eleven types mentioned previously is incorporated here.

### Forest

#### 5.2.1. FOz1 Southern Afrotemperate Forest

Mostly confined to the pediment, plains and river valleys extending through the area but absent from the coastal plain. The vegetation is characterized by tall closed canopy forest comprised of typical species such as Yellowwood *Afrocarpus falcatus*, *Podocarpus latifolius*, *Olea capensis ssp. macrophylla*, *Nuxia floribunda*, *Cassine peragua*, *Elaeodendron croceum*, *Ekebergia capensis*, *Cunonia capensis*, *Curtisia dentata*, *Rhus chirindensis* and *Rapanea melanophloeos* among others. Shrubs or low trees such as *Trichocladus crinitus*

and *Carissa bispinosa* occur under the trees, with climbers such as *Rhoicissus tometosa* and *Clematis brachiata* growing into the canopy. Forbs tend to be absent from the undergrowth due to the shading effect of the trees but along the fringes or where more light reaches the floor *Dietes iridioides* and *Oplismenus hirtella* are found. Ferns are common and varied, again mostly limited to areas where more light reaches the ground. These include *Pteris dentata*, *Hypolepis sparsisora*, *Polystichum lucidum* and *Blechnum australe* with other taxa such as *Adiantum capillus-veneris*, *Blechnum giganteum* and *Christella gueinziana* present along streams.



Photo: Extensive Indigenous forest

Although broadly incorporated in Afrotemperate Forest, many north-facing slopes are covered by Thicket comprising more arid adapted trees and shrubs such as *Rhus pallens*, *Buddleja saligna*, *Pittosporum viridiflorum*, *Sideroxylon inerme*, *Scutia myrtina*, *Gymnosporia buxifolia*, *G. nemorosa*, *Apodytes dimidiata*, *Carissa bispinosa*, *Aloe arborescens*, *Asparagus macowanii*, *A.*

*aethiopicus*, *A. setaceus*, *Rhoicissus digitata*, *Cynanchum ellipticum*, *Indigofera denudata* and others.

The largest areas within the GREMF area include Groeneweide and Bergplaas Forests, both falling within the Garden Route National Park. Smaller remnants occur along the Touw and Duiwe Rivers, but many others, mostly in sheltered valleys on south facing slopes, are on private land.

Mucina & Rutherford (op cit) list 11 endemic plant species within this vegetation type, six of which occur within the project area.

### **5.2.2. FOz6 Southern Coastal Forest**

Within the GREMF area Southern Coastal Forest appears to be limited to a small area within the Goukamma Nature Reserve and Garden Route National Park. These forests tend to be generally low with mixed species composition including *Sideroxylon inerme*, *Rhus chirindensis*, *Gymnosporia buxifolia*, *Mystroxyllum aethiopicum*, *Trichocladus crinitus* and *Celtis africana*. Climbers occurring include *Cissampelos torulosa* and *Cynanchum obtusifolium*. Shrubs such as *Carissa bispinosa*, *Olea exasperata* and *Rhus glauca* may be present (Mucina & Rutherford (op cit)). A single plant species *Sterculia alexandri* is endemic to this vegetation type, but does not occur within the GREMF area.

This vegetation type is least threatened with most of it within the GREMF occurring within a conservation area, although some has been affected by urban development. Invasion by alien woody plants especially Rooikrans *Acacia cyclops* and Port Jackson Willow *A. saligna* is a serious threat.

## **Fynbos**

### **5.2.3. FFb6 Eastern Coastal Shale Band Vegetation**

According to Mucina & Rutherford (2006) this vegetation community has a disjunct and restricted distribution within the GREMF, mostly along the Outeniqua Mountains. Elsewhere it occurs in pocket along the Garden Route between the sea and the mountains.

The vegetation is characterized by the presence of four proteoid taxa, *Protea neriifolia*, *Leucadendron eucalyptifolium*, *L. salignum* and *Leucospermum cuneiforme*.

This vegetation type is considered endangered (Mucina & Rutherford op cit), parts of which are conserved within the Garden Route National Park but large parts have been transformed by agricultural and silvicultural activities.



Photo: High Mountain Fynbos

#### **5.2.4. FFd10 Knysna Sand Fynbos**

Within the GREMF this vegetation type has a patchy and limited distribution along the northern side of the lakes forming a dense scrub. Common species include *Passerina rigida*, *Leucadendron salignum*, *Muraltia squarrosa* and *Erica curvifolia*. Important species include *Widdringtonia nodiflora*, *Metalasia densa* and *Tephrosia capensis* (Mucina & Rutherford op cit). At Rondevlei clumps of Southern Coastal Forest species have invaded this vegetation community due to



the exclusion of fire, particularly along the base of dunes although this is likely to be moisture related.

This vegetation type is considered endangered with only pockets protected within the Garden Route National Park and several private nature reserves.

#### 5.2.5. FFd11 Southern Cape Dune Fynbos

This vegetation type appears to be restricted to a very narrow zone along the coast with patches occurring from the Touw River estuary eastwards to Buffels Bay, within the GREMF area. The vegetation is characterized by fynbos elements such as *Agathosma apiculata*, *Phyllica spp.*, *Metalasia muricata* and *Muraltia squarrosa* with *Ficinia spp.* and the restio *Ischyrolepis eleocharis* common in the field layer. It includes a large proportion of broadleaf species such as *Sideroxylon inerme*, *Tarchonanthus littoralis*, *Pterocelastrus rostratus*, *Salvia africana-lutea*, *Rhus glauca* and *Olea exasperata*.

According to Mucina & Rutherford (op cit) the occurrence of *Tarchonanthus littoralis*, *Sideroxylon inerme* and *Pterocelastrus tricuspis* are a consequence of fire exclusion, resulting in the displacement of fynbos vegetation by broadleaf species.

Four plant species, *Aspalathus cliffortiifolia* (possibly extinct), *Lampranthus algoensis*, *Erica chloroloma* and *Pentaschistis barbata ssp. orientalis* are listed as endemic to this vegetation type (Mucina & Rutherford op cit), but only the latter two species occur within the EMF area.

This vegetation type is considered Least Threatened, being well protected in the Goukamma Nature Reserve and the Garden Route National Park within the GREMF area (Mucina & Rutherford op cit). However there is some concern that species turnover from west to east along the coast is not being catered for, and species and communities may become vulnerable with uncontrolled urban expansion. Alien plants, especially *Acacia cyclops* and *A. saligna* are major threats to this vegetation type.



Photo: Southern Dune Sand Fynbos

#### 5.2.6. FFg5 Garden Route Granite Fynbos

Garden Route Granite Fynbos occurs in limited areas along the coast west of the Kaaimans River mouth and on the plateau east of Hoekwil on soils derived from the weathering of granite. It is typically dense proteoid and ericoid shrubby grassland, mostly comprised of shrubs such as *Osyris compressa*, *Passerina corymbosa*, several *Protea spp.*, *Mimetes cucullata*, *Leucadenron salignum*, *Cliffortia serpyllifolia*, *Erica discolor*, *E. canaliculata*, *E. peltata*, *Phylica confusa*, *Agathosma ovata*, *Erioccephalus africanus*, *Pelargonium fruticosum*, *Lampranthus sociorum* among others. Grasses, sedges and restios are common, the former including *Eragrostis capensis*, *Heteropogon contortus*, *Pentaschistis eriostoma* and *Themeda triandra*. The latter include *Tetraria cuspidata*, *Ficinia nigrescens* and *Restio triticeus* (Mucina & Rutherford op cit).

According to Mucina & Rutherford (op cit) this vegetation type is endangered with approximately 70% transformed by agricultural and sylvicultural activities,

and urban expansion. Most of the remaining areas occur in isolated pockets along steep slopes and only 1% is conserved in the proposed Garden Route National Park.

#### 5.2.7. FFh9 Garden Route Shale Fynbos

This fynbos community occurs in scattered areas along the coastal plateau but the exact extent of this vegetation type is less than that incorporated by Mucina & Rutherford (op cit). Mapped areas in some instances include areas of Afrotemperate Forest on south facing slopes and Thicket on north-facing aspects. Areas within the GREMF are found along the plateau between Hoekwil and Knysna.

The vegetation varies between a taller proteoid and ericoid fynbos in wetter areas to a graminoid fynbos in drier sites. Characteristic species include *Protea* spp., *Leucadendron eucalyptifolium*, *L. salignum*, *Elytropappus rhinocerotis*, *Metalasia densa*, *Phyllica axillaries*, *P. pinea*, *Helichrysum cymosum*, *Pteridium aquilinum*, *Erica hispidula* and *Crassula orbicularis*. Graminoids are common including grasses such as *Aristida junciformis*, *Brachiaria serrata*, *Eragrostis capensis*, *Themeda triandra*, and the restios *Ischyrolepis gaudichaudiana*, *I. sieberi*, *Elegia juncea* and *Restio triticeus* (Mucina & Rutherford op cit). According to these authors three plant species *Cyphia georgica*, *Disa newdigateae* and *Gladiolus roseovenosus* are endemic to this vegetation type and occur within the GREMF area.

According to Mucina & Rutherford (op cit) this vegetation type is endangered with at least 50% transformed by cultivation, converted to pasture and forestry, with 8% conserved within two formal conserved areas (5%) and the remainder mostly in private conservation areas. Alien vegetation encroachment threatens the remaining remnants outside of these areas.



#### 5.2.8. FFs19 Southern Outeniqua Sandstone Fynbos

This is probably the most extensive vegetation type within the study area, occurring along the south-facing slopes of the Outeniqua Mountains from east to west ranging in altitude from sea level to the 1579 m Cradock Peak. It is characterized by a tall open to moderately dense shrubland - mostly a proteoid, ericoid and restioid fynbos. Taller woody vegetation includes *Dodonaea angustifolia*, *Widdringtonia nodiflora*, *Osteospermum monilifera*, *Halleria lucida*, *Protea neriifolia*, *P. repens*, *P. mundii*, *Metalasia densa*, *Laurophyllus capensis*, *Brunia nodiflora*, *Berzelia intermedia* and *Leucadendron eucalyptifolium* amongst others. Numerous smaller shrubs include many *Erica* spp., *Relhania calycina*, *Leucadendron salignum*, *Protea cynaroides*, *Stoebe alopecuroides*, *Acmademia* spp., *Cliffortia ilicifolia*, *Euryops pinnatipartitus*, *Otholobium carneum* and others. Herbs, grasses, sedges and restios are abundant, the former including *Centella affinis*, *Anginon difforme*, *Helichrysum felinum*, *Geissorhiza* spp., *Lanaria lanata*, *Tritoniopsis caffra* and *Watsonia fourcadei*. The latter are also very diverse with grasses such as *Ehrharta dura*, *E. rupestris*, *Pentameris distichophylla*, *Merxmuellera decora* and *Pentaschistis* spp., occurring together with *Tetraria* spp., and numerous restios primarily *Cannamois* spp., *Elegia* spp., *Restio* spp., *Thamnochortus* spp. and others.

Mucina & Rutherford (op cit) list 27 plant species endemic to this vegetation type of which approximately 20 are likely to occur within the project area.

Although 47% of this vegetation type is statutorily conserved it is still regarded as Vulnerable due in part to the transformation of large areas by forestry together with alien encroachment primarily by *Pinus pinaster* and *Hakea sericea* (Mucina & Rutherford (op cit)).

## Azonal Vegetation

Azonal vegetation includes those types or communities which are limited to certain edaphic, hydrophytic and halophytic conditions, mostly associated with waters of varying salinity.

### 5.2.9. AZd3 Cape Seashore Vegetation

Cape Seashore Vegetation occurs in a very narrow zone along the seashore, including beaches, coastal dunes, dune slacks and cliffs, in the GREMF area. The vegetation cover is varied from open herbaceous or grassy areas to dwarf shrubby vegetation, often dominated by a single pioneer species. Plant species typical of this vegetation include *Arctotheca populifolia*, *Gazania rigens*, *Pelargonium capitatum*, *Senecio elegans*, *Solanum africanum*, *Cynachum ellipticum*, *C. obtusifolium*, *Carpobrotus edulis*, *C. acinaciformis*, *Tetragonia decumbens*, *Drosanthemum spp.*, *Dasispermum suffruticosum* and grasses such as *Ehrharta villosa*, *Sporobolus virginicus* and *Thinopyrum distichum*. Mucina & Rutherford (op cit) also list 18 species endemic to this vegetation type of which three occur within the GREMF area.



Photo: Coastal Thicket Vegetation

#### 5.2.10. AZe2 Cape Estuarine Salt Marshes

Within the GREMF area this vegetation community is mostly limited to Swartvlei and Knysna Estuaries occurring within the zones affected by tidal action. The vegetation is characteristically comprised of low herbs and shrubs which are tolerant of flooded conditions. It includes salt marsh meadows dominated by sedges and rushes (Mucina & Rutherford op cit). Halophytic plants typically characterize this community including submerged grasses *Ruppia maritima*, *R. cirrhosum* and *Zostera capensis*. Herbs, rushes and grasses such as *Sarcocornia perennis*, *S. capensis*, *S. pillansii*, *Chenolea diffusa*, *Plantago crassifolia*, *Juncus kraussii*, *Sporobolus virginicus* and *Stenotaphrum secundatum* are typical under these conditions. Two endemic species namely *Poecilolepis ficoidea* and *P. maritima* occur in this vegetation type but only the former perhaps in the GREMF area (Goldblatt & Manning 2000).



Photo: Saltmarsh vegetation

#### **5.2.11. AZf1 Cape Lowland Freshwater Wetlands**

The Cape Lowland Freshwater Wetlands community occur primarily within low lying areas behind dune cordons and around the lakes fed by rivers arising in the Outeniqua range. As such the vegetation community is a misnomer as the water of the Wilderness Lakes is of varying salinity (Whitfield, Allanson & Heinecken 1983, Randall, Randall & Kiely 2007).

The vegetation around these lakes is typically zoned, these frequently formed by monotypic stands of club rushes *Schoenoplectus scirpoides*, reeds *Phragmites australis*, bulrushes, *Typha capensis*, rushes *Juncus rigidus*, *J. kraussii*, sedges such as *Cladium mariscus*, *Ficinia nodosa*, *Cyperus textilis*, *C. sphaerospermus*, *C. thunbergii*, *Pycnus nitidus* and grasses, mostly *Stenotaphrum secundatum*, *Pennisetum macrourum* and *Paspalum vaginatum* according to the depth of water (Mucina & Rutherford op. cit, Randall, Randall & Kiely op cit.).



Aquatic herbs, such as waterlilies *Nymphaea nouchallii*, *Aponogeton junceus*, *Nymphoides indica*, *Ceratophyllum demersum*, *Potamogeton pectinatus* and *Ruppia maritima* amongst others, are common. Mucina & Rutherford (op cit) list three endemic species, namely *Aponogeton angustifolius*, *A. distachyos* and *Cotula myriophylloides* for this vegetation type, of which only *A. distachyos* occurs within the GREMF.

As a consequence of the range of habitats present in the area, the vegetation is very diverse resulting in substantial plant species richness with 1403 taxa having been recorded within the  $\frac{1}{4}^{\circ}$  grid squares 3322DC, DD, 3422BA, BB including 79 Red Data Book species (Precis Data, South African National Biodiversity Institute). Some of these are endemic to the area under discussion. However parts of 3322DC and 3322DD fall outside of the GREMF area which will affect the actual number of taxa present.

## Threats

It is evident that the area has been severely impacted by anthropogenic activities ranging from farming and afforestation to urban expansion. The construction of the N2 has exacerbated impacts as it has opened up the area to development. This has led to the expansion of towns and villages such as George, Knysna, Wilderness and Sedgefield and a demand for housing along the sea shore. Golf estates have been developed at an alarming rate along the Garden Route, on the pretext of being environmentally friendly. The Lakes Eco Golf Estate on Swartvlei is an example, with 800 houses, two golf courses, a polo field and several 'Gentlemens' Estates as well as an airfield in the proposal.

This has resulted in the fragmentation of the vegetation communities especially along the plateau and coastal plain, the latter being particularly vulnerable to housing developments. Apart from relatively small areas such as the Wilderness National Park and Goukamma Nature Reserve, most of the GREMF area is privately owned and has been extensively subdivided with the result that

property owners, on building, bulldoze most of the site, clearing the terrain of all vegetation, with the possible exception of some Milkwood trees, the latter requiring a permit from the Department of Water Affairs and Forestry for removal. Unfortunately this permit is easily accessible and even Milkwoods are not secure. Alien infestation by species such as Rooikrans *Acacia cyclops*, Port Jackson A. *saligna*, Black Wattle *A. mearnsii*, Blackwood *A. melanoxylon*, Pine *Pinus pinaster*, Silky Hakea *Hakea sericea* and *Eucalyptus* spp. is rife throughout the area. Pines and Hakea have invaded the slopes of the Outeniqua Mountains and it appears as if little is being done to contain this invasion. A noticeable feature of the Outeniqua Mountains is the stubble of dead pines along the crests of the ridges, these killed by the frequent wildfires in the area.

Alien vegetation dominates most of the riparian vegetation flanking rivers and streams in the area, mostly Black Wattle and to a lesser extent Blackwood, pines and eucalypts. Fynbos areas are invaded by Hakea, Blackwood, pines and to a lesser extent Rooikrans. The latter dominates the vegetation along the coastal plain, especially along the sea front dunes, with Port Jackson common in some areas, especially around Swartvlei and Sedgefield.

It is therefore likely that in the next 10 years little of the remaining natural vegetation will remain unless a management plan is implemented which will ensure and enforce orderly development, containing the footprint for a dwelling, thereby minimizing the impact on the remaining natural areas. It is essential that a system of corridors along the coast with links to the hinterland and formal conservation areas are identified and expanded to include a more significant and viable portion of the plateau and coastal plain, areas which are currently under greatest threat. In addition restrictions on development of remaining areas of fynbos and forest along the plateau should be considered.

Figure 5: Vegetation



## 6. LANDSCAPE AND LANDFORMS

The regional geology of the study area is largely responsible for the physiography of the region and thus its unique landscape characteristics. It should be acknowledged that this unique landscape is a substantive attraction to the area bringing both tourism and economic benefits, and as such has immense value. Tyson, (1971 in Brink 1981) described four morphological divisions being the Outeniqua Mountains, the foothills, the coastal platform and the Wilderness-Knysna embayment. The mountainous belt defines the northern boundary of the study area and consists of steep to extremely steep slopes generally above 800m above mean sea level. This area is predominantly underlain by quartzite and sandstone of the Table Mountain Group (TMG).

The foothills are composed of undulating to steeply rolling hills which rise up from the coastal platform above 230m. This area is underlain by sandstone of the TMG, and in places includes remnants of an upper plateau supported by resistant silcretes. The coastal platform is a level or gently seaward sloping plateau between 180 and 230m above mean sea level. This plateau is a wave cut platform remnant of a period of higher sea level when it formed part of the offshore continental shelf, about 20 million years ago<sup>1</sup>. It is predominantly underlain by pre-Cape granite, Kaaimans group metal sediments (phyllites, schists and shales) and TMG sandstones, covered in places with alluvium and aeolian deposits<sup>2</sup>.

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<sup>1</sup> Norman and Whitfield, 2006

<sup>2</sup> Schafer, 1991



Photo: Foothills and Mountains

The Wilderness- Knysna embayment consists of a series of estuaries and lakes just above sea level, alluvial floodplains and the coastal dune cordons of Wilderness and Sedgefield. The highest dunes rise to some 350m above mean sea level. Schafer (1991) recognises four ages of aeolianite (or dune) depositions with the youngest being adjacent to the coast in the west, while the oldest lie to the east of Knysna predominantly in the Concordia area. The younger dunes in the west have consolidated into dune rock in certain places resulting in the steep cliffs along the coast and features such as Flat Rock in Wilderness and Gericke's Point near Sedgefield<sup>2</sup>. Of note in this area is the presence of Enon conglomerates adjacent to the north and east of the Knysna estuary, as well as the occurrence of quartzitic sandstone of the TMG responsible for the presence of the famous Knysna Heads at the mouth of the estuary<sup>2</sup>. The Enon beds are most clearly visible along the waterside entry to Knysna as steep cliffs consisting of coarse

arenaceous conglomerates including closely packed well rounded pebbles of TMG origin<sup>2</sup>.

Schafer (1991) further divides this study area to include the steeply incised valley system which dissects the coastal platform with narrow valley bottoms, and forms the escarpment between the plateau and the embayment. This landform is found adjacent to the main perennial rivers in the study area being, Kaaimans on the western boundary, Touw, Wolwe, Hoëkraal, Karatara, Homtini, and Knysna, with the Noetsie on the eastern boundary<sup>2</sup>.

### **6.1. Slope Analysis**

The study was analysed with GIS software to calculate the Slope Aspect for the entire study area. It is evident that the mountainous area in the north has the highest slope aspect due to high altitude mountainous terrain. The inland plains have shallow slope aspect due to their relative flatness, where the slope aspect increase once again to the south of the plains at the terrain sharply forms into foothills. The coastal dune areas are also characterised by steep slopes around the built-up areas of Knysna and Wilderness. Due to their high slopes they are extremely susceptible to erosion and the formation of soil pipes, which leads to dune slumping.





Photo: Dune slumping caused by erosion and soil pipes

The Knysna Heads are also dominated by steep slopes due the rock geology of the area. The coastal plains are nestled between the steep foothills and dunes, which comprises much of the urbanised areas in the study area.



Photo: development on steep slopes



Photo: development on head crests



Photo: Dune crest development



Photo: Eastern Heads development

Figure 6: Topography

## 7. LANDSCAPE CHARACTER

### 7.1. Principles of Landscape

Landscape is about the relationship between people and place. It provides the setting for our day-to-day lives. Landscape can be a small parcel of urban wasteland to a mountain range, from an urban park to a vast desert plain. Landscape is the result of the sum of various components of the natural environment – natural (geology, soils, climate, flora and fauna) and cultural (historical and current impact of land use, settlement, and other human interventions). People's perceptions of land, turn land into landscape. Subjectively landscape is not only about quantitative visual perceptions, but qualitatively of how we see the land, and experientially through tactile sensory feelings, memories, smells, and the emotions and associations they evoke.

Landscape character, the pattern that arises from the particular combinations of the various components as above, provides a sense of place to our surroundings, commonly referred to as Genus Loci, or 'Sense of Place'.

People value landscapes for ;

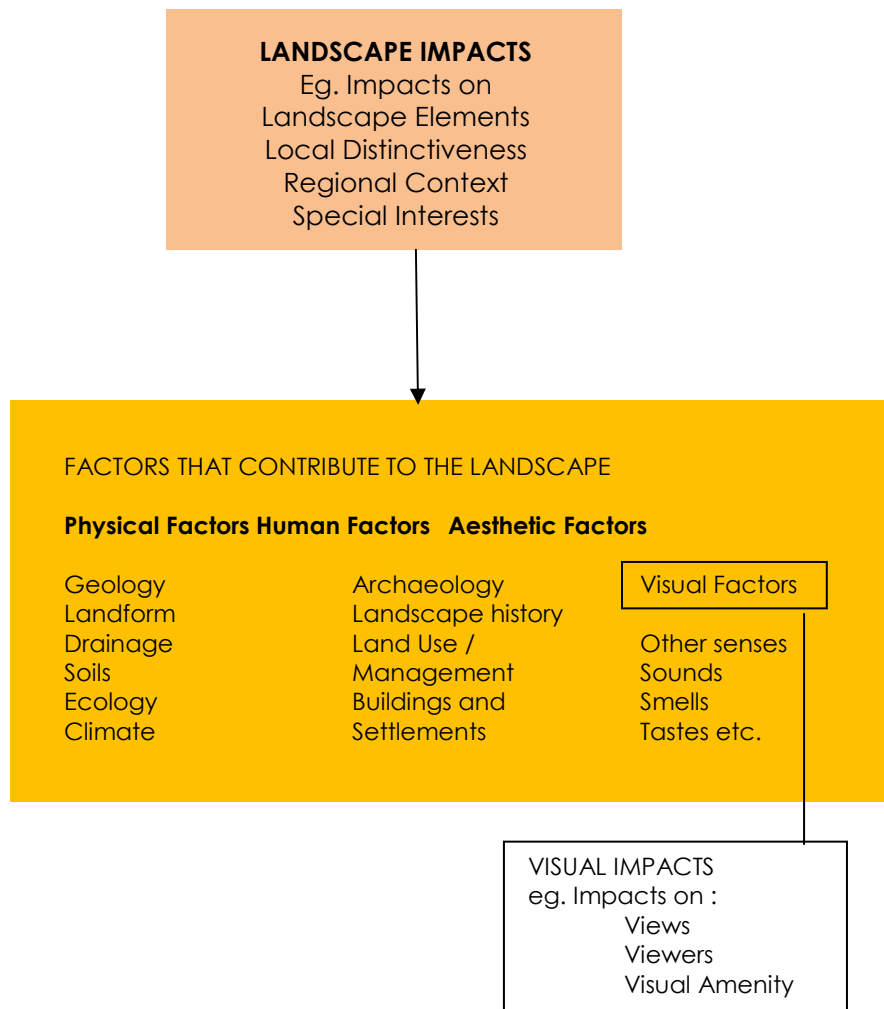
- traditional concepts of aesthetics and beauty;
- habitats for wildlife;
- cultural record of how people have lived on the land, and harnessed its resources (cultural and agricultural landscape);
- important part of people's day to day lives;
- contribute to a sense of identity, well-being, enjoyment and inspiration;
- economic value, providing the context for economic activity (ie business and tourism attraction).



The Landscape and visual characterisation Assessment must inform and guide the strategy as to the most optimal and sustainable placement of bulk electricity and power provision infrastructure.

## 7.2. Landscape and Visual Impacts

Landscape and visual impacts are separate, but related.



### 7.2.1. Landscape Impacts

Landscape impacts result from the changes in the fabric character and quality of the landscape as a result of development.

Landscape impacts are concerned with:-

- direct impacts upon specific **landscape elements**,
- more subtle effects upon the overall pattern of spatial elements that gives rise to **landscape character** and **regional and local distinctiveness**,
- impacts upon acknowledged special interests or values such as designated landscapes, conservation sites and cultural associations.

### 7.2.2. Visual Impacts

These are a subset of landscape impacts. They relate to changes in available views of the landscape, and the effect of those changes on people. Visual impact determination refers to:-

- the **direct impacts** of the development upon views of the landscape through intrusion or obstruction;
- the **reaction** of viewers who may be affected;
- the **overall impact** on visual amenity, which can range from degradation through to enhancement.

Landscape and visual impacts do not necessarily coincide. Landscape impacts can occur in the absence of visual impacts, where development is screened from available views, but results in a loss of landscape elements, and landscape character within the site boundary (ie. Visual impact is largely based upon the amount of viewers [people] who will physically observe the development from any given point or time). Certain developments may have significant visual

impacts, but significant landscape impacts; such as telecommunications masts or high tension overhead powerlines within an industrial area.

Influences and impacts occur when landscape or visual resources are affected. **Receptors of landscape** and visual impact may include physical and natural landscape and biological resources, special interests and groups of viewers (Table 6).

The **significance** of landscape and visual impact is a function of the sensitivity of the affected landscape and visual receptors and the magnitude of change that they will experience. Sensitivity incorporates the value (relative) of the landscape and how tolerant it is to change. By combining magnitude and sensitivity in a systematic approach, consistent conclusions on impact significance can be drawn.

Table 6: Landscape and Visual Receptors

Examples of Landscape and Visual Receptors	
Areas of distinctive landscape character	<ul style="list-style-type: none"> <li>• Characteristic patterns and combinations of landform and land cover and a sense of place (genius loci)</li> </ul>
Valued landscapes	<ul style="list-style-type: none"> <li>• Nationally designated landscapes – National Parks, Nature Reserves etc.</li> <li>• Locally designated landscapes – scenic areas, conservation areas.</li> <li>• Areas of local importance – local beauty spots, popular walks and trails, meanders and rambles.</li> </ul>
Other conservation interest	<ul style="list-style-type: none"> <li>• Archaeological sites, historic sites and landscapes, important habitats</li> </ul>
Specific landscape elements	<ul style="list-style-type: none"> <li>• Open hilltops, rocky ridges, river and stream corridors, woodlands etc.</li> </ul>
Viewers of the landscape	<ul style="list-style-type: none"> <li>• Residents, tourist, visitors, rambles.</li> </ul>

### 7.3. Landscape Characterisation Process

Landscape Character Assessment is concerned primarily with landscape character, rather than with landscape quality or value. These are however still relevant when a Landscape Character Assessment is used to inform decisions, and when judgements are made regarding the implications of an assessment.

**Landscape character** is defined as a distinct and recognisable pattern of elements that occur consistently in a particular type of landscape. This will relate to specific combinations of geology, landform, soils, vegetation, land use, field patterns and human settlement. Character makes each part of the landscape distinct, providing each with an individual sense of place.

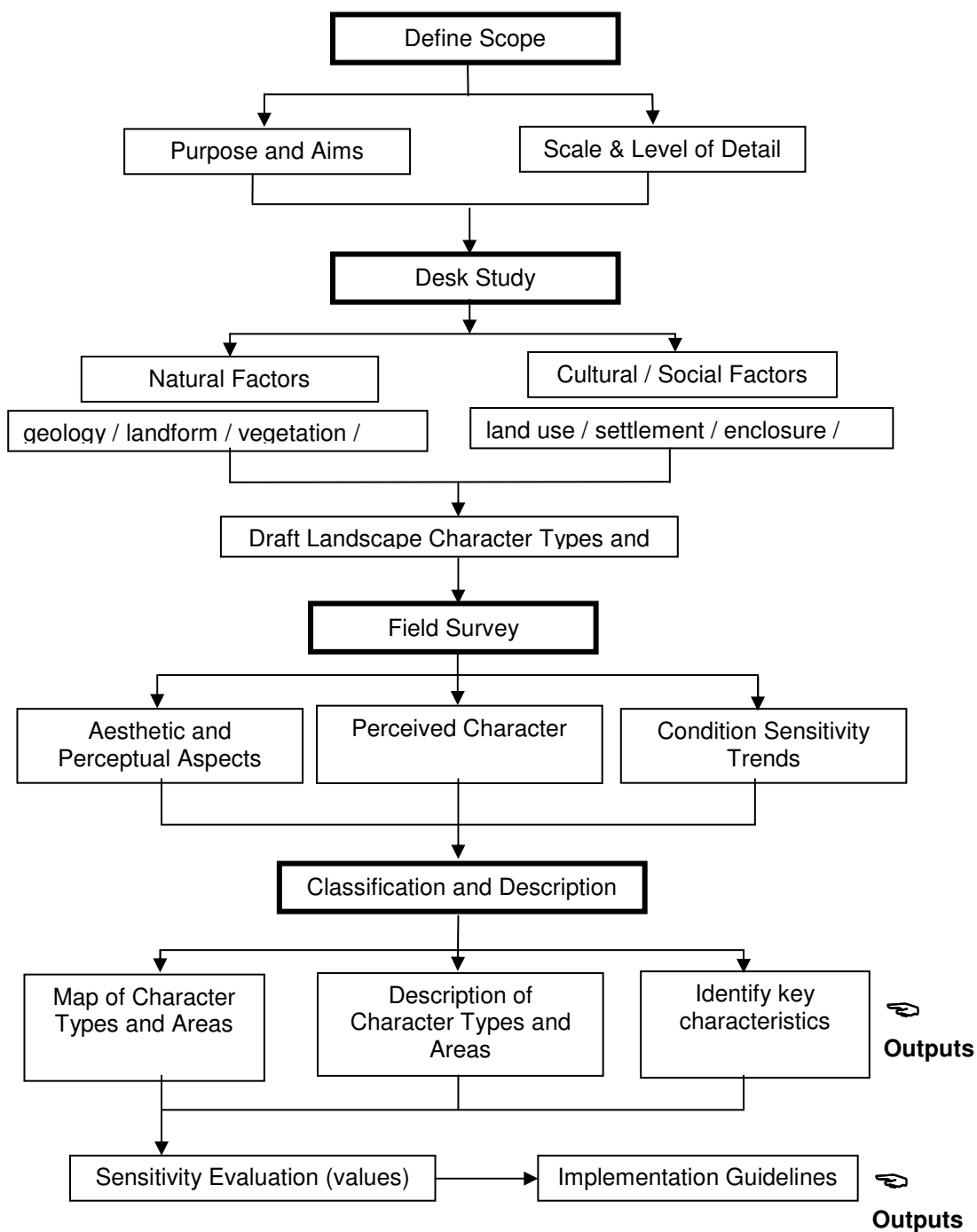
The first step in characterisation is the identification of **areas of distinctive character**, classifying and mapping them, with descriptions of the character, focussing on the distinctive differences between areas, and will entail the identification of both character types and areas.

#### 7.3.1. Landscape Character Types

These are distinctive types of landscapes that are relatively homogeneous in character. They are **generic** in nature in that they may occur in different areas in different parts of the study area, but where they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern.

### 7.3.2. Landscape Character Areas

Compared to the above these are single **unique** areas and are the discrete geographical areas of a particular landscape type. Each has its own individual character and identify, even though it shares the same generic characteristics with other areas of the same landscape type. This distinction is reflected in the naming of types and areas: landscape character types are names such as Bushveld and river valley, but landscape character areas take on names of specific places, such as Groot Marico Bushveld and Gonube River Valley. Landscape character areas and types very rarely conform to administrative boundaries.



## 7.4. CATEGORIES AND CLASSIFICATION

### 7.4.1. Categories

Baseline inventory and description of landscape character is primarily established on a platform of desk study and survey. Information that will be utilised in the structuring of the categories to be used in the classification of landscape areas and types will include:-

- past use of the land,
- designations and their distribution, such as,
  - historical precincts,
  - conservation and protected areas,
  - national monuments and listed heritage sites,
  - battlefields, etc
- Natural features such as;
  - geology,
  - land form,
  - river and drainage systems,
  - land cover,
  - vegetation
- Local Architecture,
- Archaeology,
- Tourism precincts and strategies,
- Existing statutory development plans and frameworks, such as EMFs and SEAs.
- Cultural / social factors
  - land use (including farming types)
  - settlement patterns



- patterns of field enclosure
- historic dimensions of the landscape

## 7.4.2. Mapping Analysis

Analysis of map and related information, including aerial photography, contributes to the understanding of the 'bird's eye' view of landscape and is essential in deciding how the different factors which shape the landscape come together and interact to create patterns of landscape character. Mapping should ideally encompass:

### 7.4.2.1. Natural Factors

- **Geological Information**

Derived by data from the Surveyor General provided by the Council for Geo-Science, available in 1:50 000 mapping for certain areas, but predominantly at a scale of 1:250 000. Spatial geological information predominantly informs the super structure of land form and topography. Similarly, it forms the foundation for the analytical understanding and interpretation of how landforms formed through the process of consecutive erosion cycles.

- **Landform / Topography**

Landform is the function of geology and geomorphological change. It is often the main influence on landscape character, especially in hill and upland areas. It is interpreted from maps and spatial information through the interpretation of contour information.

- **Rivers and drainage systems**

Similarly also have a significant aspect to play in the development of landform, and the shaping of the landscape. This information is also interpreted from topo-cadastral mapping and aerial photography.

- **Soil Types**

Soil types are influenced by the geological substrata, as well as the various erosion cycles, and the processes of transportation and deposition with respect to hydrological action. Soil types directly influence landscape units such as land use (with respect to agricultural practices) and the occurrence of natural vegetation.

- **Vegetation Cover / Land Cover**

Relies on a variety of information sources which are sometimes difficult to simplify to an appropriate level of detail. Aerial photography and field verification is extensively utilised, as well as land cover data.

#### **7.4.2.2. Cultural Factors**

- **Land Use**

Land Use information provides information about the physical use of the landscape. Information is derived from Local Authority Development Plans, as well as interpretation of satellite and aerial photographic information.

- **Settlement Patterns / Field Systems**

Field systems and settlements are often intimately linked and together contribute to distinctive regional patterns in the landscape, notably the division between current and historic planned landscapes and settlements.

- **Special Features**

These will notably refer to significant elements which do not fit into the above categories, or small singular units which require specific attention, such as archaeological, cultural and historical sites, as well as, sensitive environmental landscapes worthy of special protection.

## **7.5. Landscape Guidelines & Policy**

A Landscape Character Assessment will normally identify the character of an area and those factors that are particularly important in creating that character. If the distinctive character of a certain landscape is to be maintained, the assumption must be that its **positive key characteristics** should be protected from adverse change.

The physical field survey should identify the physical state of individual elements and features, and should indicate the probability of future change. These should subsequently reveal opportunities to prevent the adverse change, or maximise opportunities for enhancement.

Landscape Guidelines are the results of this analysis, and are established to indicate the actions required to ensure that distinctive character is maintained. These guidelines are sub-divided according to both the landscape type and the main pressures likely to result in landscape change, namely agriculture, natural open space, conservation areas, settlement and built development etc.

### **7.5.1. Status of Landscapes**

Certain landscape types and areas will be identified for special recognition, base upon considerations such as:-

- **Natural Beauty**

This encompasses flora, fauna, geological and physiographical features.

- **Recreational Opportunity**

Opportunities afforded for open-air recreation, having regard both to landscape character and position in relation to centres of population.

- **Natural Beauty and Amenity**

This is a composite term. It regards natural heritage as including the physical elements of flora, fauna, geology, physiographic features and natural beauty and amenity. This combination of terms covers the physical landscape, but also the less tangible aspects such as remoteness or tranquillity, and aspects of landscape experience which appeal to senses other than sight.

### **7.5.2. Landscape Value**

Refers to the relative value or importance attached to different landscapes, and reasons for valuation. Criteria for the evaluation includes:

- Landscape Quality  
The intactness of the landscape and the condition of features and elements;
- Scenic Quality  
Used to describe landscapes which appeal primarily to the visual senses;
- Rarity  
Presence of rare features and elements in the landscape, or the presence of a rare landscape character type;
- Conservation Interests

Presence of features of particular wildlife, earth science or archaeological, historical and cultural interest can add to the value of a landscape as well as having value in their own right;

- Wildness  
The presence or wild character in the landscape which makes a contribution to sense of place;
- Associations  
With specific people, artists, writers, media or historical events; such as the Herman Charles Bosman and Groot Marico historic association.
- Tranquillity  
Is a composite feature related to low levels of built development, traffic, noise and artificial lighting.

The above value criteria is the starting point for determining and selection for designation or recognition of special areas.

### **7.5.3. Landscape Capacity**

The application of this Landscape Character Assessment will assist in making decisions about the ability of a specific area to accommodate change. Judgements must be based on an understanding of the ability of the landscape to accommodate this change without a significant effect on its character. Capacity is informed by potential effects on character and/or particular features and elements.

## 7.6. LANDSCAPE CHARACTER ASSESSMENT

### 7.6.1. Regional Character Area Description

The regional character area is situated in the southern part of the Western Cape Province. The area is commonly known as the Garden Route for obvious and very clear reasons – due to its very high aesthetic and landscape appeal.

The Broad Terrain Patterns classify the area as Coastal Forelands throughout the region. The Cape Fold Region forms the boundary to the north represented by the Outeniqua Mountains.

The Broad Terrain Patterns can be further disseminated into Morphological Divisions which are comprised of plains incised by hills and river valleys, hills and lowlands, with high mountains to the north. The Terrain morphological description categorises the area on a similar basis as the Morphological Divisions; the areas adjacent to the coast as slightly irregular undulating plains and hills, parallel hills, with high mountains to the north.

The entire study area is topographically diverse in many respects. The area is flanked by the high Outeniqua Mountains to the north, and the Garden Route coastline to the south. Similarly the western extent of the study area encompasses the scenic Kaaimans River valley, and the pristine Noetzie River valley in the east.



Photo : Kaaimans River Valley



Photo : Noetzie River Valley

The extreme northern extent of the study area is topographically very diverse comprising the Outeniqua Mountains. The 'Outeniquas' provide a dramatic backdrop and setting to the Garden Route, constantly framing the landscape quality with its covering of mountain fynbos, indigenous forest and forestry plantation. The foothills of the Outeniquas are characterised predominately by a mix of agricultural landscapes, in the upper reaches and catchments of the larger Garden Route Rivers. Water abstraction for pivot irrigation purposes are concentrated around the head waters of permanent water sources, in areas where slopes are more gradual.



Photo : Headwaters of river catchment



Photo : Large Scale Pivot Irrigation



The interphase between the agricultural landscape and the indigenous forest and plantation areas forms a distinctive fringe (forest fringe). The overarching cultural landscape is composed predominantly of small farm units and small holdings, interspersed throughout the characteristically diverse topographical landscape.

Closer towards the coastline along the inland plains, urban and rural residential landscapes emerge more prominently. There is an extensive mix of rural residential (which includes smaller home industries, hospitality industry and tourism related land uses), commercial forestry, and farmsteads all interspersed by natural vegetation and indigenous forest mosaics.



Photo : Defined forest fringe

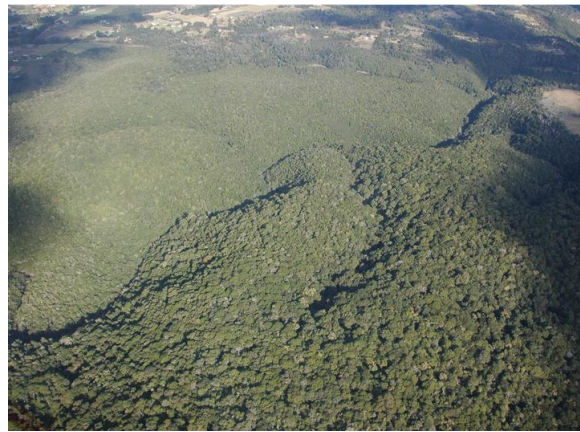


Photo : Indigenous Forests

The inland plain is separated from the coastal plateau by a series of low foothills. The coastal hamlets of Knysna, Wilderness and Sedgefield are all situated along the periphery of the coastal lake system which gives the Garden Route its very unique *genus loci*. Similarly, this is further enhanced by the fact that the Lakes are protected areas. Wilderness and Knysna are particularly difficult areas to manage from a landscape and aesthetic quality perspective as the National Parks are intertwined by urban and residential development, making these Parks

relatively unique in the South African context of traditionally recognised protected areas. The study area is similarly characterised by a dramatic and equally diverse coastline.

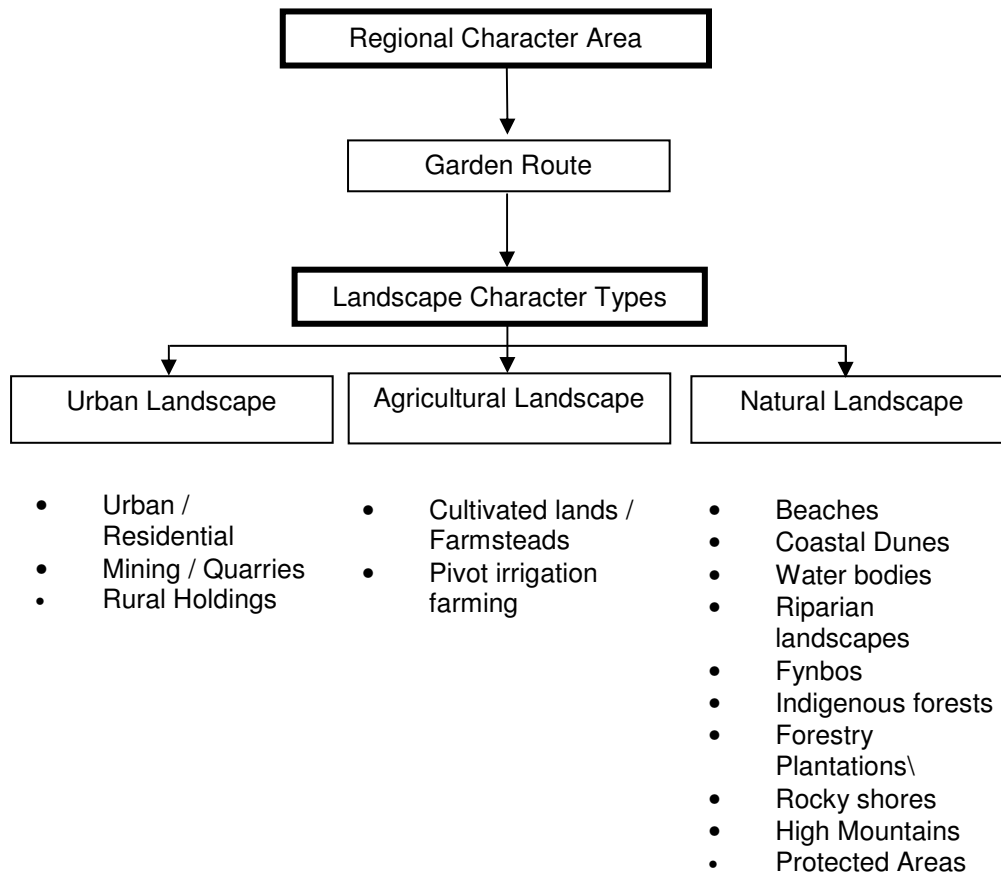
Vegetatively the area is characterised by fynbos, coastal thicket and extensive indigenous forests. Similarly, the area is also characterised by extensive forestry plantations. Although these plantations are not indigenous they do contribute to the overall quality of the Garden Route sense of place, whilst the undiscerning traveller would not find them particularly offensive.

The qualitative value of the fynbos and indigenous forest cover varies substantially, from pristine to modified, with areas of extensive alien vegetation infestation (particularly along the lower reaches of the more significant rivers), and mixed exotic and indigenous forest mosaics patches. The azonal coastal dune vegetation has similarly in areas been impacted significantly on by alien infestation of 'Rooikrans'.

Generally speaking the Regional Character Area can be considered as having a significant scenic landscape value, with a complex mosaic of high quality visual experiences, from numerous prominent visual receptors and viewshed throughout the study area. The Genus Loci of the area is not only limited to the natural and topographical splendour, but is similarly enhanced by the quaint villages and hamlets, which have largely retained their character and developed around the existing sense of place.

### **7.6.2. Landscape Character Descriptions**

This section entails the detailed descriptions of the respective landscape character types.



• **Landscape Value**

The criteria to assign 'values' to a specific landscape area based upon the sensitivity of its character is as follows (Table 7):-

- 0 - Low or no inherent character quality of value
- 1 - Medium level of character quality or value
- 2 - High or exceptional landscape character value.  
Assigned to topographical and culturally unique landscapes within a specific study area.

Table 7: Landscape Value

<b>Landscape Character Type:</b>	URBAN LANDSCAPE
<b>Local Character Area :</b>	<b>Settlements / Urban</b>
<b>Description :</b>	<p>Small towns, hamlets and villages. The larger of which are positioned along the coast on the lakes of the Garden Route. Knysna, the largest is positioned around the Knysna Estuary, with commanding views across the estuary towards the ocean. Wilderness and Sedgfield are similarly positioned around The Serpentine and Touws River, and Eilandvlei; and Swartvlei respectively. The hamlets comprise predominantly of residential land use and supporting industries such as limited industry (local market predominantly), retail and commercial. Further, this landscape also includes social amenities such as cemeteries. This landscape also constitutes formal as well as informal settlements. Associated with various topographical areas and features.</p> <p>Infrastructure in the Garden Route tends to contribute to the Sense of Place through its utilisation as a conduit for visual reception. Although the main infrastructure contributor to the area, the N2 has influenced the Genus Loci negatively, it is the same element which affords the visitor the opportunity to experience the Garden Route. The N2 can be considered as a Scenic Highway.</p>
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Residential neighbourhoods</li> <li>• Open space amenity</li> <li>• Cultural and heritage areas</li> </ul>
<b>Landscape Capacity :</b>	Certain urban residential landscapes have a very low ability to accommodate change, such as residential

	and heritage precincts, and urban open space.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Residential precincts are to be protected from visual deterioration,</li> <li>• Central business districts with defined heritage sense of place to be protected and enhanced,</li> <li>• Open space amenity should be retained,</li> <li>• Urban heritage precincts are to be protected.</li> </ul>
<b>Landscape Value :</b>	1



Photo : Knysna



Photo : Sedgefield on Swartvlei

<b>Landscape Character Type:</b>	URBAN LANDSCAPE
<b>Local Character Area :</b>	<b>Urban Fringe / Rural Holdings</b>
<b>Description :</b>	The interphase between formal settlements and larger farmsteads and commercial agricultural landscapes. This would include the interphase between the villages and forestry / large scale natural vegetated areas as well, comprising rural residential units. Usually well

	<p>structured small holdings of between 1 -10 ha in extent, usually located on the outer limits of structured residential areas. At times forming the buffer between residential settlements and forestry / natural areas. In urban growth areas experiences significant pressure from denser residential, commercial and light industrial development.</p> <p>Characterised predominantly by single dwelling units with rights for a second dwelling. Small scale farming activity associated with classic land use, as well as a mosaic of commercial activities centred on resorts and tourism, cottage industries etc. In affluent areas, small holdings are primarily utilised exclusively for residential purposes. Usually areas of higher landscape character value due to strong rural / natural residential character, within lower residence densities.</p>
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Large rural properties</li> <li>• Large component of natural environmental features</li> <li>• Rural 'sense of place'</li> </ul>
<b>Landscape Capacity :</b>	Low ability to absorb development change.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Rural 'sense of place' to be protected</li> <li>• Tranquil country lifestyles</li> <li>• Largely natural environmental features</li> </ul>
<b>Landscape Value :</b>	1





Photo : Typical Rural Residential Landscape



Photo : Eastford Small Holdings

<b>Landscape Character Type:</b>	URBAN LANDSCAPE
<b>Local Character Area :</b>	<b>Mining and Quarrying</b>
<b>Description :</b>	<p>Identifiable large scale mining and quarrying activities. Restricted in the study area to sand and stone quarrying activities. Located on fringes of settlements or within the rural / natural or agricultural landscapes. Very low landscape character value due to the level of qualitative degradation associated with this type of activity. Mining landscapes can usually accommodate a high level of detrimental change.</p> <p>This landscape is characterised by large scale sand extraction activities.</p>
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Visually poor landscape</li> <li>• Associated with polluting activities, ie dust.</li> </ul>
<b>Landscape Capacity :</b>	Medium ability to absorb change.



<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Generally large capacity for landscape improvement</li> <li>• Medium ability to absorb reasonable negative change</li> </ul>
<b>Landscape Value :</b>	0
<b>Landscape Character Type:</b>	AGRICULTURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Pivot Irrigation Crop Production</b>
<b>Description :</b>	Medium scale agricultural landscapes comprising predominantly of identifiable circular irrigated fields mostly in close proximity to surface water resources, such as dams, rivers or 'spruits'.
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Monoculture dominated landscapes</li> <li>• At times scenic diverse areas</li> <li>• Rural landscape character</li> <li>• Defined sense of place</li> <li>• Natural ecological areas (functional)</li> <li>• Certain of the older agricultural landscapes have cultural and heritage significance</li> </ul>
<b>Landscape Capacity :</b>	Medium to high ability to accommodate moderate change, only due to the low possibility of viewer incidences. Certain rural agricultural landscapes will however have a low ability to absorb change.

<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Rural 'sense of place' to be protected</li> <li>• Tranquil country lifestyles</li> <li>• Interspersed with natural environmental features</li> </ul>
<b>Landscape Value :</b>	1
<b>Landscape Character Type:</b>	AGRICULTURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Rural / Farmsteads</b>
<b>Description :</b>	Rural residences without definite signs of large scale commercial farming. Identifiable as smaller units than the larger commercial practices. Usually an intermediate between formal large scale agricultural landscapes and urban fringe landscapes which are easily identifiable by their critical mass and size. At times no distinguishable agricultural practices associated with the residences.
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• At times scenic diverse areas</li> <li>• Rural landscape character</li> <li>• Defined sense of place</li> <li>• Natural ecological areas (functional)</li> <li>• Certain of the older agricultural landscapes have cultural and heritage significance</li> </ul>
<b>Landscape Capacity :</b>	Medium to low ability to accommodate moderate change, only due to the low possibility of viewer incidences.

<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Rural 'sense of place' to be protected</li> <li>• Tranquil country lifestyles</li> <li>• Interspersed with natural environmental features</li> </ul>
<b>Landscape Value :</b>	1

<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Sandy Beaches</b>
<b>Description :</b>	The sensitive azonal area between the water level of the sea and the dune system. Usually unvegetated, but may comprise low hummock dunes and azonal vegetation. A landscape utilised for recreation purposes and appreciated visually for its visual access to the sea.
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Scenic diverse areas</li> <li>• Natural landscape character</li> <li>• Defined sense of place</li> <li>• Natural ecological areas (functional)</li> </ul>
<b>Landscape Capacity :</b>	Low ability to accommodate moderate change, due to the exposed nature of this landscape, and the very high viewer incidence associated with it.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Natural 'sense of place' to be protected</li> <li>• Often associated with extreme tranquillity</li> <li>• Interspersed with natural environmental features</li> </ul>

	<ul style="list-style-type: none"> <li>Associated with conservation areas</li> </ul>
<b>Landscape Value :</b>	1



Photo : Buffels River Mouth



Photo : Sandy Beach at Gericke's Point

<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>High Mountains</b>
<b>Description :</b>	<p>The Outeniqua mountains form a dramatic backdrop to the Garden Route in the north. The National Lakes area / Garden Route is nestled or cradled between the Indian Ocean in the south and the Outeniqua Mountains in the north. The mountains “frame” the viewshed of the Garden Route. A sensitive landscape in the study area. Comprising significant areas with distinctly identifiable topographical diversity. The vegetated slopes of the Outeniquas are similarly important in emphasising the natural sense of place.</p>

<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Topographically scenic diverse areas</li> <li>• Often social amenity structure</li> <li>• Well defined sense of place</li> <li>• Natural ecological areas (functional)</li> <li>• Associated at times with conservation areas</li> </ul>
<b>Landscape Capacity :</b>	<p>Usually with a physically higher ability and capacity to accommodate change, especially in the lowland areas associated with this landscape.</p> <p>However, the sensitivity of the landscape (social, cultural and visual perspective) does not support change well.</p>
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Areas which serve as places of active social amenity – passive and active recreation, require protection,</li> <li>• Scenic and visually sensitive environmental features require protection,</li> <li>• Ecological and amenity functionality – landscape linkages to be protected,</li> <li>• Strong visual sense of place to be protected,</li> <li>• Protected environment status.</li> </ul>
<b>Landscape Value :</b>	2



Photo : Outeniqua Mountains

Photo : Forest Mosaics on High Mountains

<p><b>Landscape Character Type:</b></p>	<p>NATURAL LANDSCAPE</p>
<p><b>Local Character Area :</b></p>	<p><b>Indigenous Forest</b></p>
<p><b>Description :</b></p>	<p>A critically important landscape within the larger South African context. The landscape comprises the vegetation of the Southern Afrotropical Forest vegetation type. It forms an extensive network across the study area, and is a significant contributor to the Garden Route Genus Loci. This landscape is similarly emphasised by the underlying diversity in topography.</p> <p>Southern Afrotropical Forest Mostly confined to the pediment, plains and river valleys extending through the area but absent from the coastal plain. The vegetation is characterized by tall closed canopy forest comprised of typical species such as Yellowwood <i>Afrocarpus falcatus</i>, <i>Podocarpus latifolius</i>, <i>Olea capensis ssp. macrophylla</i>, <i>Nuxia floribunda</i>, <i>Cassine peragua</i>, <i>Elaeodendron croceum</i>, <i>Ekebergia capensis</i>, <i>Cunonia capensis</i>,</p>

	<p><i>Curtisia dentata</i>, <i>Rhus chirindensis</i> and <i>Rapanea melanophloeos</i> among others.</p> <p>The largest areas within the GREMF area include Groeneweide and Bergplaas Forests, both falling within the Garden Route National Park. Smaller remnants occur along the Touw and Duiwe Rivers, but many others, mostly in sheltered valleys on south facing slopes, are on private land.</p>
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Scenic diverse areas</li> <li>• Natural and Rural landscape character</li> <li>• Defined sense of place</li> <li>• Natural ecological areas (functional)</li> </ul>
<b>Landscape Capacity :</b>	A medium to low ability to accommodate change.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Areas which serve as places of active social amenity – passive and active recreation, require protection,</li> <li>• Scenic and visually sensitive environmental features require protection,</li> <li>• Ecological and amenity functionality – landscape linkages to be protected,</li> <li>• Strong visual sense of place to be protected,</li> </ul>
<b>Landscape Value :</b>	2





Photo : Forest Structure



Photo : Gouna Forest

<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Riparian Landscapes</b>
<b>Description :</b>	<p>Aquatic and riparian landscapes occurring throughout the study area, but excluding those associated with residential / urban settlement landscapes. Consisting of:</p> <ul style="list-style-type: none"> <li>• Rivers</li> <li>• Dams</li> <li>• Wetlands</li> <li>• Pans</li> <li>• 'Spruits'</li> </ul> <p>High value landscapes, often with a higher 'sense of place' structure and character. Areas which serve as</p>

	places of active social amenity – passive recreation, needs to be distinguished from landscapes which are purely ecologically functional.
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Often scenic diverse areas</li> <li>• Social amenity structure</li> <li>• Natural ecological areas (functional)</li> </ul>
<b>Landscape Capacity :</b>	Low ability to accommodate development change, due to the exposed nature of the landscape.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Areas which serve as places of active social amenity – passive and active recreation, require protection,</li> <li>• Scenic and visually sensitive environmental features require protection,</li> <li>• Ecological and amenity functionality – landscape linkages to be protected,</li> <li>• Strong visual sense of place to be protected.</li> </ul>
<b>Landscape Value :</b>	2



Photo : Buffels River Mouth

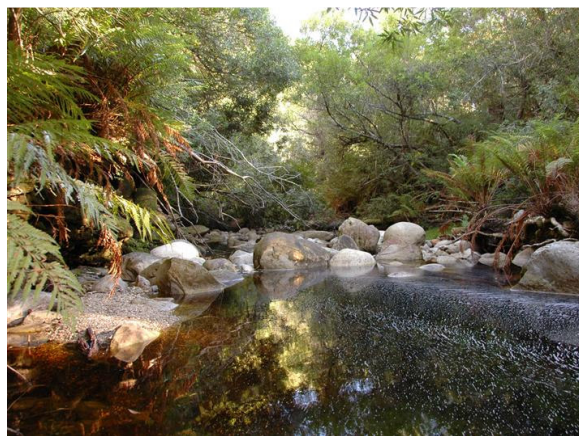


Photo : Forest Streams

<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>High Coastal Dunes</b>
<b>Description :</b>	One of the most significant landscapes in the study area. Unfortunately in certain areas one of the most impacted upon landscapes due to its commanding position and views towards the ocean. The high coastal dunes predominantly have a vegetative covering of fynbos. Development occurring on the dunes are therefore visually exposed. Most development have occurred on the crest of the dunes towards, and facing, the ocean. It is a landscape of high scenic, visual and sense of place character, and very high landscape quality.
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Topographically scenic area</li> <li>• High social amenity structure</li> <li>• Well defined sense of place</li> <li>• Natural ecological area (functional)</li> </ul>
<b>Landscape Capacity :</b>	Low ability to accommodate development change, due to the exposed nature of the landscape.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Provincially and nationally important landscape</li> <li>• Area serves as a landscape of active social amenity – passive and active recreation, requiring protection,</li> <li>• Scenic and visually sensitive environmental feature requiring protection,</li> <li>• Ecological and amenity functionality – landscape</li> </ul>

	<p>linkages to be protected,</p> <ul style="list-style-type: none"> <li>• Strong visual sense of place to be protected</li> </ul>
<b>Landscape Value :</b>	2



Photo : Steep Dune Slump



Photo : Steep Coastal Dunes at Gericke's Point

<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Protected Areas</b>
<b>Description :</b>	<p>Landscapes and identifiable areas which are designated nature reserves and National Parks, including:</p> <ul style="list-style-type: none"> <li>• Provincial nature reserves</li> <li>• Designated conservation areas</li> <li>• Conservancies</li> <li>• Designated landscapes</li> <li>• Designated cultural and heritage sites</li> <li>• Proclaimed National Parks</li> </ul>



	<p>Landscape of high social and ecological importance and qualitative value. Usually proclaimed by National Legislation or Provincial Ordinances.</p> <p>What makes the Garden Route unique is the mosaic of protected areas intertwined in the urban landscape. This provides are different type of access and use to the resources, promoting leisure and recreational use as well as purely conservation and active ecotourism use. What increases the value of this resource is the subjectivity that it not only is a scenically diverse landscape, but that due to the land use and statutory designation of this landscape it will not change. Offering the landscape user the assurance of visual stability and continuity over time.</p>
<p><b>Landscape Value :</b></p>	<ul style="list-style-type: none"> <li>• Statutory designated landscape areas</li> <li>• Usually topographically scenic area</li> <li>• High social amenity structure</li> <li>• Well defined sense of place</li> <li>• Natural ecological area (functional)</li> </ul>
<p><b>Landscape Capacity :</b></p>	<p>Very low capacity and ability to absorb development change due to the perceived sense of place and social requirements.</p>
<p><b>Positive Key Characteristics:</b></p>	<ul style="list-style-type: none"> <li>• Provincially and nationally important landscape</li> <li>• Area serves as a landscape of active social amenity – passive and active recreation, requiring protection,</li> <li>• Scenic and visually sensitive environmental feature requiring protection,</li> <li>• Ecological and amenity functionality – landscape</li> </ul>

	<p>linkages to be protected,</p> <ul style="list-style-type: none"> <li>• Strong visual sense of place to be protected</li> </ul>
<b>Landscape Value :</b>	2



Photo : Ebb and Flow Rest Camp –  
Wilderness National Park

Photo : Gericke's Point

<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Rocky Shores and Promontories</b>
<b>Description :</b>	<p>A limited landscape within the study area, but one of the most prominent which includes the Knysna Heads. Visually very exposed and pronounced. The eastern Heads have been developed and the sense of place has largely been transformed. The western heads have been retained and incorporated into a private nature reserve, retaining its unique sense of place. Gericke's Point is another example of rocky shores and promontories, being protected by SANParks, associated with areas of high scenic and landscape quality. Occurs interspersed in the study area, and never in</p>

	significant densities.
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Topographically scenic diverse areas</li> <li>• Strongly defined sense of place</li> <li>• Natural ecological areas (functional)</li> </ul>
<b>Landscape Capacity :</b>	Very low ability to accommodate any kind of development change due to the exposed nature of this visual resource.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Scenic and visually sensitive environmental features require protection,</li> <li>• Ecological and amenity functionality – landscape linkages to be protected,</li> <li>• Strong visual sense of place to be protected,</li> <li>• Protected environment status</li> </ul>
<b>Landscape Value :</b>	2



Photo : Eastern Heads - Developed



Photo : Knysna Heads



<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Exotic Forestry Plantation</b>
<b>Description :</b>	<p>A lot of subjectivity especially from a visual perspective is associated with exotic plantations and forestry landscapes. For the purist the landscape is considered offensive due purely to the exotic nature of the vegetative cover associated with this landscape. To the general visitor and uninformed the landscape is generally not offensive, and in fact contributes significantly to the Garden Route Genus Loci in establishing a backdrop of 'green' dense foliage associated with this region.</p> <p>A medium visual quality is associated with this landscape. Well defined sense of place.</p>
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Medium landscape visual and scenic quality.</li> <li>• Visually well defined</li> </ul>
<b>Landscape Capacity :</b>	Medium ability to accommodate change.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Generally large capacity for landscape improvement</li> <li>• Medium ability to absorb reasonable negative change</li> </ul>
<b>Landscape Value :</b>	1



Photo : Forestry Impacting on Fynbos



Photo : Forestry Landscape

<b>Landscape Character Type:</b>	NATURAL LANDSCAPE
<b>Local Character Area :</b>	<b>Fynbos Landscapes</b>
<b>Description :</b>	<p>One of the landscape types in the study area which is under the most development pressure due to its association with landscape close to the coast. The general visual quality to the undiscerning visitor is not as high as that experienced by the forest and topographically diverse landscapes. Although the landscape vegetatively is significantly high, visually the value is medium.</p> <p>Supports ecological and plant diversity. Medium value landscapes, with a medium 'sense of place' structure and character.</p>
<b>Landscape Value :</b>	<ul style="list-style-type: none"> <li>• Often associated with scenic diverse areas, such as high mountains and coastal dunes</li> <li>• Natural ecological areas (functional)</li> </ul>

<b>Landscape Capacity :</b>	Low ability to accommodate development change, due to the exposed nature of the landscape.
<b>Positive Key Characteristics:</b>	<ul style="list-style-type: none"> <li>• Scenic and visually sensitive environmental features require protection,</li> <li>• Ecological and amenity functionality – landscape linkages to be protected,</li> <li>• Medium visual sense of place to be protected.</li> </ul>
<b>Landscape Value :</b>	1

Figure 7: Landscape character

## 8. LAND USE

In the KMA, the greatest pressure on land is from urban development, in particular the expansion of housing estates, as well as commercial forest plantations. Human activities have also resulted in the introduction of invasive alien species, which has had serious consequences for natural habitats and water courses<sup>1</sup>. There are a number of national policies and programmes currently being implemented that attempt to address many of the issues related to land, including the Convention to Combat Desertification, United Nations Framework Convention on Climate Change, the South African LandCare Initiative and National Stock Reduction Scheme<sup>1</sup>.

### 8.1. Agriculture

South Africa has very limited areas of high potential arable land, i.e. land with high potential for crop production<sup>1</sup>. It is, therefore, important to identify and demarcate these areas and to ensure that non-agricultural land use is not allowed on these scarce fertile areas<sup>2</sup>. In general, South African soils are prone to erosion due to local climatic and topographical conditions – steep terrain slopes and poor vegetation makes it vulnerable to runoff and erosion<sup>3</sup>. The study area receives on average more rainfall, therefore soil erosion is more pronounced. Increased runoff results in the selective removal of organic matter and clay minerals, which leads to a reduction in the water retention capacity of the soil. (Garland *et al* 1999 in Knysna Municipality, 2005).

Schafer & Robertson , (2003) state the Knysna area has dune sands which are relatively young and have been subjected to weathering and podzolisation. Weakly developed podzols in the Pinegrove, Witfontein, Constantia, Concordia and Lamotte soil forms are found in the area<sup>1</sup>. Fernwoods, which are the most

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<sup>1</sup> Knysna Municipality , 2005

<sup>2</sup> Laker, 2002

<sup>3</sup> Knysna Municipality , 2005

common, are Pale pinkish brown coloured sands<sup>1</sup>. These soils are light textured (medium grained sands) and loose. Due to the fact that the soil is extremely drained it has a low water holding capacity<sup>1</sup>. Topsoil organic carbon contents are relatively low, especially in the Fernwood soils<sup>1</sup>.

The fluviually reworked deposits comprise deep fine to medium loamy sand and sand (Fernwood and Constantia forms) or moderately deep fine sand overlying a firm clay or sandy clay in Vilafontes, Longlands and Kroonstad forms (Schafer & Robertson , 2003). These soils are leached, low in iron and organic matter and have hard setting properties<sup>1</sup>.

Alluvial soils occur adjacent to the lakes, comprising sand and gravel layers found in the Dundee form<sup>1</sup>. The soils immediately adjacent to the lake have high salt levels<sup>1</sup>.

Soils derived from felsphatic quartzite occur on the moderate to steep plateau escarpment slopes. These soils are dominantly duplex, viz. fine sandy loam topsoils abruptly overlying structured clay soils in the Klapmuts, Estcourt and swartland forms<sup>1</sup>. Oakleaf, Glenrosa and Cartref forms occur on steeper slopes<sup>1</sup>.

Soils derived from Granite occur on the upper plateau escarpment slopes as well as on the plateau<sup>1</sup>. The soils are dominantly duplex, with some 30 cm of sandy loam abruptly overlying deep structured clays<sup>1</sup>. On level top slopes these clays are always in excess of 150 cm (auger depth) and deep pitting in the area has revealed that the clays are often as thick as 3 to 5 metres<sup>1</sup>. The thickness of the clay subsoil is less on convex plateau side slopes and spurs, and saprolite is normally reached at between 60 and 100 cm<sup>1</sup>.

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<sup>1</sup> Schafer & Robertson , 2003



Table 8: Breakdown of land use types in KMA, 1999 (National landcover Database (ARC & CSIR 1999))

Land use type	Area	
	(Hectares)	Percent
Forestry/Indigenous Forest	60509	57.1
Un-utilised veld/Indigenous forest	20877	19.7
Planted Pasture	6693	6.3
Natural grazing	5650	5.3
Urban areas	4936	4.7
Small holdings	3412	3.2
Marshlands	1945	1.8
Dams	1898	1.8
<b>Total</b>	<b>105920</b>	<b>100</b>

In Table 8, it is evident that about 6.3% (6 693 hectares) of land in the Knysna Municipality is classified as agriculture (ARC and CSIR 1999 in Knysna Municipality, 2005). Little commercial crop production occurs in Knysna, rather annual and/or perennial planted pastures are scattered across the municipality (ARC and CSIR 1999). There are about ten farming units in the region, producing dairy, citrus fruit, beef and vegetable products (Urban- Econ, 2004 in Knysna Municipality , 2005).

### 8.1.1. Cultivate lands & pastures

The only areas suitable for agriculture are located on the inland plateau between the coastal plains and high mountains. Climate, topography and soil types combine to create area suitable for agriculture in the flat open areas. They are in close proximity to surface waters and thus play a key role in river health. Pasture land, assists in reducing soil erosion by limiting the areas of exposed and bare soil. Cultivated lands can have an adverse effect on natural ecosystems, by polluting rivers and stream with runoff from agricultural fields.

Cultivated lands have the potential to increase soil erosion if proper land use practises are not followed. When soil is left bare after the harvesting season soil erosion often takes place through wind and water erosion. The addition of artificial fertilizer to increase crop yields has an adverse affect on river health and increases eutrophication. The majority of pasture land is used for livestock grazing; however some pasture land is created by pioneer grass species that have grown in previously cleared forestry plantations.



Photo: Typical Pasture Agriculture

Cultivated fields have very little biodiversity value, since they are dominated by monoculture food crops. Cultivated lands are extremely susceptible to erosion and salinisation through the excessive use of chemical fertilizers.

### **8.1.2. Pivot Irrigated lands**

Pivot irrigated lands rely less on natural rainfall, to enable more intensive agricultural practises. Pivot irrigated fields, due to their density have even less biodiversity value than cultivated fields and pastures, since the circular area is dominated by monoculture food crops. A much smaller percentage of Pivot Irrigated Fields are found in the Garden route, this could be due to lack of suitable fertile soils or limited access to irrigation water required. The symmetrical circular design of Pivot Irrigated lands have a greater negative visual impact than pasture and cultivate lands.

## **8.2. Forestry – Plantations**

A large percentage of the Garden route is utilised for forestry Plantations. Monoculture trees are planted in dense patterns to maximize commercial output. The forestry plantations contain almost no species variation, since they are solely composed of alien vegetation, which do not function as an ecosystem. The largest continuous sections of forestry occur north of Wilderness, another between Knysna and Sedgefield along the N2, another east of Knysna and from west to east along the mountainous areas, with another large forestry area, in the north-eastern border of the study area.



Photo: Forestry Plantations on the border of indigenous forests

### 8.3. Urban – Built up areas

The urban areas are confined by topography and access to water and transport infrastructure. The three main urban centres in the Garden Route are Wilderness, Sedgefield and Knysna, the former being smallest, the latter the largest. They are all located along the national N2, running east to west, which provides access to the area. On the plateau in the north, Karatara and Rheenendal are the main population nodes near Knysna.

The main population of Knysna is located in the area north of the town. Hornlee, located east of Knysna town, is another significant suburb comprised of predominantly middle to low income families<sup>1</sup>. The Eastern and Western shores of



the Knysna lagoon are flanked by attractive and well established “suburban” communities<sup>1</sup>.



Photo: Knysna Urban area



Photo: Thesen' Island Development

Future development in the area is limited due to unsuitable steep topography around urban areas. Lakes and estuaries further limit the direction and size of future development and as such the impact current hydrological system is increasing rapidly.

#### **8.4. Residential Golf Course Estates**

The area has three Golf Estates, the largest is east of the Knysna Estuary. Another smaller estate lies just North of Knysna, whilst the smallest estate is located north of Groenvlei. Water resources are under increasing pressure (Eden Municipality District, 2004). Golf estates are dominated by alien vegetation and have high water demands and thus golf estates are unsustainable in the Garden Route area. The most significant new residential developments are the Golf Estates at Simola and Pezula and the Marina on Thesen Island<sup>1</sup>.

<sup>1</sup> Eden Municipality District, 2007





Photo: Pezula Golf Estate



Photo: Simola Golf Estate

### 8.5. Protected Areas – National Parks

Two National Parks exist. Wilderness National Park and Knysna National Lakes Area. The largest is located just west of Knysna proper. The second, is located just east of Wilderness proper, adjacent to the N2. The Natural lakes area also forms part of the protected areas, Groenvlei, Rondevlei, Langvlei and Swartvlei. The lake areas are currently protected under the international RAMSAR convention.



Photo: Wilderness National Park



Photo: Knysna National Lakes Area

The Knysna Protected area is 15 000ha (1985) and under SANParks jurisdiction, this includes the lower portions of the Knysna River basin and the entire Knysna Water body<sup>1</sup>. There are three islands in the lagoon, namely; Leisure Isle, Thesen's Island and Rex Island. The overall habitat accounts for the remarkable diversity

<sup>1</sup> SANParks & ff, 2003

of species. If left unchecked, residential and recreational development and the associated effects and by-products will change the natural and rural character of this estuary<sup>1</sup>.

Due to the fact that the Knysna Estuary has a high biodiversity value and high development potential, it was selected as one of the six priority estuaries of the Cape Action for People and the Environment (C.A.P.E.) Estuaries Programme.

### 8.6. Protected Areas – Provincial Reserves / heritage sites

Goukamma Nature Reserve is located 40km east of George and 20km west of Knysna. It is accessible from the N2 near Buffalo Bay. The 2500ha of protected land incorporates 14km of coastline, and 1.8km of marine protected area, extending seaward. The coastline includes a dunefield, with some of the highest vegetated dunes in the world. It also includes the Goukamma River and estuary, and the unique Groenvlei lake, which has no outlet to the sea<sup>2</sup>.



Photo: Goukamma Nature Reserve

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<sup>1</sup> Knysna Municipality, 2005

<sup>2</sup> CapeNature, 2007



## 8.7. Lakes

The Wilderness Lakes, classified as a RAMSAR site, were formed by the natural damming of water between two dune ridges. These lakes include Island Lake, Langvlei and Rondevlei and are connected to each other by small shallow channels, as well as to the Touw River Estuary. As a result, the lakes have salinities that vary and an estuary mouth that is open for about 30% of the time<sup>1</sup>.

Groenvlei is a freshwater coastal lake that has been separated from the sea<sup>1</sup>. It is an endorheic system that is completely dependent on groundwater<sup>1</sup>. The lake still harbours some relic estuarine species, such as Estuarine roundherring, which contributes to its unique character<sup>1</sup>.



Photo: Groenvlei

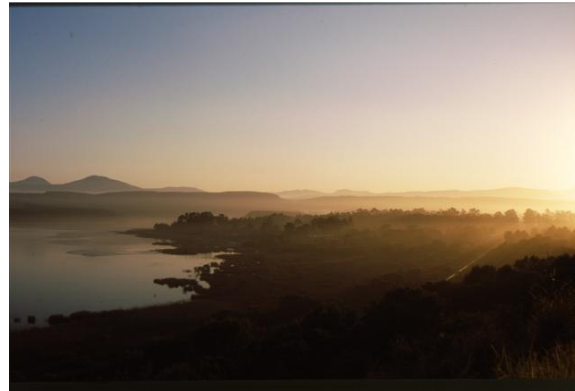


Photo: Swartvlei

Swartvlei is the largest and deepest of the estuarine lakes in the Southern Cape. It consists of a lake and estuary. The estuary mouth that is open about 55% of the time<sup>1</sup>. Inflow from the catchment is far greater than Swartvlei's volume and future water abstraction in the catchment is an important consideration in the management of this lake<sup>1</sup>.

<sup>1</sup> CSIR *et al.*, 2007

### 8.8. Rural Enterprises & Small holdings

Rural enterprises and small holdings are located outside the urban edge and are grouped into scattered, small to medium clusters. Typical examples would include single family homes on small holding properties, small scale tourism/commercial services such as “bed and breakfasts” and small scale “weekend farming exercises”.



Photo: Small scale agriculture



Photo: Eastford Smallholdings

In most cases the small holdings act as secondary service centres for the agricultural areas, located on the inland plateau, which reflects their scattered pattern on the perimeter of dedicated agricultural areas.

### 8.9. Natural Vegetation

Natural vegetation mostly occurs outside urban development and agricultural areas, along the mountains slopes, foothills in the north, east and west, and in small isolated pockets in urban areas. These latter “corridors” are the last remaining ecological habitats near the urban centres and are under severe pressure from development. The northern indigenous forests form part of one the largest continuous protected indigenous forest areas in South Africa, and is placed somewhat distant from urban development, mainly found on the lower slopes on the high mountains in the north. Fynbos and thicket are the main groups of natural vegetation that occur on the high slopes and south of the high mountains, and are more predominant along the coast and coastal dunes.

Gouna State Forest is demarcated by Government Notice 1049 of 1894, and is one of the indigenous forests that been left in its natural state. The management objective is to allow the forest to exist in its naturally dynamic state for fauna and flora with no human interference<sup>1</sup>.



Photo: Indigenous Forest



Photo: Mixed thicket

### 8.10. Quarries and mining

The abundance of sandstone makes the area attractive for quarrying and mining. Quarries are located along the N2, between Wilderness and Sedgefield, north-west and north-east of Knysna. Mines and quarries reduce species diversity by clearing large areas of earth. This removes all associated flora and fauna. In addition the effect of acid mine drainage are well documented, which irreparably alter natural ecosystems.

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<sup>1</sup> Mackay, 1996





Photo: Sand quarry along the N2

### 8.11. Landuse Trends

The dominant land uses in and around Knysna in 2005 was forestry, agriculture and residential (Figure 8)<sup>1</sup>. More than half of the municipal land is covered by forests, with commercial plantations comprising a large proportion of this land use type<sup>1</sup>.

Land use particularly along the coast is changing rapidly as a result of development pressures<sup>1</sup>. A recent audit of municipal land showed that the municipality owns approximately 1 881 portions of vacant land of various sizes, of which about 600 portions are regarded as 'developable' (Knysna Municipality 2004 in Knysna Municipality , 2005).

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<sup>1</sup> Knysna Municipality , 2005



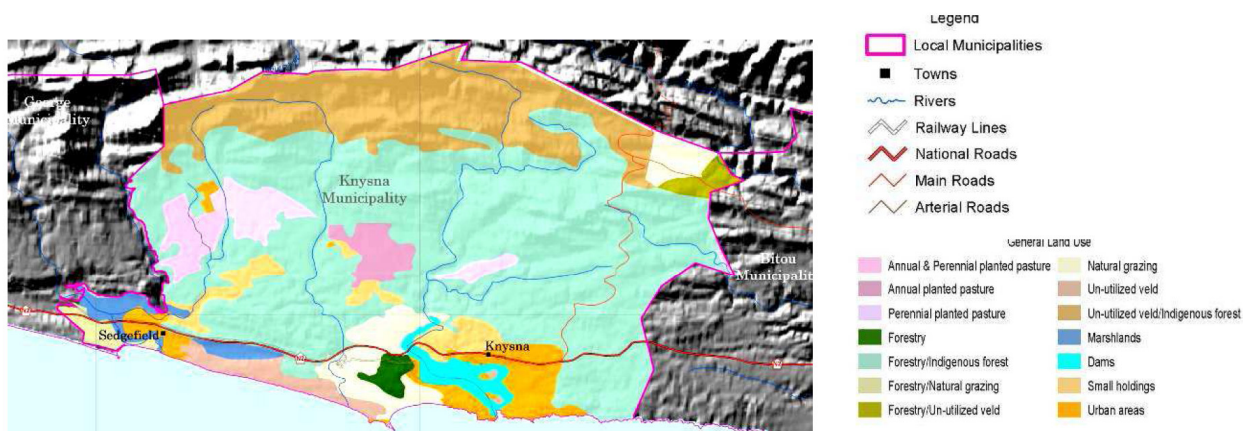


Figure 8: General Land use types in the KMA (Source: Knysna Municipality 2005)

### 8.11.1. Large Scale Developments

Soil and veld degradation is caused and accelerated through human activities (Knysna Municipality , 2005). Large-scale developments by their nature have a large negative impact on soil. The expansion of existing rural, urban and informal settlements may exacerbate the problem of destabilisation of dunes and the clearing of veld and forests (Garland et al 1999 in (Knysna Municipality , 2005). Demonstrating the drive for new developments, the Knysna town planning department is currently considering 74 land use and rezoning applications and receives, on average, six major and 10 minor land use applications (rezoning and sub-division) a month (Cape Times 7 June 2005 in Knysna Municipality , 2005)



Photo: Resort development along Touws River



Photo: Large Scale low cost development

## 8.12. Soil and Veld Degradation Index

Land degradation results in a significant reduction in the productive capacity of land<sup>1</sup>. Land degradation can be measured using soil and veld degradation indices, which indicate the severity and rate of soil and vegetation degradation. These indices were developed as part of South Africa's Nation Action Plan (NAP) in an attempt to resolve the country's land degradation problems<sup>1</sup>. Soil degradation is divided into erosive forms, e.g. wind and water erosion, and non erosive forms, e.g. acidification or salinisation. The five main types of veld degradation according to the Knysna Municipality , (2005) are:

- Loss of veld cover and change in species composition;
- Alien plant invasions;
- Deforestation/ land clearing;
- Bush encroachment.



Photo: Serious erosion and slipping



Photo: Slope stabilisation techniques

<sup>1</sup> Knysna Municipality , 2005



- Figure 8a: Landuse

## 9. BULK SERVICES AND INFRASTRUCTURE

### 9.1. Water Sources and Supply

Water for consumption in the study area is predominantly abstracted from run-of-river schemes, apart from the Garden Route dam in George (situated on the Swart River, a tributary of the Kaaimans River, and technically outside of this study area) and the Glebe Dam in Knysna. Knysna also has an off-stream storage dam at Akkerkloof. The following information has been extracted from Dudenski (2007), unless otherwise stated.

The water consumption in George has dramatically increased at an average annual rate of as high as 7% per year from 1980 to 1999<sup>1</sup>. In terms of water supply, George is not considered to be situated in a water deficient area as defined by the Department of Water Affairs and Forestry (SCDC). The main source of potable water is the Garden Route Dam in the Swart River<sup>1</sup>. In the near future the unpurified water storage capacity of the municipality needs to be extended. This is currently under investigation. The current capacity of the water purification system on the other hand is considered to be adequate<sup>1</sup>.

Capacity problems in terms of water supply are also related to the water distribution network with, for instance, pipes that need to be upgraded and additional reservoirs which need to be built<sup>1</sup>. Thus priority water and sewerage projects were created to upgrade the unpurified water storage capacity of the municipality as well as the main water distribution network, by adding additional reservoirs and the upgrading of sewerage purification plants (Eden Municipality District. 2004).

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<sup>1</sup> Eden Municipality District, 2004

The majority of residents of the KMA have access to municipal services (Figure 9). However, in many cases services reached a lower percentage of the population in 2001 than in 1996.

About 12% of households had no or only very basic sanitation facilities in 2001, which is worse than in 1996.

Almost every fifth household had to fetch water from a distance of 200 metres or more. Water supply to residents seems to have deteriorated between 1996 and 2001. One percent of households did not dispose of their waste in municipal, private or communal dumps in 2001, an improvement compared to 1996 (Statistics South Africa 2001, Figure 9 in Knysna Municipality, 2005)

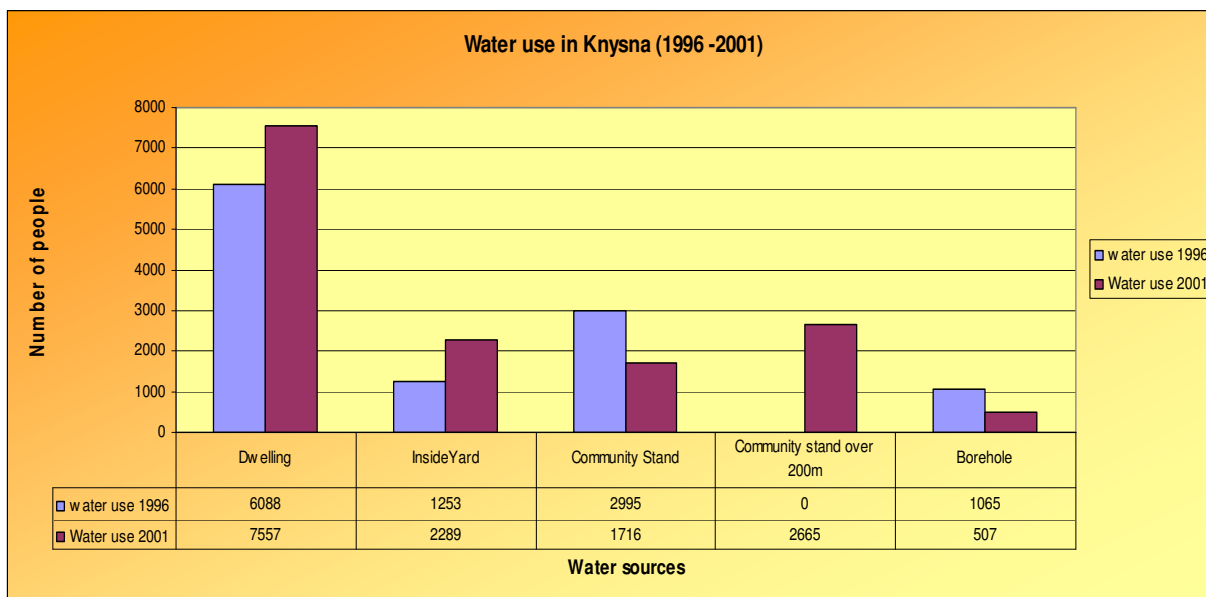


Figure 9: Bar graph indicating where people have access to water (Eden Municipality Districts, 2007).

### 9.1.1. The Kaaimans River

The water consumption in George has dramatically increased at an average annual rate of as high as 7% per year from 1980 to 1999<sup>1</sup>. In terms of water supply, George is not considered to be situated in a water deficient area as defined by the Department of Water Affairs and Forestry (DWAF). The main

source of potable water is the Garden Route Dam in the Swart River<sup>1</sup> which is a tributary of the Kaaimans River. In the near future the unpurified water storage capacity of the municipality needs to be extended. The current capacity of the water purification system in George is considered to be adequate<sup>1</sup>.

Abstractions are also made from the recently refurbished Kaaimans River pump station and pumped to the Garden Route Dam, which in turn supplements abstractions from the Touw River weir in Wilderness. This water is used to service the Wilderness (a suburb of George), which includes Wilderness Heights, Hoekwil, Touwsrante and Kleinkrans. The Kaaimans river weir and pump station has a permitted abstraction capacity of 7.6 Mm<sup>3</sup>/a.

### 9.1.2. The Touw River

According to Dudenski (2007) Wilderness obtains most of its water from a run-of-river abstraction on the Touw River, located to the north of the town. The abstraction in 2004 was 0.425 Mm<sup>3</sup>. The Wilderness WTW has a capacity of 0.77 Mm<sup>3</sup>/a. The water supply to the town is supplemented from the George RWSS, when required. It is estimated that the yield balance for the catchment will be in deficit of about 0.9 Mm<sup>3</sup>/a. With regard to water sources for George, Dudenski states that the water supply situation in this area is critical as the assured yield of the existing water sources is insufficient to meet the present and projected future water requirements and thus need to be augmented urgently.

### 9.1.3. Diep, Hoëkraal, and Karatara Rivers

The combined catchments, which all feed the Swartvlei estuary, currently experience a surplus of approximately 1.3 Mm<sup>3</sup>/a. Growth in the Sedgefield requirement will decrease the surplus to about 1.2 Mm<sup>3</sup>/a in 2025. It was estimated during the Outeniqua Reserve Determination Study that the combined riverine EWR requirements from the Diep, Hoëkraal and Karatara

<sup>1</sup> Eden Municipality District. 2004



Rivers will be sufficient to meet the Swartvlei wetlands Ecological Water Requirements (EWR).

The water supply to Sedgefield is drawn from a run-of-river off-take on the Karatara River, where the permitted abstraction is 1.46 Mm<sup>3</sup>/a. The raw water is pumped to the Ruigtevlei Water Treatment Works (WTW) located close to the off-take point with both the pump station and the WTW having capacities of 0.91 million m<sup>3</sup>/a. Treated water is pumped from the WTW into a 4 000 m<sup>3</sup> command reservoir, via a pumping main with a capacity of 2.30 Mm<sup>3</sup>/a. From there the water is gravitated through a piped reticulation network to the users in the town, whose residents currently also use well points for irrigation of gardens, parks and sports fields.

The assured yield of the water source is insufficient to meet the current water requirements of Sedgefield. Flows in the river could cease for a period of up to two months during droughts with a recurrence period of 1 in 20 years. The WTW has inadequate capacity for the water requirements during peak demand periods and is situated within the floodline of the Karatara River which subjects it to periodic flooding. Knysna municipality has an Environmental Authorisation granting permission for the WTW to be moved from the floodplain and for the capacity to be sufficiently increased to treat all of the licensed abstraction amount.

Water to Karatara residential areas is supplied from a run-of-river scheme with the off-take located on the Karatara River. The raw water is pumped through a 5 km long pipeline to the Karatara WTW which has a capacity of capacity 0.265 million m<sup>3</sup>/a. Treated water is pumped to a 1 000 m<sup>3</sup> reservoir at a command position above the town, from where it is gravitated through a piped reticulation network.

The existing water supply system has no seasonal storage and the assurance of supply is therefore entirely dependent on the availability of low flows in the river. Water demand projections suggest a substantial increase in water demand.

#### **9.1.4. The Homtini / Goukamma River**

The raw water supply to Rheenendal is sourced from a run-of-river temporary diversion weir on the Homtini River, a tributary of the Goukamma River. The temporary diversion weir is constructed from sand bags, from which water is pumped into the WTW at a current rate of 0.095 million m<sup>3</sup>/a. The WTW has a capacity of 0.19 million m<sup>3</sup>/a. Treated water is pumped to a single command storage reservoir, from which it is gravitated to the town through a piped reticulation network.

The water supply system does not have seasonal storage, and the assurance of supply is therefore entirely dependent on the availability of flows in the river during times of drought. The Knysna Municipality plans to develop 330 low cost housing units in the town and the existing source and water supply infrastructure does not have sufficient capacity to accommodate the proposed housing project.

The water source and bulk water infrastructure of Rheenendal is currently adequate. However, the Knysna Municipality plans developing 330 low cost housing units in the town and the existing source and water supply infrastructure do not have sufficient capacity to accommodate the proposed housing project.

The water supply to Buffelsbaai is drawn from a run-of-river off-take located approximately 13 km inland from the mouth of the Goukamma River. The off-take draws water where possible from the water surface of the river in order to improve quality through minimizing the intake of saline water. The raw water is pumped through a 13 km long pipeline to the Buffelsbaai WTW (capacity 0.35



million m<sup>3</sup>/a). Treated water is pumped to a 455 m<sup>3</sup> command reservoir located to the north of the town, and from there it is conveyed to three other reservoirs, before being delivered to the users through piped reticulation networks.

The permanent population of Buffelsbaai is in the order of 30 people, while the influx of holidaymakers during the peak season is estimated at some 3 000. The peak seasonal water demand at Buffelsbaai is in the order of 280 m<sup>3</sup> /d or 3.2 l/s. Problems are periodically experienced with the supply, particularly during dry periods, peak season and during spring high tide when saline water pushes over or around the abstraction weir.

The salinity levels of the raw water increase during river low flow periods. The source is inadequate to meet the water requirements during peak season and additional storage is required.

Groundwater is an obvious target for solving the water supply problems of Buffelsbaai. Boreholes or wellpoint clusters can be developed to the north of the town, and fed directly into the town's water supply reservoir. The absence of urban development in the wellfield target area precludes concerns about contamination, while the small volume of water required will not result in saline intrusion or environmental impact. As the target area is close to the storage reservoir, the economics of developing groundwater is extremely favourable.

#### **9.1.5. The Knysna River**

The Knysna Regional Water Supply Scheme supplies water to the towns of Knysna, Brenton-on-Sea and Belvedere. The raw water sources are the Knysna and the Gouna River Weirs, the Glebe Dam, the Akkerkloof off-channel storage dam, the Bigai Springs and the Belvedere boreholes.

Water from both the Knysna and Gouna rivers (run-of-river weir abstractions) is pumped via separate conveyance systems to the 6 000 m<sup>3</sup> Knysna Balancing Dam located close to the Knysna WTW. Water from the Glebe Dam is pumped into the Akkerkloof Dam and is further conveyed by gravity to the Knysna Balancing Dam. This conveyance system from the Akkerkloof Dam has a dual purpose. During low demand periods, the excess water supplied from the Knysna and Gouna Weirs is pumped back from the Knysna Balancing Dam into the Akkerkloof Dam. During high demand periods any shortfall in the water supply is met by discharging water from the Akkerkloof Dam.

The Water Treatment Works (WTW) is supplied by gravity from the Knysna Balancing Dam. The treated water from the WTW is pumped into various reservoirs from where it is distributed to the users via a piped reticulation network. The Bigai Springs are located in the eastern part of Knysna and water from the springs is pumped directly into the water reticulation system. This source (average yield of about 500 m<sup>3</sup>/day) is used when the peak water requirements exceed the capacity of the WTW. Water from five boreholes located in Belvedere is disinfected using ozone treatment facilities prior to being pumped into two command storage reservoirs, which are part of the reticulation network. The yield of the boreholes (combined yield about 600 m<sup>3</sup>/day) is sufficient supply the town of Belvedere during low water use periods. The water supply is, however, augmented from the Knysna distribution system only during peak periods.

The water supply situation in this area is critical. The assured yield of the existing water sources is insufficient to meet the present and projected future water requirements and the water sources need to be augmented urgently.

## 9.2. Water Schemes

### 9.2.1. Knysna River Scheme

This scheme was constructed in 1985. The permitted abstraction is 3.08 million m<sup>3</sup>/a. Raw water is abstracted from a weir on the Knysna River and pumped by the Charlesford pump station (capacity 2.71 million m<sup>3</sup>/a) through a 5.6 km long pipeline via the Eastford booster pump station into the Knysna Balancing Dam.

### 9.2.2. Gouna River Scheme

This scheme was constructed in 1985. The permitted abstraction is 0.84 million m<sup>3</sup>/a. Raw water is pumped from a weir on the Gouna River, a tributary of the Knysna River, through a 15 km long AC pipeline into the Knysna Balancing Dam.

### 9.2.3. Akkerkloof Off-Channel Storage Dam

The Akkerkloof Dam is an off-channel dam with a storage capacity of 0.80 million m<sup>3</sup>, located to the north-east of Knysna. Water is pumped through a 200 mm diameter pipeline from the Glebe Dam on the Grootkops River (average supply of 1 400 m<sup>3</sup>/day) to the Akkerkloof Dam. From there it is gravitated (pipeline capacity 3 700 m<sup>3</sup>/day) to the Knysna Balancing Dam.

### 9.2.4. Glebe Dam

The Glebe Dam was constructed in the 1960's. It has a 10.8 m high earth fill dam wall on the Grootkops River, and a storage capacity of 0.15 million m<sup>3</sup>. Raw water is pumped from the Glebe Dam to the Akkerkloof Dam.

Table 9: Catchment Yield Balance (from Dudenski, 2007)

Catchment	MAR	Existing scheme names	Availability (million m <sup>3</sup> /a)				Requirements (million m <sup>3</sup> /a)		Balance (million m <sup>3</sup> /a)
			Yield from run-off of river (present day flow used)	Current groundwater abstraction	Impact of EWR on yield (Base scenario)	Total availability	Urban and rural (High growth scenario)	Total requirements	Balance (surplus / Deficit)
<b>K30C below Garden Route Dam</b>	51.9		1.200	0.510	-2.544	-0.834	0	0.000	-0.834
<b>K30D (Touws)</b>	34.50	Touws	0.120	0.080	-0.924	-0.724	1.01	1.010	-1.734
<b>K40A (Diep)</b>	16.70		0.720	0.000	-0.528	0.192	0.017	0.017	0.175
<b>K40B (Hoëkraal)</b>	25.00		1.039	0.000	-0.676	0.363	0.115	0.115	0.248
<b>K40C (Karatara)</b>	27.90	Karatara	0.789	0.000	-1.264	-0.475	0.362	0.362	-0.837
<b>K40D (Swartvlei)</b>	29.00	Sedgefield Karatara Scheme	1.985	0.490	-1.680	2.475	0.73	0.730	1.745
<b>K40E (Goukamma)</b>	59.30	Buffels Bay & Rheenendal	3.156	0.010	-2.976	0.190	0.44	0.440	-0.250
<b>K50A</b>	57.80		3.718	0.000	-5.328	-1.610	0.105	0.105	-1.715
<b>K50B (Knysna)</b>	53.40	Knysna and Gouna Rivers and Glebe	5.460	0.800		6.250	4.411	4.411	1.849

The Garden Route  
Environmental Management Framework



Dam									
<b>K60G (Noetsie)</b>	25.20	3.984	0.590	-1.752	2.822	0.065	0.065	2.757	
<b>TOTAL</b>	380.7	22.171	2.48	-17.672	8.649	7.255	7.255	1.404	

### 9.3. Reservoirs and water towers

In the Wilderness area there are two reservoirs, i.e. Ebb-and-Flow reservoir of 1,28M l and Wilderness reservoir of 0,5Ml. Wilderness Heights has one reservoir of 0.25Ml, Hoekwil has one reservoir of 0,5Ml and Kleinkrantz has a reservoir of 1,0Ml capacity. A new 2 Ml reservoir was recently constructed for the Touwsrante area in 2004<sup>1</sup>.

Water to Wilderness and Kleinkrantz areas is supplied from the existing water network in George. When the WTW at Ebb-and-Flow cannot cope with peak demand, water can be drawn from George to the Akela Reservoir. Water is fed to the Kleinkrantz reservoir from the Ebb-and-Flow reservoir in Wilderness<sup>1</sup>.

### 9.4. Waste Water Treatment Works

#### 9.4.1. Kleinkrans

Waste Water from the Wilderness area is piped to a Waste Water Treatment Works (WWTW) to the east of Kleinkrans. This works currently has a capacity of 0.4 Mm<sup>3</sup>/a, and only serves the village to the west of it while the rest of the study area makes use of onsite sewage disposal methods.

#### 9.4.2. Karatara

Karatara Waste Water treatment works currently has a capacity of 0.08 Mm<sup>3</sup>/a<sup>2</sup>.

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<sup>1</sup> Eden Municipality District, 2004

<sup>2</sup> Dudenski, 2007





Photo: Kleinkrans water treatment plant

### 9.4.3. Sedgefield

Sedgefield Water Treatment Works currently has a capacity of 0.26 Mm<sup>3</sup>/a<sup>1</sup>.

### 9.4.4. Rheenendal

Rheenendal has two Water Treatment Works, with Petro having a current capacity of 0.11 Mm<sup>3</sup>/a, and Beacon a capacity of 0.18 Mm<sup>3</sup>/a<sup>1</sup>.

### 9.4.5. Buffelsbaai

Buffelsbaai Water Treatment Works currently has a capacity of 0.20 Mm<sup>3</sup>/a<sup>1</sup>.

### 9.4.6. Knysna

Knysna Water Treatment Works currently has a capacity of 2.46 Mm<sup>3</sup>/a<sup>1</sup>.

#### 9.4.7. Other

A number of private Waste Water Treatment Works are situated in the study area, at the following locations:

- Collinshoek
- Bergplaas
- Pine Lake Marina
- Bay Water Village
- Belvidere
- Brenton on Sea
- Brenton on Lake

#### 9.5. Future land use and water demand

For Wilderness and Kleinkrantz, residential areas, the expected future and is estimated at 1451 kl/day. The expected growth rate for the Greater Wilderness area is 3% per annum which indicates a time period of  $\pm 30$  years for the total AADD of 5629 kl/day<sup>1</sup>.

The Knysna Water Treatment works was upgraded from 11Ml per day to 22Ml per day<sup>2</sup>. Normal domestic consumers receive the first 6kl of water free and prepaid consumers, in the northern suburbs, receive the first 8kl for free. There are currently no backlogs and new water connections are addressed with the roll out of housing projects (Eden Municipality District, 2007). All informal housing has been served with standpipes within a 200m radius<sup>2</sup>.

Water restrictions were applicable for 2005/2006 due to the limited capacity of the Knysna and Sedgefield water treatment<sup>1</sup>. Additional boreholes were brought on-line to meet Sedgefield's supply. A feasibility study of raw water supply,

<sup>1</sup> Eden Municipality District, 2004

<sup>2</sup> Eden Municipality District, 2007



namely an off channel storage dam on the farm Swartriver, and the upgrading of the Sedgefield water treatment works was done<sup>1</sup>.

Development rights already issued by the Council will be permitted to continue with normal building operations. The project for the expansion of Knysna Water treatment works commenced on April 2006. The demand for water has remained within acceptable limits<sup>2</sup>.

### **9.6. Solid Waste**

No licensed solid waste sites exist in the study. All solid waste is removed by road transport to the George Waste Transfer Station, from where it is railed to the PetroSA waste site near Mossel Bay.

### **9.7. Rail**

The renowned “Outeniqua Tjoo Tjoo” line between George and Knysna is currently not in commission due to recent flood damage, which damaged the railway line. No rail operations are currently possible.

### **9.8. Roads**

The study area is traversed by the N2 national road from George to Port Elizabeth. For many years a number of options for new routes and by-passes have been explored but to date no plans have been finalised. Further, the study area is also traversed by a number of district roads, the most important being the “Seven Passes” road, which provides access to the many rural settlements on the coastal plateau between George and Knysna, including Karatara and Rheenendal.

Figure 10: Water quality

## 10. POTENTIAL POLLUTION SOURCES

### 10.2. Wastewater Treatment

Municipal waste treatment sites exist at Sedgefield, Rheenendal, Buffelsbaai, Knysna, and other privately owned sites exist at Collinshoek, Bergplaas, Pine , Lake Marina, Bay Water Village, Belvidere, Brenton on Sea and Brenton on Lake. These are all potential pollution sources since in high rain events their holding tanks capacity can be exceeded, causing untreated effluent to enter nearby streams and rivers. This leads to eutrophication which leads to fish die-offs and creates an unpleasant odour.



Photo: Water purification plant near Wilderness

#### 10.2.1. Kleinkrans

Waste Water from the Wilderness area is piped to a Waste Water Treatment Works (WWTW) to the east of Kleinkrans. This works currently has a capacity of 0.4

Mm<sup>3</sup>/a, and only serves the village to the west of it while the rest of the study area makes use of onsite sewage disposal methods.

### 10.2.2. Karatara

Karatara Waste Water treatment works currently has a capacity of 0.08 Mm<sup>3</sup>/a<sup>1</sup>. “The existing water treatment works on the Karatara River is at risk during flooding”, which occurred again in the August 2006 storms. As a result of this event, flood relief funds have been secured to relocate the treatment works and planning is proceeding for this project<sup>1</sup>.

Unfortunately, until water supplies for Sedgefield have been secured and assured, the Council is not able to approve water supplies for any new developments in Sedgefield.

### 10.3. Solid Waste

No licensed solid waste sites exist in the study. All solid waste is removed by road transport to the George Waste Transfer Station, from where it is railed to the PetroSA waste site near Mossel Bay. Solid waste has a negative effect on the visual quality of the landscape, as litter accumulates in areas. Solid waste also has the potential to kill fauna due to the chemicals contain in some waste. The primary points sources of solid waste accumulation would be near waste drop off and collection points, where waste could be blown away by wind, or washed away by rain water, allowing it to enter natural systems.

### 10.4. Rail

No rail operations are currently possible in the study area due to damage to rail infrastructure, due to flood and landslides. Operating rail roads do not contribute to air pollution if electric trains are utilised. Rail tracks will, if not

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<sup>1</sup> Dudenski, 2007





maintained, rust and allow iron to leech into soils, which will affect the quality of the surrounding soil.

### **10.5. Roads**

The study area is traversed by the N2 national road from George to Port Elizabeth. Further, the study area is also traversed by a number of district roads, the most important being the "Seven Passes" road, which provides access to the many rural settlements on the coastal plateau between George and Knysna, including Karatara and Rheenendal. Roads contribute to ambient air pollution in the form of noise and gas emissions, which have a negative effect on air quality. This can lead to acid rain, killing vegetation and degrading soil, along with negative health effects.

## 11. SOCIAL & SOCIAL-ECONOMIC DEMOGRAPHICS

### 11.1. Introduction

Knysna Local Municipality (WC048) consists of the former local council areas of Knysna, Sedgefield, Brenton, Belvidere Estate, Noetzie, Buffalo Bay, Rheenendal and the intervening rural areas<sup>1</sup>. The Greater Knysna Municipal Area is made up of socially and racially diverse communities and a rapidly growing, predominantly poor population<sup>1</sup>. It is an area with great quantities environmental resources. These special environmental attributes form the basis of tourism which contributes significantly to the local economy<sup>1</sup>. Knysna town and Sedgefield are the two primary urban settlements where retail and commercial activity are concentrated <sup>1</sup>.

On the plateau above the town lie the significant population nodes of Karatara and Rheenendal. The main population of Knysna is located in the area north of the town generally referred to as the “Northern Areas”. Hornlee, located east of Knysna town, is another significant suburb comprised of predominantly middle to low income families<sup>1</sup>. The Eastern and Western shores of the Knysna lagoon are flanked by attractive and well established “suburban” communities. The most significant new residential developments are the Golf Estates at Simola and Pezula and the Marina on Thesen Island. More than 2,000 housing units will be built in the “Northern Areas” over the next 5 years<sup>1</sup>.

### 11.2. Population

According to the Eden Municipality District (2004), the first population boom occurred in the period 1960 to 1970 due to the exceptionally high growth in the Coloured population. This altered the population structure of George

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<sup>1</sup> Eden Municipality District, 2007



significantly. The Coloured population's share in the total population of George increased from 49% in 1946 to 67% in 1980<sup>1</sup>.

The second population boom occurred from 1980 onwards with the strong influx of Black migrants originating mostly from the Eastern Cape. In the second boom, the population structure of George, once again, underwent structural changes. The Black Population's share increased dramatically from a mere 5% in 1980 to 21% in 1996 and 27% in 2001<sup>1</sup>.

In the period 1991 to 1996 population growth rates still remained high albeit slightly lower than for 1980 to 1991, but accelerated again between 1996 and 2001. The high growth in the Black population has strong implications for the provision of social services and housing<sup>1</sup>.

The average growth in the White population was higher than national growth levels since 1980 and indicates a high degree of migration by this ethnic group into the area. Sharp increases in fixed property prices occurred from 1970 to 1980 (McCarthy, 1984:12 in Eden Municipality District, 2004) and from 1980 to 1991. This phenomenon is still continuing in 2004<sup>1</sup>.

According to *Statistics South Africa 2001*, the KMA has a population of 51 468 and a population density of 0.5 persons per hectare<sup>2</sup>. The population is comprised of 44% Coloured, 32% Black Africans, 24% White and less than 1% Indian residents (Figure 11).

The population has grown by 22% between 1996 and 2001. The number of people between the ages of 35 and 65 has increased most rapidly (*Statistics South Africa 2001* in Knysna Municipality, 2007). In terms of population composition, the African population experienced the largest increase in numbers, up 46.6% between 1996 and 2001, followed by the Indian population

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<sup>1</sup> Eden Municipality District, 2004

<sup>2</sup> Knysna Municipality, 2007



(up 25.9%), the White population (up 15.5%) and the Coloured population by up 12.2%. (*Statistics South Africa 2001 in Knysna Municipality, 2007*). Afrikaans is the dominant language, with 55% of residents speaking it at home. IsiXhosa is spoken by 29% of residents as home language and English by 14%<sup>1</sup>.

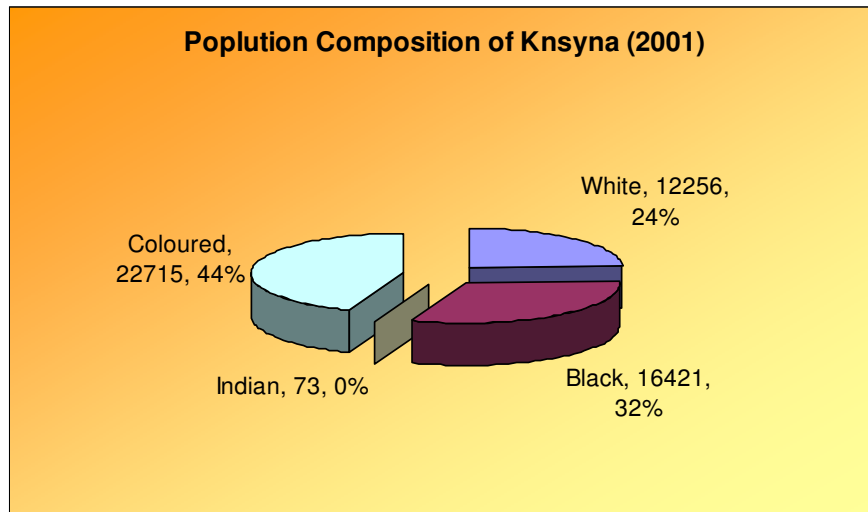


Figure 11: Knysna Municipality population composition (Source *Statistics South Africa 2001 in Knysna Municipality, 2005*)

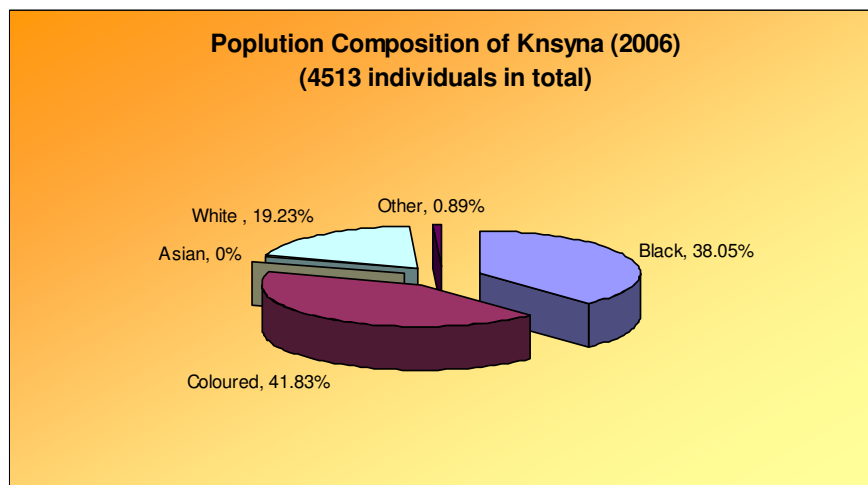


Figure 12: Knysna Municipality population composition in 2007 survey (University of Stellenbosch, 2006)

<sup>1</sup> Knysna Municipality 2007

Figure 12<sup>1</sup> (source University of Stellenbosch, 2006) indicates that the number of coloured people have decreased by three percent (41.38%), while the Black population has increase by six percent (38.05%). The White population group has also decreased and now only constitutes 19 percent of the total population in this representative sample group of 2006.

### 11.2.1. Population growth

According to the Knysna SDF, it is estimated that, if the growth rate remains at 3,7% per annum for the next 5 to 15 years, the population of Knysna will be 106,403 in 2021. If growth per annum is 5,16% it will be 136,420; at 6% 165,005; at 7 % 199,092; and if growth per annum reaches 8% the population could be 239,803 (Knysna Municipality, 2005). The figure below assumes a fixed growth percentage. In all these growth scenarios, service provisions will be put under great strain.

The outstanding characteristics of George over the past 40 years are the continuous change in the demography and a population growth rate of approximately double that of the national average. The population figures grew from 38 676 in 1960 to 135 415 in 2001. The population growth rate of George was 4.6% per annum between 1996 and 2001 According to a projection by Professor Simon Bekker, the population of George will be 239 089 by 2010<sup>2</sup>.

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<sup>1</sup> *Distinctive Choice & Unit for Religion and Development Research. 2006: Socio Economic survey for Knysna Municipality. University Stellenbosch.* The survey was done to yield a representative sample. Questionnaires were assigned proportionally to the different race groups.

<sup>2</sup> Knysna Municipality , 2005



### 11.3. Socio Economic Status

Table 8: Main Sectors of the Knysna Municipality economy by rand value 2000/01

Sector	Value in million Rands	Proportion of Knysna GDP
Trade	410	31.00%
Tourism	(260)	(19.5)%
Financial & Business Services	260	19.50%
Personal Services	140	10.80%
Construction	140	10.60%
Government	140	10.30%
Agriculture, Forestry, Mining	94	7.10%

In 2001, Knysna contributed approximately R1.3 billion, or 1%, to the Western Cape economy and 20% to the Southern Cape economy (MCA Planners, 2003 in Knysna Municipality, 2005). Table 8 indicates that trade and Financial services are the biggest contributors to Knysna's GDP. Knysna has attracted a relatively high number of foreign residents (Knysna Municipality 2004 in Knysna Municipality, 2005). A large income inequality exists in the KMA. Approximately half of the population lived in or near poverty with a household income of R1 600 or less a month in 2001. Figure 8 indicates that only 17.5% of residents earned more than R6 400 a month (Statistics South Africa 2001 in Knysna Municipality, 2005). The economic growth rate for the Knysna Municipality was 5.8% for the period 1996 to 2002. This is above the national average of 2.7% (Urban-Econ 2004 in Knysna Municipality, 2005). Trade and tourism are the best performing sectors of the Knysna Municipality's economy <sup>1</sup>.

The residents of the KMA come from a wide range of backgrounds and income groups and therefore their needs and aspirations vary greatly<sup>1</sup>. The provision of

<sup>1</sup> Knysna Municipality , 2005





basic housing and services to luxury accommodation and entertainment are but some examples<sup>1</sup>.

Tourism growth accounts for many jobs and the good performance of both the retail and construction sectors may be directly attributed to the increase in the popularity of Knysna as a tourist destination, due to the beauty of the natural environment (Eden Municipality District. 2007). The State of the Environment Report states, 2005 that "the tourism industry is the main driver of the trade sector, which is a much larger component of the Knysna economy (31%) than of the Western Cape economy (11%)". The state of the environment report (2005) goes on to note that the local economy's dependence on tourism gives the Knysna economy a seasonal character as seen in Figure 9 (Eden Municipality District. 2007).

Other important sectors are financial services, personal services, construction and government (MCA Planners 2003 in Knysna Municipality , 2005). The Knysna economy is currently undergoing structural changes, partly owing to the scaling back of timber production, so that the importance of the manufacturing and forestry sectors are declining (Knysna Municipality 2004 in Knysna Municipality , 2005). The unemployment rate in the KMA was about 19% in 2001, with 35% of residents not being economically active (*Statistics South Africa 2001* in Knysna Municipality , 2005).

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<sup>1</sup> Knysna Municipality , 2005



**Income Distribution**

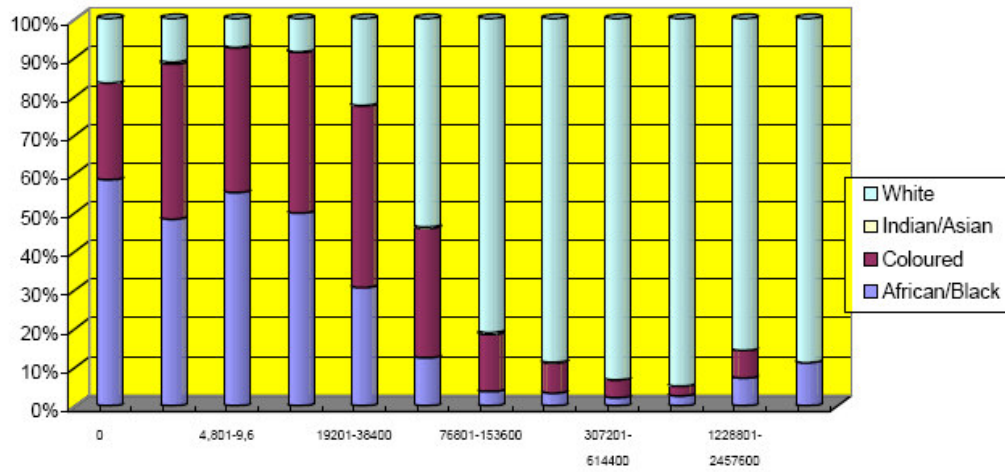


Figure 14: Income distribution for KMA. (Source: Statistics South Africa, 2004)

**Tourism**

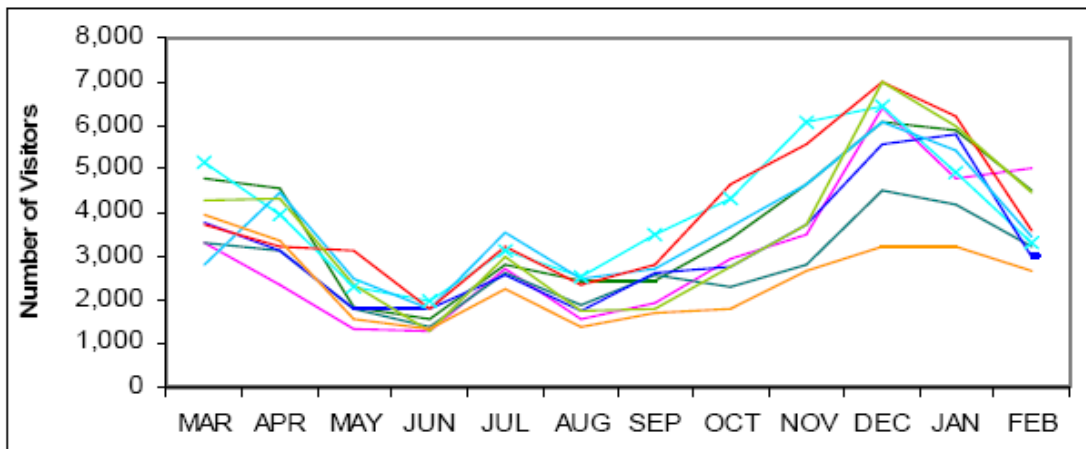
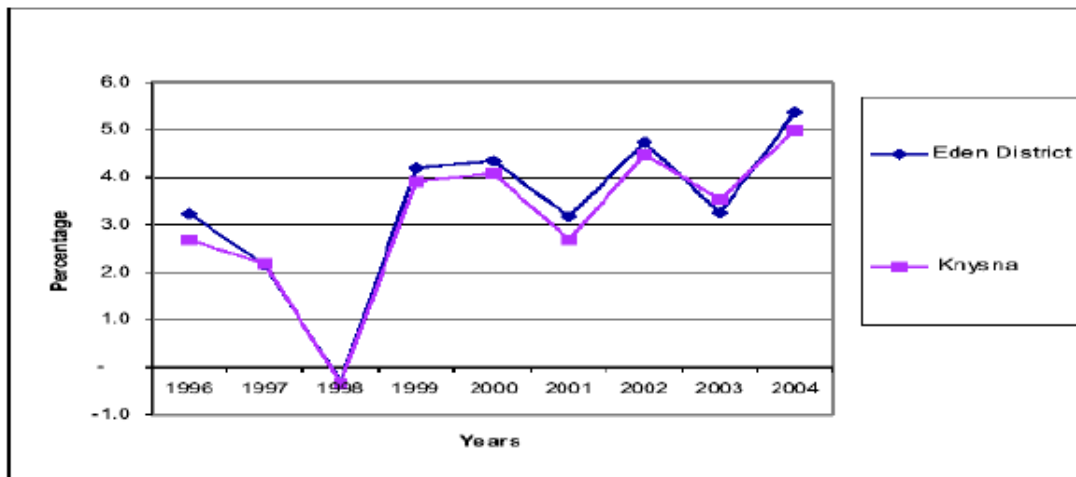


Figure 15: Number of visitors at the tourism office by month for the period 1993-2005 (source: Eden Municipality District, 2007)



Source: Own calculations: Quantec dataset

Figure 16: Knysna Municipality Economic Performance (source: Eden Municipality District, 2007)

Figure 16 depicts the performance of the Knysna economy of compared with that of the Eden District for the period starting 1996 to 2004. The key finding is the consistency in the performance of the economy Knysna Municipal area with that of the Eden District<sup>1</sup>. Gross Domestic Product measures economic development, based mainly on the national accounts, but it is not the best measure of the wellbeing of a nation's people<sup>1</sup>.

<sup>1</sup> Eden Municipality District, 2007



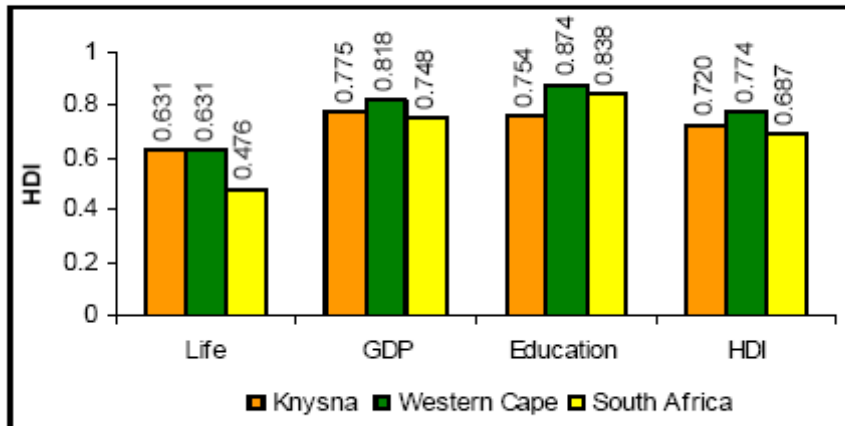


Figure 17: Source: State of the environment report 2005, Human development index 2001 (source PGWC in Eden Municipality District, 2007)

The HDI, however, measures life expectancy, levels of education and standard of living based upon the purchasing power of an individual and is considered a relatively sound measure of human development. A higher index indicates a better quality of life and development. Poverty as an occurrence suggests that it has a consistent relationship with income levels, level of access to services, average life expectancy and level of education. The Knysna area's HDI is lower than that of the Western Cape as a whole but above that of the nation (Figure 17). The Knysna area performs relatively well on life expectancy, but less so on education<sup>1</sup>.

<sup>1</sup> Eden Municipality District, 2007

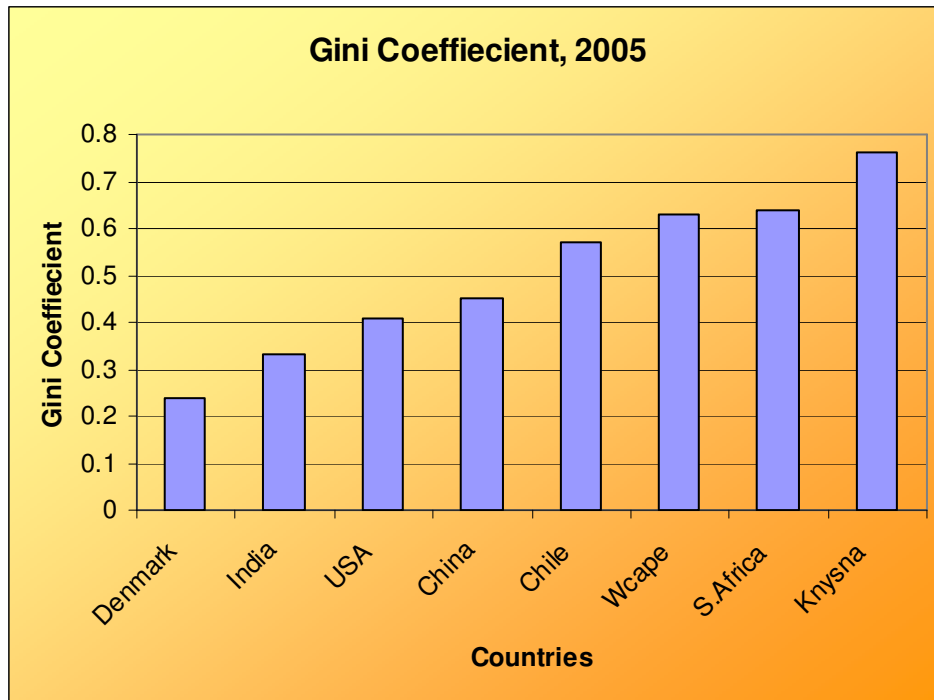


Figure 17: Gini Coefficient (Source State of the Environment report 2005)

“The Gini coefficient is a measure of levels of equality or inequality in a particular area. It is measured at a scale of 0 – 1 where 0 depicts perfect equality, everyone has the same income and 1 depicting a perfect inequality, one person has all the income, everyone else has none. The Figure above compares Gini coefficients for different areas”<sup>1</sup>. According to Figure 17, South Africa has one of the highest income inequalities in the world, and Knysna Municipality is sitting at above the average of South Africa<sup>1</sup>.

<sup>1</sup> Eden Municipality District, 2007



Photo: High income residential areas



Photo: Informal Settlements in the GR area

The fact that Knysna Municipality enjoys above average economic growth and yet has one of the highest Gini coefficients is ironic. From Figure 172, it can be seen that Knysna has had good economic growth; however the Gini coefficient indicates Knysna has severe social economic disparities. This can be explained by high population growth and the comparative little economic growth during the period. This emphasises the need for the Spatial Development Framework (SDF) to manage future growth<sup>1</sup>.

Table 10: Household income data for Greater Knysna Municipal area (Statistics South Africa, 2004)

Income (Rands)	Number of households
No Income	2140
1 - 4800	392
4800 - 9600	1806
9601 -19200	2876
19201 - 38400	2918
38401 - 76800	2149
76801 - 153600	1569
153601 - 307200	740

<sup>1</sup> Eden Municipality District, 2007



307201 - 614400	196
614401 - 1228800	79
1288801 - 2457600	28
2457601 and greater	9

Figures 14 and the 17 above reinforce the assertions regarding unequal distribution of income (Table 10), depicting the trend that this disparity is taking. The group with high incomes is predominantly white, whilst the group with lower incomes is predominantly black and coloured (Figure 14). Since the black and coloured and white communities have historically lived in separate areas<sup>1</sup>.

#### 11.3.1.1. Unemployment

The results of *Statistics South Africa 2001* in Eden Municipality District (2007) indicate that a high proportion of family heads within the white community have come to retire in Knysna (Table 11), where 2,081 heads of household within the white community are retired persons. Unemployment is the highest within the African and Coloured communities with 1,387 and 583 unemployed household heads respectively.

Table 11: Employment Status of the head of the household (Source: Statistics South Africa, 2004)

Category	African				
	/Black	Coloured	Indian/Asian	White	N/A
Employed	2783	2687	18	2175	0
Unemployed	1387	583	0	59	0
Scholar or Student	43	18	0	10	0
Home-maker/housewife	61	363	0	199	0
Pensioner or retired or too old to work	466	749	5	2081	0

<sup>1</sup> Eden Municipality District, 2007

Unable to work due to illness or disability	133	277	0	45	0
Seasonal worker nor working presently	12	19	0	14	0
Chooses not to work	207	243	2	126	0
Could not find work	1	0	0	0	0
Not Applicable	17	16	0	97	68

There are a significantly large number of coloured households which are headed by housewives<sup>1</sup>. Also within the African and Coloured communities is a total of 411 heads of households who are unable to seek a job due to illness. This could be a consequence of the HIV / AIDS epidemic within communities, although this is not supported by empirical evidence from the survey<sup>1</sup>.

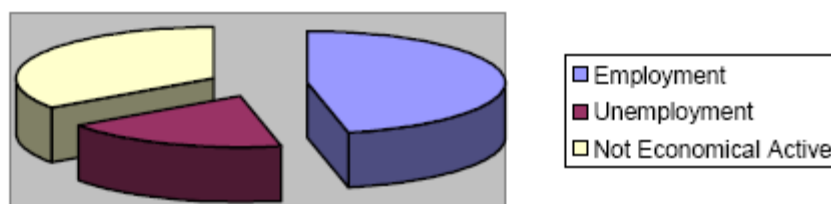


Figure 17: Official Employment Status (Census 2001 in Knysna SoER, 2005 )

The 2001 Census (Statistic South Africa, 2001) indicates that the official employment status within the Knysna Municipality is below the national average<sup>2</sup>. The total employed population as at 2001 Census (Statistic South Africa, 2004) is 16,130 whilst there were 6,450 unemployed (Figure 17). Those that are not economically active are estimated at 11,968. The employment statistics focus solely on the labour force which includes all persons aged 15 to 65 years. A key issue is the fact that the Census Subcommittee to the SA Stats Council on Census 2001 seems to be suggesting an overestimate of the extent of unemployment and an underestimate of those who were employed for only few hours per week<sup>1</sup>.

<sup>1</sup> Eden Municipality District, 2007

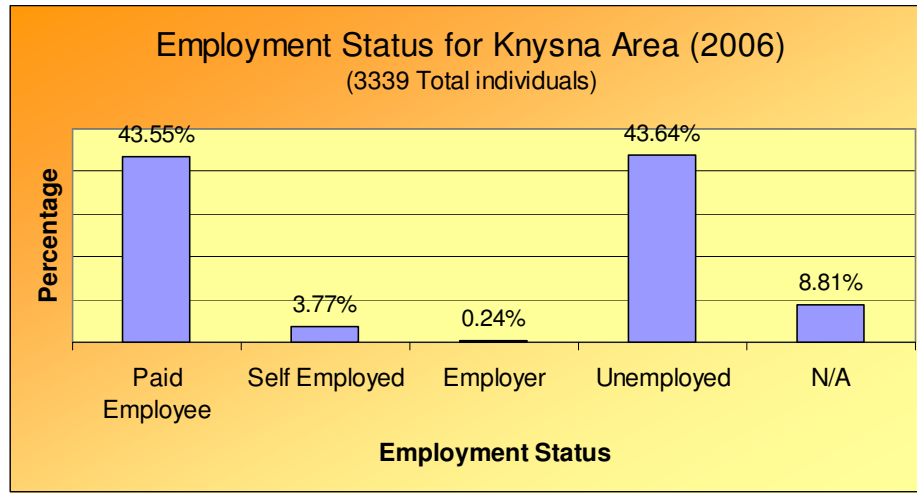


Figure 18: Employment Status in Knysna (2006) <sup>1</sup>.



Photo: Informal trading stalls

Figure 18<sup>1</sup> indicates that the largest wage earners are paid employees (43.55%), while unemployed persons make up 43.64%. The low number of employers

<sup>1</sup> Eden Municipality District, 2007

(0.24%) could explain the high trend in numbers of unemployed persons. This data correlates well with the Census data from 2001 (Statistic South Africa, 2004) in Knysna Municipality, (2005).

### 11.3.2. Infrastructure Housing backlog and shortage

The Knysna Municipality estimated in 2004 that there was a housing shortfall of approximately 6 000 units. Housing projects that have recently started are expected to provide 3 900 houses (Knysna Municipality 2004). The remaining housing backlog would thus be 2 100 houses based on 2004 estimates<sup>2</sup>.

Secondary research was done to determine people’s perception of available infrastructure (Table 11). “The level of infrastructure and access thereto, is another key determinant of the level of poverty in any society. National Government’s programmes emphasise the need to ensure that poverty alleviation programmes underpin all strategies designed to deal with underdevelopment”<sup>2</sup>. Much analysis of regional infrastructure is based on a recent survey that was undertaken by the Eden District Municipality and 61% of individuals had access to flush toilets and related sewage infrastructure<sup>2</sup>.

Table 11: Socio Economic Survey, Eden DM, Type of toilet

Ward	Flush Toilets, sewage system	Flush toilet, Septic tanks	Chemical Toilet	Pit latrine, ventilation	Pit latrine, no ventilation	Bucket	None	N/A
1	41.13%	45.04%	2.48%	2.48%	1.06%	0.35%	5.67%	1.77%
2	49.60%	25.40%	1.21%	1.61%	8.87%	1.21%	10.48%	1.61%
3	76.35%	0.34%	0.00%	2.36%	6.08%	1.69%	11.82%	1.35%

<sup>1</sup> Distinctive Choice & Unit for Religion and Development Research. 2006: Socio Economic survey for Knysna Municipality. University Stellenbosch. The survey was done to yield a representative sample. Questionnaires were assigned proportionally to the different race groups.

<sup>2</sup> Eden Municipality District, 2007



4	38.15%	0.00%	0.00%	10.37%	12.22	2.22%	3.70%	33.33%
5	93.49%	4.98%	0.00%	0.00%	0.00%	0.00%	0.00%	1.53%
6	97.85%	0.00%	0.00%	0.00%	0.00%	0.36%	0.36%	1.43%
7	23.28%	0.00%	0.00%	60.69%	11.07%	1.53%	2.29%	1.12%
8	40.22%	0.36%	0.00%	1.45%	43.12%	10.51%	0.36%	3.99%
<b>Total</b>	<b>61.28%</b>	<b>8.22%</b>	<b>0.51%</b>	<b>8.59%</b>	<b>9.46%</b>	<b>2.11%</b>	<b>5.02%</b>	<b>4.80%</b>

### 11.3.3. Housing and development

Knysna Municipality currently has two projects being funded by the Department of Housing. These projects are expected to deliver almost 4,000 homes in the next five years<sup>1</sup>. Knysna faces the challenge of identifying and acquiring suitable land for development, particularly for housing. It is estimated that there is a backlog of over 6,000 housing units in the Greater Knysna Area. The environment within which development can occur is determined by the Spatial Development Framework<sup>1</sup>.

<sup>1</sup> Eden Municipality District, 2007





Photo: Low-cost housing developments

In keeping with the Provincial Spatial Development Framework the Urban Edge has been drawn close to the existing urban fabric. The only areas where provision is made for urban growth are:<sup>1</sup>

- The Eastford area up to the edge of the currently approved Simola development. This is the only area in the Knysna Basin where private sector, Greenfield residential development will be permitted. There are approximately 500 ha in this area and could accommodate some 1,500 dwelling units at currently accepted density levels.
- In the Kruisfontein area north of the N2 there is capacity for expansion to accommodate affordable housing and industry, whilst a cemetery is planned for south of the N2 in the same area<sup>1</sup>.

<sup>1</sup> Eden Municipality District, 2007





The Knysna Urban Edge includes “Bosdorp” and “Welsynsdorp” and the land east of “Welsynsdorp” and south of “Bosdorp” where the Eden University is being developed in a way that knits the two communities together. An agreement with the Provincial Administration stipulates that subsidies will be made available for the transfer of houses to the tenants and any additional land may be developed by the Municipality. The area provides an opportunity for affordable, bonded housing<sup>1</sup>. Refer to “Section 13 – Planning and Policy imperatives”, for more information on the SDF and Urban Edge

#### **11.3.4. Education**

“Skills enhancement is a major challenge facing the regional economy. As the government gears for accelerated growth through instruments like the ASGISA, local strategies must be developed”<sup>1</sup>. A 6% economic growth target in South Africa requires a determined strategy. Obstacles to that objective are clearly tabulated and they include (i) skills scarcity and (ii) the state’s capacity limitation. Human capital is amongst such capacity issues<sup>1</sup>. “Skills development is identified as one of the principal strategies to achieve the government’s targets as set out on the ASGISA programme”. Formal education is also critical in this context. The 2005 State of the Environment Report reveals that the Western Cape has a relatively high standard of education. Access to education and access to education infrastructure are the key contributors to this state of affairs<sup>1</sup>.

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<sup>1</sup> Eden Municipality District, 2007



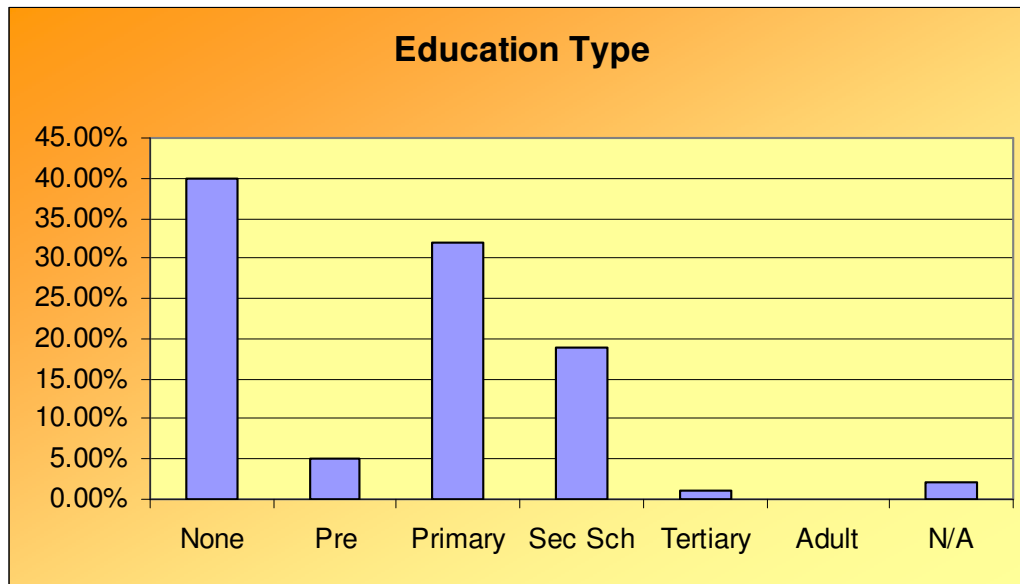


Figure 19: Percentage population (non adults) attending Educational Institution  
(Source Statistics South Africa 2001 in Eden Municipality District. 2007)

As per the survey that was undertaken with the assistance of the Eden District Municipality, the number of young people between the ages of 5 years and 25 years who are not active in the education environment, whilst not certain, has increased to 41percent in Figure 19<sup>1</sup>. This is further worsened by the significant drop in the number of such individuals that are at secondary school and higher educational institutions.

The leading reasons from the survey results are economical: 21,19% left school for work, 20.57% left school and are looking for work and 14.60% have no money to fund attendance at school<sup>1</sup>.

This accounts for approximately 56% of the people who left school. Social problems ranging from pregnancy, marriage, failed exams, family commitments and poor health account for approximately 10%. Another interesting trend that has been measured during the survey has been the level of education<sup>1</sup>. Figure

<sup>1</sup> Eden Municipality District, 2007

20 indicates that the majority of adults in the study area have attended Grade 12.

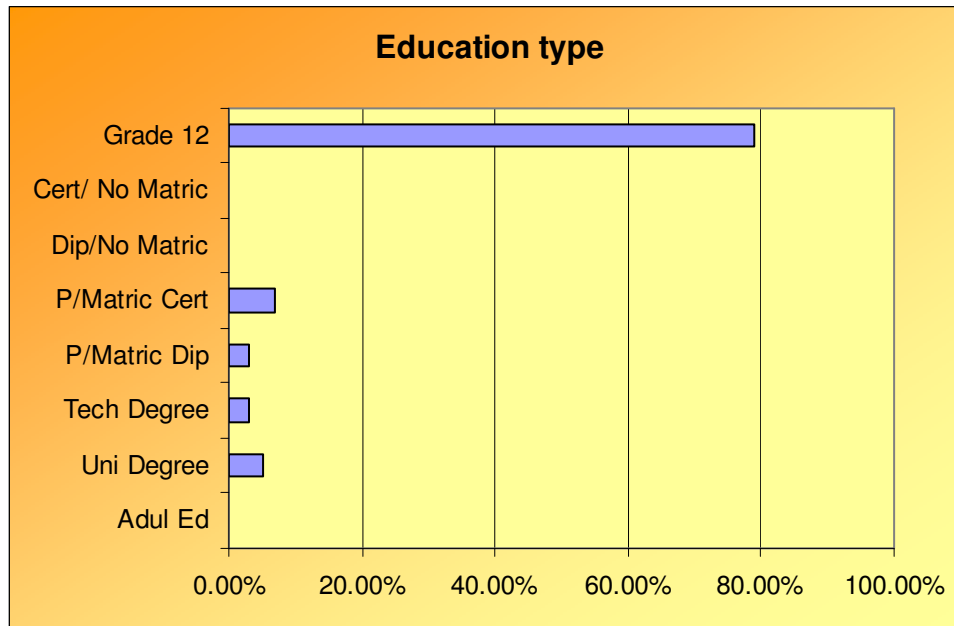


Figure 20: Percentage of Adults with education (Statistics South Africa 2001 in Eden Municipality District, 2007)

## 12. PLANNING AND POLICY IMPERATIVES

### 12.2. Introduction

The Provincial SDF suggests plans of action to deal with pertinent issues that were identified. This section outlines the pertinent issues as identified by the Provincial SDF and the suggested actions plans to implement the objectives and strategies. Broader classification of issues were firstly identified, such as Socio-economic Development, Urban Restructuring and Environmental Sustainability (CNDV & WCDEA&DP, 2005). The Knysna SDF looks at each of the Provincial SDF issues and objectives at “micro” level, and attempts to implement and address each issue in a practical way to promote sustainability.

### 12.3. Western Cape Provincial Spatial Development Framework Issues

The main focus of the Provincial SDF is to address the built environment and socio-economic trends, quoted issues from the WCSDf which have reached critical levels and have been marked for action include<sup>1</sup>:

- Water shortages, including the current water rationing in the City of Cape Town, low dam levels in the Winelands and Overberg, and concern about falling underground water levels in the Sandveld;
- Global warming and climate change considered partially responsible for the ongoing drought in the Swartland (dry land wheat farming) and floods in the Southern Cape;
- Continuing problems resulting from demands for services and housing as a result of ongoing migration along with funding and capacity constraints;
- Worsening air (particularly in the City of Cape Town) and water pollution

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<sup>1</sup> CNDV & WCDEA&DP, 2005



in many parts of the Province;

- Increasing urban and regional road traffic demand coupled with a decline in railway services and a lack of success in shifting the modal split to 80% public and 20% private transport;
- Diminishing biodiversity contributing to water scarcity, soil destruction and global warming through decreases in bio-mass and the ability to absorb green house gases, particularly carbon dioxide;
- The slow progress in meaningfully altering the socio-economic and physical patterns of the Province's urban settlements thereby continuing the patterns of apartheid development;
- The inability of urban settlements to provide opportunities for small and medium enterprises to flourish. This is especially critical because for many current and future employment seekers, lacking formal skills and training, the small and informal business sector is their only prospect of a legal livelihood
- The general quality of education, high school drop-out rates, health issues, especially HIV / AIDS and TB prevalence, unemployment levels, housing backlogs and,
- The threat of loss of the socio-economic base of the Province. There is broad agreement that bold, simple and far reaching policies are required to address these issues. These policies should be implemented as soon as possible.

“The Western Cape Province Spatial Development Framework (WCPSDF) will, in general, make broad policy statements, except on matters of provincial or regional interest which may be addressed in more detail. It will be expected that the district and local municipal SDFs be revised to give effect to the broad WCPSDF proposals in addition to addressing issues of local importance. Departmental budgets and their spatial impacts need to inform and be informed

by the WCPSDF with respect to their investment spending and institutional structuring<sup>1</sup>”

### 12.3.1. Western Cape SDF Objectives and Implantation Strategies

Objectives outline the broader goals as well as identifying methods of rectifying identified issues by the use of strategies. The following objectives and strategies are quoted from the WCSDF, (CNDV & WCDEA&DP, 2005).

**Objective 1:** Align the future Settlement Pattern of the Province with economic potential and the location of environmental resources

#### Strategies

- “Identify existing settlements with sufficient natural and built resources and economic potential to accommodate long term sustainable population growth; and,
- Determine the best share of transport modes (rail and road) for the long term future freight and passenger needs of the Province”<sup>1</sup>.

**Objective 2:** Deliver human development and basic needs programs wherever they may be required<sup>1</sup>

#### Strategies

- “Using the provincial Human Capital and Social Capital development strategies and the municipalities' Integrated Development Plans (IDPs), identify settlements throughout the Province which are in need of human development programs;

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<sup>1</sup> CNDV & WCDEA&DP, 2005



- Deliver these programs from existing facilities where possible which should be renovated and shared by the various delivery institutions and organisations where necessary; and,
- It may be necessary and appropriate to deliver certain programs on a periodic basis using the periodic market system in remote rural areas"<sup>1</sup>.

**Objective 3: Strategically invest scarce public sector resources where they will generate the highest socio-economic returns**

**Strategies**

- "Identify settlements using the NSDP and Growth Potential study guidelines to prioritise where fixed investment should be directed; and,
- Align the initiatives from various provincial, local and national government departments, state owned enterprises, public entities and the private sector to ensure maximum socio-economic return on investment"<sup>1</sup>

**Objective 4: Support land reform<sup>1</sup>**

**Strategies**

- "Identify land suitable for achieving the national land reform goal of transferring 30% of land to black ownership
- by 2015;
- Value land at market rates based on commercial rather than speculative returns;
- The Department of Land Affairs and the Land Reform Commission are reviewing policy on land reform. While the broad goals of the WCPSDF and the Department of Agriculture with regards to protection of agricultural land are fully support there is a need for flexibility with respect to minimum farm sizes and support of family and co-operative farming; and
- Establish guidelines appropriate to the needs of land reform projects that do not undermine broad Provincial Spatial Development Framework Policy"<sup>1</sup>,

<sup>1</sup> CNDV & WCDEA&DP, 2005



**Objective 5: Conserve and strengthen the sense of place of important natural, cultural and productive landscapes, artefacts and buildings<sup>1</sup>**

Heritage resources are important socio-economic assets as they are a reference point for communities in terms of their past and they reflect the Western Cape's diversity, providing a mosaic of varied experiences in both memory and economic opportunity for the future. Tree planting, landscaping and gardens make important contributions to urban landscapes and open space systems<sup>1</sup>.

**Strategies**

- Identify and map key heritage resources;
- Ensure their protection in the face of increasing urbanisation of both urban settlements and rural areas;
- Encourage regional and Western Cape building styles, urban design and land use patterns;
- Strongly discourage the copycatting of foreign building styles and unsympathetic form and massing;
- Improve the appearance, pedestrian accessibility and performance of main streets and civic spaces in the urban settlement; and,
- Promote tree planting and greening in urban settlements.
- All changes proposed to landscapes and urban settlements whether they be for agricultural or urban and rural development purposes shall consider any heritage resource policy that may be relevant including those which might be proposed, e.g. Proclaimed Urban Conservation Areas, SAHRA Regulations, Cape Winelands World Heritage Site application.
- The describing of heritage resources in order to give due consideration as to how they should be conserved, provide the basis for economic opportunity or otherwise be incorporated into development plans, shall include a mapping exercise that should incorporate the whole Province.
- The culture and history of indigenous people that were suppressed by the colonial and apartheid regimes as well as important buildings,

<sup>1</sup> CNDV & WCDEA&DP, 2005



- Artefacts and places in the struggle for freedom shall be identified, exposed and commemorated.
- Foreign or unsympathetic styles of site layout and buildings shall be discouraged in urban settlements and rural areas so as to strengthen the local sense of place
- And minimise visual impact.
- Urban design and architectural guidelines should be prepared to control the function and appearance of the main street or streets and squares in all of the urban settlements of the Province. These should control, among other things, building styles and heights, materials and colours, advertising, roadways and sidewalk pavements, encourage colonnades and other devices to shelter
- Pedestrians and landscaping and tree planting, and respect historic buildings and precincts<sup>1</sup>

#### **EXPLANATION**

“These route sections and the adjacent countryside are memorable gateways to the City of Cape Town and the Garden Route respectively and urban development has already substantially detracted from their visual quality. No further deterioration should be permitted”<sup>1</sup>.

#### **Protection Controls**

“All future buildings, roads and infrastructure including powerlines should be sited and designed according to relevant guidelines and should undergo Heritage, Environmental and Visual Impact Analyses before they are approved / rejected<sup>1</sup>.

#### **Objective 6: End the Apartheid structure of urban settlements**

“Urban settlements shall be restructured so as to break down the spatial barriers created by apartheid and make them more convenient and pleasant to live in

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<sup>1</sup> CNDV & WCDEA&DP, 2005



while crating economic opportunities close (within walking distance) to where people live<sup>1</sup>”

- “Prohibit further outward expansion of urban settlements that entrenches the current spatial apartheid pattern and results in urban sprawl;
- Ensure public funds are not spent in perpetuating segregated and sustainable settlement patterns;
- Use socio-economic gradients based on walking distance to create a far higher level of integration than currently exists while remaining sensitive to community social norms and levels of living; and,
- Use publicly owned land and properties to spatially integrate urban areas and to give access for second economy operators into first economy spaces”.<sup>1</sup>

### **Objective 7: Conveniently locate urban activities and promote public and non-motorised transport**

#### **Strategies<sup>1</sup>**

- “Use walking distance as the primary measure of accessibility;
- Increased density in urban settlements, especially along main transport routes, modal interchanges and other foci of opportunity;
- Identify areas of highest accessibility that can be designed to maximise safe social and economic activity, especially for participants in the 2nd economy;
- Restructure road networks to promote economic activity in appropriate locations; and,
- Cluster community facilities together with commercial, transport, informal sector and other activities so as to maximise their convenience, safety and social and economic potential<sup>1</sup>.

<sup>1</sup> CNDV & WCDEA&DP, 2005



### **Objective 8: Protect biodiversity and agricultural resources<sup>1</sup>**

- “In order to withstand climate change, great biodiversity is required, to sustain life in the province. Agricultural potential must be maintained to ensure the long term viability of food production. Processes must be implemented to ensure that anthropogenic activities do not negatively impact on the state of these fertile areas.
- Strategies to reduce impacts
- Prevent the inappropriate conversion of bio-diverse rich rural areas, existing agricultural activity and soil with agricultural potential and important cultural and scenic landscapes to other uses;
- Provide the highest protection to rivers and remaining areas of critically endangered biodiversity;
- Where it is proved appropriate to convert endangered areas of biodiversity, use an offset mechanism to make good these losses; and,
- Cease Urban Development outside of Urban Edges<sup>1</sup>”.

### **Core areas**

Core areas represent a national and/or provincial/regional resource in which the natural environment is able to provide a range of ecosystem services essential for sustainable life on earth and as such they should be retained their natural state. Core areas also include critically endangered ecosystem remains<sup>1</sup>.

- “Therefore only non-consumptive activities are permitted, for example, passive, non intrusive recreation and tourism, research and environmental education;
- Core areas should fall under public ownership. or stewardship regulations;
- Only non-impact directly related activities such as research, outdoor recreation and environmental education shall occur within Core Areas.

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<sup>1</sup> CNDV & WCDEA&DP, 2005



- No further development in Core areas shall be permitted except that scale delineation of Spatial Planning Categories in national parks, provincial nature reserves and private nature reserves / stewardship areas shall identify areas where buildings, including accommodation and residences, should be located.
- No further extensions of Intensive Agriculture should be permitted.
- Rivers are in a particularly poor state with 90% of river main stems being critically endangered with respect to water quality and quantity;
- To maintain a minimal level of biodiversity functioning – seed transport, animal movement - a network of interconnected ecological corridors throughout the Province must be instituted.
- Although the intention is that full biodiversity functioning should be restored, including game farming, there is evidence to suggest that in some instances carefully managed grazing can have a more beneficial effect on veld management and biodiversity than poorly controlled game farming<sup>1</sup>.

### Protection Controls<sup>1</sup>

Buffer Areas should serve as an interface between Intensive Agriculture and Urban Development areas but in some instances these land-use categories may directly abut Core Areas, (as happens in the City of Cape Town between Urban Development and the Table Mountain National Park (Core 1)) (G)<sup>1</sup>

- Stock farming shall incorporate veld management grazing and resting methods that improve the quality of the veld and thereby biodiversity;
- In the case of endangered areas of biodiversity further loss of habitat shall not be permitted unless there are significant biodiversity off-sets;
- Activities that have a minimal ecological footprint can be permitted in the Buffer Area. Such activities have buildings that have minimal footprints and are built from local recyclable materials;
- Buildings primarily associated with managing biodiversity or agriculture will be permitted, including for tourism purposes<sup>1</sup>.

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<sup>1</sup> CNDV & WCDEA&DP, 2005





### **1. Intensive agriculture and agro-forestry areas:<sup>1</sup>**

“Ploughed land has little biodiversity potential but is required to ensure food security and as a comparative advantage resource for export and cash crops as an essential part of the regional economy;

- Permanently cultivated intensive agricultural land can contribute to the unique character of the Province;
- Although considerably destructive to biodiversity this land use plays an essential role in the production of food and fibre necessary for sustaining human life and contributing to the cash economy and export market of the Province
- Strict protection of Intensive Agriculture is required near the urban edge. It is in this location where agricultural produce generally has the lowest production costs, especially with respect to transport. This is an effective method of limiting food prices. Agricultural land that has been damaged by sandmining or other activities shall be rehabilitated by importing topsoil and other techniques<sup>1</sup>”

#### **Protection Controls**

- All existing Intensive Agriculture that has been ploughed and permanently cultivated lands on low, high and medium potential soils shall be protected from urban development<sup>1</sup>.

### **2. The Urban Edges**

In order to effectively redirect the continuing urban development phenomena of urban sprawl, urban growth needs to be halted so as to focus urban development opportunities inwards<sup>1</sup>.

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<sup>1</sup> CNDV & WCDEA&DP, 2005



The Medium Term Urban Edge should be delineated so as to: <sup>1</sup>

1. Exclude land of agricultural, biodiversity and heritage significance;
2. Encompass an area of a size in where the settlement is likely to increase to 25 within the next 5 to 10 years.
3. Include the transport routes and some adjacent developable land between the classical racial components of apartheid towns, so as to encourage physical integration via development along the transport corridors between them. A strongly held Urban Edge is the most effective urban management tool to initiate settlement restructuring.

Targets can be revised when the average gross residential densities approach 25 densities<sup>1</sup>.

### **2.1 Development outside the urban edge<sup>1</sup>**

- A minimal impact approach with respect to visual impact and foundation disturbance, demand for services and traffic generation will be used.
- New settlements can only be permitted if they are agrivillages or resorts. The latter by definition excludes freehold, sectional-title or share-block tenure because of the tendency to require larger units and more infrastructure which have a higher impact, when people own and use property in their individual capacity;
- The ongoing employment opportunities and holiday and recreation benefits associated with resorts are considerably greater in resorts than with primary or secondary residences<sup>1</sup>.

### **2.2 Urban development<sup>1</sup>**

All land identified for Urban Development purposes within a demarcated Urban Edge includes a wide variety of activities. This policy implies that golf and eco-estates with densities greater than 1du/ha should be located within urban areas as demarcated by Urban Edges<sup>1</sup>.

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<sup>1</sup> CNDV & WCDEA&DP, 2005



### Protection Controls<sup>1</sup>

- All urban development utilising conventional urban services and generally exceeding gross densities of 1 dwelling unit per hectare should be regarded as urban and thus appropriately located within an urban area as demarcated by the Urban Edge; and,
- SDFs will not be approved if the area set aside for urban development within Urban Edges cannot demonstrate how this policy can be achieved<sup>1</sup>.

### 2.3 Peri-urban settlements

The reality of existing historic and resort estates such as golf and holiday resorts cannot be ignored. However, the growth of these settlements is to be discouraged and it must be these settlements cannot expect delivery from state funds beyond minimum basic services and human capital development programs<sup>1</sup>.

### 3. Coastal and river bank zones

All coastal eco-systems and riparian zones play an important socio-economic role in communities, recreational activities and tourism. There is insufficient protection to ensure the general public retains access to the coast and there is a danger that access could become privatised along the remaining section; <sup>1</sup> Developments that are located in a linear section along the coast or river result in diminished access to these sensitive areas, in addition they contribute to visual blight<sup>1</sup>.

### Development conditions<sup>1</sup>

- Coastal and river bank residential development shall be limited to the Urban Edges of existing coastal towns;

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<sup>1</sup> CNDV & WCDEA&DP, 2005



- Coastal resort development outside the Urban Edge shall be nodal, and restricted to less sensitive coastal and river habitats (sensitive habitats include frontal dunes systems, estuaries, mud flats, and wetlands);
- Nodal frontage shall be limited to a maximum of 25% of the property boundary abutting the coast or other banks. Parameters for the numbers of units permitted in such projects should be guided by policy RC6;
- Coastal and river bank resort development shall not limit public access to beaches and river banks; and, □ Resorts on coastal and river cliffs shall be set back far enough from the cliff edge that they are not visible from coastal paths and beaches below<sup>1</sup>.

#### **4.Sea level Rise <sup>1</sup>**

- Studies indicated the Province is vulnerable to sea level rise and flooding. Greater Cape Town and Mossel Bay to Natures Valley although many other parts of the coast are also susceptible (Hughes: 1992) (Hughes P and Brundit GB, An index to assess South Africa's vulnerability to sea level rise. SA Journal of Science, Vol. 88, p308-311). Research show that although the Province is likely to become drier it will also be subject to more violent weather events. It is essential that the Western Cape's coastal defences in the form of primary dune systems, estuarine mudflats, sand dunes and other systems are not further destroyed by urban development or agricultural practices.
- Certain of the Province's rivers have flooded violently in recent years, particularly in the Southern Cape, for example, the Goukamma and in the Winelands, for example the Breede River<sup>1</sup>.

### **12.3.1. Provincial Approach to the Control of Development**

"The Department's approach to controlling development on mountains, hills and ridges is focussed on key investigation as to decide which areas can development be considered or where should it be avoided. Where

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<sup>1</sup> CNDV & WCDEA&DP, 2005



development can be considered, what type and form of development can be considered in the respective topographical areas<sup>1</sup>".

"The determination of appropriate development on mountains, hills and ridges will be guided by the demarcated urban edge (where this has been determined in the IDP); or the identification of a development line (where no urban edge has been determined), in combination with the environmental sensitivity (based on biophysical, cultural and social characteristics) of the mountain, hill or ridge"<sup>1</sup>.

## 12.4. Knysna SDF Concepts & Issues

During the Knysna SDF and IDP process numerous pertinent issues were identified, as well as the strategies that should be implemented to rectify these issues. The list below outlines the overarching goals of the Knysna SDF and issues that have been identified during the IDP proceeds.

### 12.4.1. The overarching concepts in the Knysna SDF include:

1. "Open Space System;
2. Settlement & Services Framework;
3. Economic Development Framework.

The concepts to be applied to **Towns** include:

1. Open Space System;
2. Urban Corridors;
3. Urban Nodes;
4. Urban Edge;
5. Infill and Densification;
6. Settlement Upgrading"<sup>2</sup>.

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<sup>1</sup> Oberholzer, 2005

<sup>2</sup> Knysna Municipality, 2007



#### **12.4.2. Specific Strategies in Eden Municipality**

- "Increase resource carrying capacity of coastal towns by implementing water, sewage and energy use minimization strategies;
- Promote urban compaction and densification in George and Mossel Bay in particular;
- Identify innovative urban development strategies to address problems created by broken topography of Knysna with respect to efficient urban management; and,
- Need to develop 24/7/12 economy by attracting permanent residents and move away from tourism boom and bust seasonal cycles" (Knysna Municipality, 2008).

#### **12.4.3. Identified Issues in Eden Municipality**

- "Water supply problems to coastal settlements especially over the December period;
- High levels of in-migration;
- High demand for golf course estates in coastal zone;
- Major area of contest for landless people;
- High property prices resulting in exclusion of the middle class;
- Inter-town commuting due to high property prices resulting in middle class relocating to towns with cheap housing and then driving back to places of work;
- Shallow economic base:- tourism and construction;
- Desertification from too many golf courses similar to that experienced in the south of Algarve (Portugal) and Andalusia (Spain) may be experienced in areas with similar Mediterranean climate and topography in the Southern Cape;
- Water shortages; and,
- Future of the "Garden" Route."<sup>1</sup>

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<sup>1</sup> Knysna Municipality, 2008





## 12.5. Knysna SDF Development Guidelines

Development guidelines assist authorities by creating clear, concise guidelines that must be followed in sensitive areas. The guidelines stress sustainability and good environmental practises in those areas that are deemed sensitive.

### 12.5.1. Development along Coastal Cliffs

- “The Knysna Council Draft policy on Development along Coastal Cliffs forms the basis of the land use management guidelines proposed for coastal cliffs. The framework proposes the adoption of the policy, which includes<sup>1</sup>:
- Development will be limited primarily to conservation, ecotourism or educational use;
- There should be no further residential development along coastal cliffs;
- An appropriate building setback distance from the cliff-edge shall be investigated, at the applicant's cost, in order to protect sensitive geotechnical formations (from disturbance, including infiltration by stormwater run-off) and vegetation, and to avoid inappropriate and insensitive development;
- The area below the setback line be zoned Public Open Space;
- Development shall be limited to less sensitive portions of a site, with public access to the cliff edge being critical;
- Sensitive areas should, where feasible, be consolidated and linked into a public open space system, as appropriate to the character of the development, and, where feasible, be managed as a nature reserve;
- Linear development along cliff-tops shall be avoided;
- Structures must be designed to reduce physical and visual impact below the skyline to be appropriate to their setting.”

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<sup>1</sup> Knysna Municipality, 2007



### 12.5.2. Development on Coastal Dune Areas

- “Similar development principles to those of coastal cliffs must be adhered to. In addition, the relative speed and mobility of dynamic dunes must be taken into consideration.
- No development may be considered on a primary dune;
- An appropriate setback must be established, to prevent damage to a stable dune
- In general, such areas should be subject to the provisions of the Outeniqua Sensitive Coastal Area Extension regulations”<sup>1</sup>.

### 12.5.3. Development on Forest Fringes

- “Due care, in consultation with environmental authorities, must be exercised in developing areas adjacent to indigenous forest areas. This includes developments in urban areas as well as in rural areas.
- A suitable setback to protect canopies and root systems must be established by a suitably qualified person;
- That setback must not be disturbed in any way, including by buildings, structures, driveways, paved areas, etc., except to the extent where a person’s primary right to erect a dwelling on the property may be unreasonably infringed”<sup>1</sup>.

### 12.5.4. Development on Ridgelines and Viewlines along Scenic Routes

- “The Municipality must identify key ridgelines and view-lines that will have a visual impact on scenic routes.
- Development along such lines should be avoided; Where development is inevitable, the Municipality reserves the right to limit buildings within 5 contour

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<sup>1</sup> Knysna Municipality, 2007

metres of such a line to a single storey building not exceeding 6,0m above natural ground level at any point below the building;

- The design of the building must comply with accepted principles for reducing visual impact;
- There is a provincial policy on ridgeline development that needs to be consulted<sup>1</sup>.

### 12.5.5. Golf Course and Polo Fields Developments

- “The Western Cape Golf Courses and Polo Fields Study<sup>19</sup> provide strong policy guidance in relation to golf courses. These policy directives should be consulted if further golf course or polo field development is to be considered.
- A number of location based criteria are discussed in relation to such developments. An important part of which includes recommendations that:
- there should be no further development of golf courses or polo fields in core conservation areas under any circumstances;
- That there are a very specific set of circumstances in relation to which they should be assessed if proposed in buffer areas of intensive agricultural areas; and □that the most appropriate locations for them is within the urban edge”<sup>1</sup>.

### 12.5.6. Knysna Municipality Open Space System (KMOSS)

“The Municipal Open Space System is essentially an interconnected web of natural systems, incorporating all the key natural elements (mountains, rivers, indigenous forests and fynbos, coastal dunes, etc.) in an integrated manner. The KMOSS is informed by the Rapid Conservation Assessment and Corridor Study undertaken by the Biodiversity Conservation Unit for EnviroGIS.” (Knysna Municipality, 2007)

The role of the KMOSS is:

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<sup>1</sup> Knysna Municipality, 2007



- "Protection and management of existing natural assets;
- Enhancing ecological functioning at a municipal scale;
- Enhancing economic and recreational potential of natural areas;
- Reflecting an interconnected web of green spaces"<sup>1</sup>.

### **(a) Core Conservation Areas**

The core Conservation Areas are made up of existing Nature Reserves and proposed Nature reserves. The former already has guidelines in place, while the latter have no protection yet and will include areas with Fynbos and other "sensitive areas"<sup>1</sup>.

#### **(i) Existing Nature Reserves and National Parks**

In the Knysna municipal area, these include all existing Nature Reserves and National Parks. These are: Kammanassie/Millwood; Jubilee Creek; Lielievlei; Gouna; Ysternek; Diepwalle; Pertrus Brand; Sinclair, Pledge and Goukamma Nature Reserves; Goukamma Marine Reserve; as well as Knysna and Wilderness National Parks<sup>1</sup>.

#### **(ii) Proposed Nature Reserves**

The Sparrebosch and Salt River valley indigenous forests on Municipal land have been included in this area, as both have been recommended for nature reserve status"<sup>1</sup>.

#### **(iv) Land-use management guidelines on private land**

Where private properties lie on identified core areas, landuse will be restricted to low visual and environmental impact designs that will minimize the impact to the council's satisfaction<sup>1</sup>.

## **12.5.7. Ecological Corridors**

"The role of ecological corridors is linkage between the mountains, oceans and the ecological systems that exist between them. It is a means for promoting and sustaining biodiversity"<sup>1</sup>.

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<sup>1</sup> Knysna Municipality, 2007



### **(i) River courses**

“The ecological corridors proposed include the entire courses of major rivers within the Municipal boundaries. They include the Knysna, Goukamma, Homtini, Karatara and Hoogekraal rivers”<sup>1</sup>.

### **(ii) River buffers**

“In addition to the rivers themselves, it is proposed that a 30m buffer either side of rivers be included in the ecological corridors”<sup>1</sup>.

### **(iii) Coastal Fynbos links**

“These include the Coastal Fynbos links identified in the Knysna Municipal Open Space System report. The importance of these linkages relates to continued genetic diversity and ecological health of the specific plant species, as well as the fauna which rely on them in various ways (movement corridors, food source, etc.)”<sup>1</sup>.

### **(iv) Forest corridors**

“These include the Forest Corridors identified in the Knysna Municipal Open Space System report. The importance of these linkages relates to continued genetic diversity and ecological health of the specific plant species, as well as the fauna which rely on them in various ways (movement corridors, food source, etc.)”<sup>1</sup>.

### **(v) Land-use management guidelines**

Low impact activities should be developed in core areas and urban development and agriculture are not desirable. The land use management guidelines should promote and ensure that ecological linkages maintained and increased through awareness and ensuring that the relevant areas are protected to ensure their continued functioning with these corridors and linkages. Coastal Fynbos must be identified in more detailed studies.

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<sup>1</sup> Knysna Municipality, 2007



### 12.5.8. Secondary Conservation areas

“The role of secondary conservation areas is to act as buffers for core conservation areas, enhancing their ecological functioning and maintaining their environmental integrity. This category includes all properties which adjoin core conservation areas. The framework proposes that they also include existing protected areas as well as proposed protected areas, identified on the plan as ‘sensitive areas’<sup>1</sup>”.

#### (i) Existing Protected areas

There are a number of protected areas which are under the jurisdiction of different bodies, hence have a set of guidelines from these bodies that governs them. They include three types:

- DWAF forestry;
- Private Nature Reserves;
- Existing & Proposed Conservancies.

#### (iii) Land-use Management Guidelines

“The areas should also be subject to controlled public access and their social and economic role enhanced through eco-tourism and educational activities. Low impact eco-tourism facilities and education related uses could be considered in areas of low sensitivity. Low impact resorts and education related uses could be considered in areas that are not environmentally sensitive”<sup>1</sup>.

Size of properties, proximity to other facilities and transport routes will be taken into account, as well as joint initiatives to form conservancies and conservation with development proposals involving several properties”<sup>1</sup>.

### 12.5.9. Productive Green Areas (Agriculture & Forestry)

“This category includes existing agricultural and commercial forestry areas. The role of these areas is primarily that of production and visual amenity. They have historically been, and should remain important sources of productive economic

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<sup>1</sup> Knysna Municipality, 2007



activity in the municipal area, as well as being contributors to the sense of 'place'<sup>1</sup>.

The objective is to maintain these activities that sustain livelihoods, albeit that in some cases they may be somewhat limited.

**(i) "Forestry**

High yield areas in southern parts of the Municipality along the N2 such as those close to the Towns of Knysna and Sedgefield must all be maintained as productive areas, except where portions are required for logical and necessary expansion of the urban fabric, i.e. Kruisfontein."<sup>1</sup>

**(ii) Agriculture**

"All existing agricultural areas identified in the Knysna Open Space System Study, most of which are in close proximity to Rheenendal and Karatara.

Areas of high agricultural potential or other agricultural significance will need to be identified in conjunction with the Department of Agriculture"<sup>1</sup>.

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<sup>1</sup> Knysna Municipality, 2007





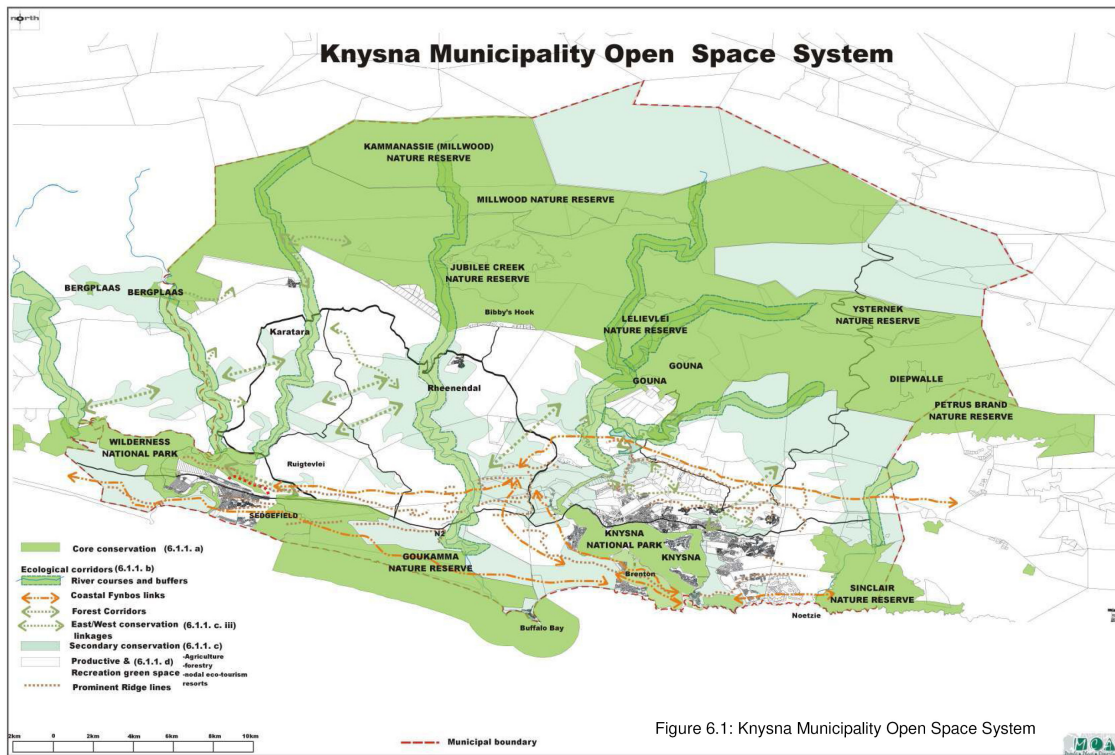


Figure 6.1: Knysna Municipality Open Space System

Figure 21: Knysna Ecological Corridors, Conservation Areas and Open Green Space<sup>1</sup>

## 12.5.10. Mobility and Scenic routes

### (i) Regional Routes

- Existing N2

The N2 should remain as the primary mobility corridor. The N2 bypass will alleviate additional traffic<sup>1</sup>.

- Existing N2 through Sedgefield

Since Sedgefield has an adequately functioning N2, it is proposed that only Knysna's section is upgraded with a bypass. This decision also protects high valued land, that will be lost if Sedgefield is upgraded<sup>1</sup>.

### (iii) Scenic routes

- Existing N2

<sup>1</sup> Knysna Municipality, 2007



“The existing N2 has an important role as a scenic corridor. In order to avoid the problems of the Harkerville / Plettenberg Bay corridor, no subdivision or development rights which increase traffic access directly onto the N2 should be permitted between White Bridge and Makou Street, Sedgfield, as well as east of the Uniondale / Noetzie turn-off and west of the Swartvlei bridge”<sup>1</sup>.

Other scenic routes include:

- Phantom Pass;
- The road to Buffalo Bay;
- Noetzie Road;
- Old Cape Road / Kom se Pad

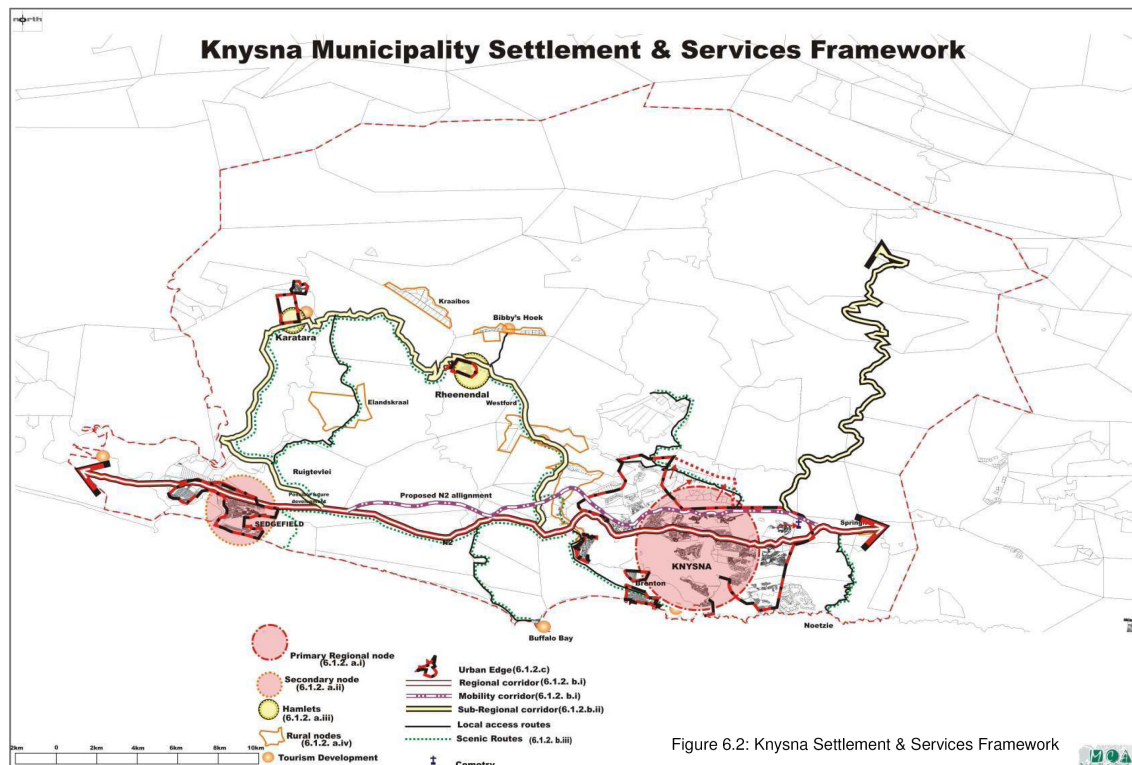


Figure 22: Regional Map indicating Urban Edges and Regional Nodes<sup>1</sup>

<sup>1</sup> Knysna Municipality, 2007



### 12.5.11. Core Productive areas

A distinction should be made as to what type development can occur inside and outside of the urban edge<sup>1</sup>.

- **Outside the urban edge**

“In regard to commercial forestry, the high yield forestry areas such as those east of Kruisfontein, as well as north and south of the N2 to the west must be maintained for forestry and continue to be a contributor to the economy”<sup>11</sup>

- **Inside or Along the Urban Edge**

“Urban Agriculture should preferably be located inside or along the urban edge due to the benefits of access and close proximity to the residences of farmers as well as local markets”<sup>1</sup>. “Cattle grazing should preferably be located on agricultural land outside the urban edge, but, within reasonable access for low income households, or along the urban edge where appropriate land is available”<sup>1</sup>.

### 12.5.12. Open Space System

“The key components of the open space system that filter from the conceptual framework include:

- Core Conservation areas and Ecological Corridors;
- Secondary Conservation areas and Core productive areas;
- Recreational areas (passive & active)”<sup>1</sup>.

#### **(i) Core Conservation Areas and Ecological Corridors**

- *Knysna Lagoon National Park*

The primary importance of the Knysna Lagoon is its role in ecological function and habitats. Public access and the lagoons delineated edge is of great importance.

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<sup>1</sup> Knysna Municipality, 2007



- **Cliffs and sensitive vegetation on the Eastern Head**

Cliffs must be preserved for their intrinsic value and if any development is to be approved, provision for public access via trails should be made.

- **Western Heads**

"The coastal dune and the sensitive indigenous vegetation on it must be conserved in perpetuity"<sup>1</sup>. "Areas that are low yield forestry areas should be rehabilitated as part of the coastal green belt stretching from the Western Head into Goukamma Nature reserve"<sup>1</sup>.

**(iv) Recreational areas**

*Passive recreational areas*

The proposed passive recreation areas include:

- *Indigenous forest north of Heidevallei*

"The indigenous forest north of Heidevallei has strong potential for passive recreation due to its proximity to urban areas"<sup>1</sup>.

- *Hornlee Green Belt & River Corridor*

"The Hornlee green belt and river corridor, as contained in the Knysna Open Space System Study, is an important continuous link between the Sinclair Nature Reserve and the lagoon"<sup>1</sup>.

- *Lagoon Edge Landscaped Precinct (George Rex Drive)*

"The lagoon edge precinct will offer residents the opportunity to experience the lagoon while spending time in a high quality landscaped public space"<sup>1</sup>.

### **12.5.13. Urban Edge**

According to the Knysna Municipality, (2007), "the urban edge is a critical tool in light of the level of development pressure on sensitive areas". "Urban Edges are intended to include an adequate supply of land that can be efficiently provided with urban services (roads, sewers, water lines, stormwater systems and streetlights) to accommodate the expected growth of the urban area for a

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<sup>1</sup> Knysna Municipality, 2007



defined period" (Provincial Urban Edge Guidelines, 2005 in Knysna Municipality, 2007).

### **Knysna**

"In the case of the Urban Edge for the town of Knysna, the full line on the Knysna Basin SDF map indicates the urban edge proposed for the next 3 to 5 years, whilst the broken line indicates areas where future development may be considered after this period (Figure 23)"<sup>1</sup>.

"The urban edge runs along the shoreline of the eastern bank of the Knysna Estuary from the south west corner of the Knysna Golf Course to the White Bridge, then proceeds northwards along the east bank of the Knysna River, excluding the small holdings adjacent to it. It then turns inland between portions 17 and 18 of Farm Charlesford, runs along the northern and eastern boundary of Simola Estate (Erf 9242), then southward eastward excluding properties largely covered in indigenous vegetation. It then follows the southern boundary of the Salt River forest and the expropriated future N2 route eastwards to the northwest corner of Kruisfontein"<sup>1</sup>.

Although the area is not experiencing and development at present, the Kruisfontein"<sup>1</sup>.

Northern areas have been included in the urban edge for the following reasons<sup>1</sup>:

- "need for further industrial land";.
- "need to relocate the portion of the Uniondale Road (R339) which passes through Dam-se-bos".
- "growth of low income housing area";.
- "need for land for a future cemetery site at Kruisfontein".

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<sup>1</sup> Knysna Municipality, 2007





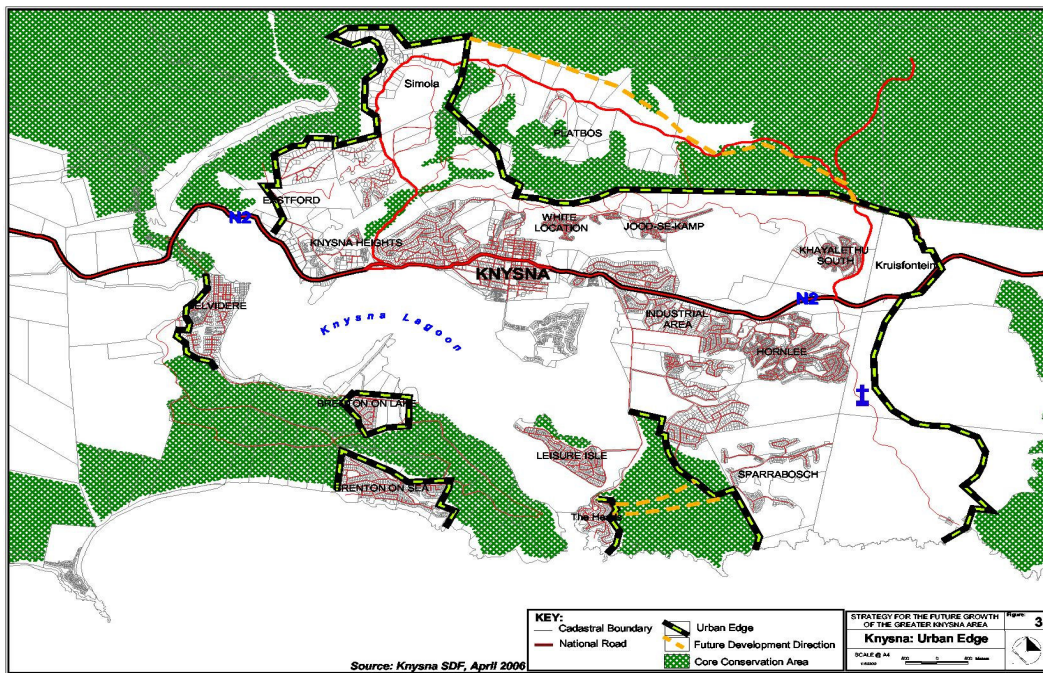


Figure 23: Knysna Municipality Urban Edge<sup>1</sup>

**Brenton-on-Sea:**

“The urban edge runs eastward along the cliffs above the seashore, starting from the south western end of CR Swart Drive, until the eastern end of Extension 1, then runs northward to the edge of the WK Grobler Road. The urban edge then runs westward along the WK Grobler Road, includes the community hall on Portion 81, then continues along CR Swart Drive to the north-western corner of Erf 1, and southward again to the coastal cliffs. The resort development on Portion 65 of Farm Uitzicht is considered a Special Planning Area, similarly Portions 71 and 77 may contain resort developments which do not provide links for further development”<sup>1</sup>.

**Brenton-on-Lake:**

“The urban edge runs along the as-built alignment of Dolly Raats Road and Captain WA Duthie Drive, then south-eastward along the eastern edge of

<sup>1</sup> Knysna Municipality, 2007



Portion 108 of Uitzicht 216. Any development outside this edge will need to comply with Province's criteria for evaluation of resort development<sup>1</sup>.

**Belvidere:**

“The urban edge runs southward along the 3m MSL contour above the Knysna Estuary from the northeast corner of Erf 11 to the southeast corner of Erf 441, then westward and northward along the railway line to the level crossing, then along the as built alignment of the DL1600, to the northwest corner of Erf 564, then eastward following the existing erven boundaries to the 3m MSL contour of the Knysna Estuary”.

**Future Development Direction**

“Once all densification and infill options have been explored, the areas delineated by the broken line will be considered for inclusion within the urban edge”<sup>1</sup>.

**Sedgefield**

“Sedgefield is a secondary node in the regional settlement framework”<sup>1</sup>. The scale of activities in Sedgefield are of a much smaller nature. However, it is clearly stated that it does not house urban activities at the same scale as Knysna Basin<sup>1</sup>. “Accordingly, most of the concepts applied, while having similar names, cannot be viewed in exactly the same manner as they are in the context of Knysna Basin. The issue of scale is very important to keep in mind here. The components of the framework include”<sup>1</sup>:

- Open Space System;
- Urban Corridors;
- Urban Nodes;
- Urban Edge.

Specific proposal with limited scale are: <sup>1</sup>.

- Deepening of the tourism chain;

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<sup>1</sup> Knysna Municipality, 2007





- “Provision for service industries”;
- “Provision of a high school”;
- “Upgrading of bulk infrastructure (water supply and waste water treatment works in particular”;
- “Relocation of the future N2 route to avoid existing erven and allow for residential infill”.

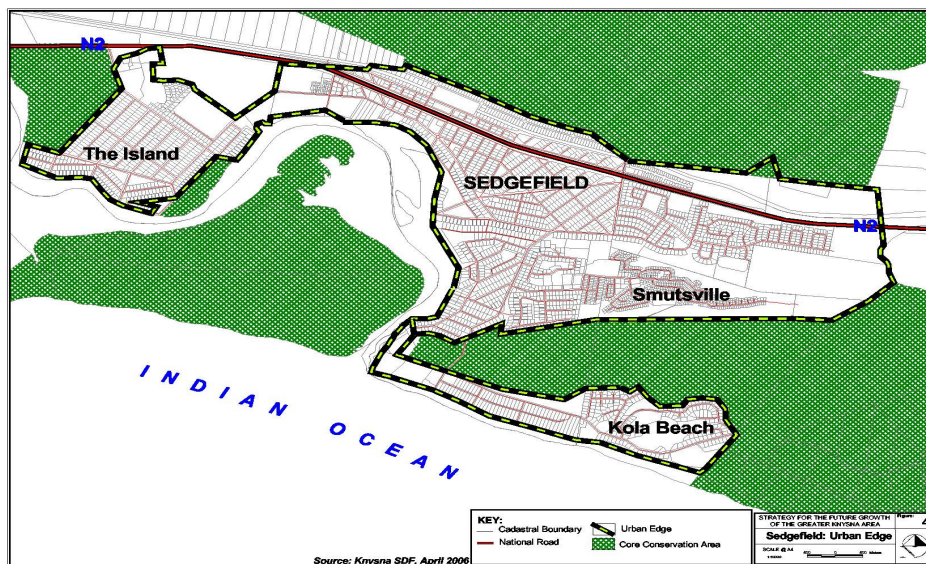


Figure 24: Sedgefield Urban Edge<sup>1</sup>

#### 12.5.14. Bioregional planning

Bioregional planning, at its core, relies upon the identification of priority areas for conservation and their location within a buffer and transition areas to create an integrated landscape. Often this could include reference to visual and scenic resources and the identification of areas and areas with special significance. Future Pressures in the Natural Environment

“Pressures from landuse and human activities are the main threats to the natural environment. These impact are often destructive examples include cultivation, urban expansion, overgrazing”<sup>1</sup>.

<sup>1</sup> Pierce, 2003

The STEP Project estimated that 8% of the natural environment faces high threat, 15% medium threat, and about 30% low threat (Pierce, 2003). Only about 50% facing negligible threat<sup>1</sup>.

## **12.6. Department of Environmental and Development Planning's Visual Guideline preamble**

"Important environmentally sensitive topographical features such as mountains, hills and ridges are often earmarked for range of development pressures"<sup>2</sup>. According to WCDEC&S, (2002). "Mountains, hills and ridges provide catchment areas for valuable surface water resources. Mountains, hills and ridges are often characterised by unique and sensitive ecosystems. Mountains, hills and ridges are of aesthetic/scenic value<sup>1</sup>. Remote mountainous areas provide a "wilderness" experience which is important for the well being of people <sup>3</sup>. They may also be of religious, spiritual or cultural value to people. These areas have a high scenic value and attract tourists and recreational users<sup>3</sup>. This provides opportunities for passive and active recreational developments. Properties in these areas are generally of high value which makes them desirable for residential development"<sup>3</sup>.

By having a controlling framework in place, such development can be controlled to preserve sensitive features<sup>3</sup>.

## **12.7. Knysna Integrated Development Plan**

The Knysna Municipal area is faced with numerous challenges. Promoting development while preserving biodiversity and limiting environmental issues

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<sup>1</sup> Pierce, 2003

<sup>2</sup> WCDEC&S, 2002

<sup>3</sup> Oberholzer, 2005



requires a complex balance. The Millennium Development Goals seek to ensure environmental sustainability in South Africa and the world<sup>1</sup>.

“In September 2000, 189 countries, including the Republic of South Africa, committed to the Millennium Declaration. This declaration sets out clear targets which are intended to be met by the year 2015. From the above, it is clear that there must be a consistency in planning between ASGISA and MDG. ASGISA would like to halve poverty and unemployment by 2014, and that is one of the eight MDGs. The timeframes of ASGISA are clearly responsive to those of the MDG and Knysna Municipal IDP must follow the trend<sup>1</sup>.

### 12.7.1. Core Approach

The Western Cape IDP process is based on a bioregional planning approach, to ensure that synergy is maintained between natural areas and ecological processes. The IDP is not a separate planning process, but rather a process that compliments statutory spatial planning processes by providing a spatial framework for the realisation of local planning initiatives<sup>1</sup>.

At its core the IDP has identified strategic focus areas and mandates, which are implemented via strategies over a given time period.

Knysna Municipality adopted its five-year (2007-2011) Integrated Development Plan (IDP), the primary strategic focus areas are:<sup>1</sup>

- “Creating links, integrating and co-ordinating plans and taking into account proposals for the development of the municipality ;
- Aligning the resources and capacity of the municipality with the implementation of the overall plan ;
- The formation of the policy framework and general basis on which annual budgets must be based ; and

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<sup>1</sup> Knysna Municipality, 2008



- To be compatible with national and provincial development plans and planning requirements binding on the municipality in terms of legislation”<sup>1</sup>.

The strategic focus areas of Knysna Municipality's five-year (2007-2011) IDP strategies where identified as follows: <sup>1</sup>

- i. “Institutional Transformation and Financial Viability;
- ii. Environmental Planning and Management;
- iii. Infrastructure Development;
- iv. Community Services; and
- v. Local Economic Development”<sup>1</sup>.

“Some of the benefits of implementing the IDP are:

- “Allocation of scarce resources to maximise effect and to ensure priorities are met;
- Effective use of available capacity;
- To ensure sustainable development and growth;
- To facilitate credible accessibility to local government by citizens;
- To enable active citizen participation in local government;
- Providing access to development funding;
- Encouraging both local and outside investment”<sup>1</sup>.

### **12.7.2. Spatial Planning of urban areas**

The Greater Knysna area has a housing backlog of more than 6000 housing units. The main challenge is to identify suitable land for development, as specified in the SDF<sup>1</sup>.

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<sup>1</sup> Knysna Municipality, 2008



The environment within which development can occur is determined by the Spatial Development Framework. The urban perimeter has been altered to fit closely to the developed region, as specified in the SDF<sup>1</sup>.

The only areas where provision has made for urban growth are:

- The Eastford area up to the edge of the currently approved Simola development. This is the only area in the Knysna Basin where private sector, Greenfield residential development will be permitted. There are approximately 500 ha in this area and could accommodate some 1,500 dwelling units at currently accepted density levels<sup>1</sup>.
- In the Kruisfontein area north of the N2 there is capacity for expansion to accommodate affordable housing and industry, whilst a cemetery is planned for south of the N2 in the same area. Both these expansions will be driven by the Municipality. However the land in question is not yet owned by the Municipality<sup>1</sup>.

Kola Beach is the only area in Sedgefield that has been authorised for expansion. Only one single row of properties along the north of Keljou Street and a narrow section north of the railway line has been approved<sup>1</sup>.

Although the Urban Edge of Karatara is not shown in the SDF, Figure 25 presents a possible Urban Edge for Karatara.

The Knysna Urban Edge includes “Bosdorp” and “Welsynsdorp” and the land east of “Welsynsdorp” and south of “Bosdorp” where the Eden University is being developed in a way that knits the two communities together. An agreement with the Provincial Administration stipulates that subsidies will be made available for the transfer of houses to the tenants and any additional land may be developed by the Municipality. The area provides an opportunity for affordable, bonded housing<sup>1</sup>.

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<sup>1</sup> Knysna Municipality, 2008



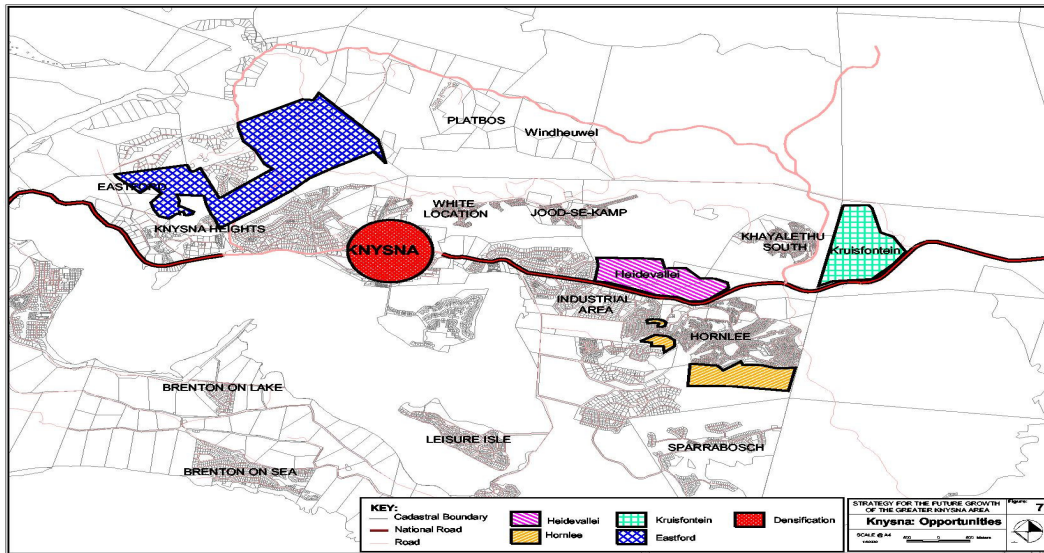


Figure 25: Knysna Municipality – Overall Development Opportunities

Source: Draft Spatial Development Framework<sup>1</sup>

The Knysna IDP stated that if infrastructure issues are addressed successfully, more development opportunities may be possible in Karatara. Only after the University has been planned and developed will this be considered however<sup>1</sup>. Table provides an indication of the number of units that the area can accommodate<sup>1</sup>.

Table 21: Knysna Municipality – Developable Land<sup>1</sup>

	Households	Residents
Heidevallei	1,500	6,000
Hornlee	500	2,000
Kruisfontein	1,500	6,000
Eastford	1,500	6,000
Densification/Infill	500	2,000
<b>Total</b>	<b>5,500</b>	<b>22,000</b>

Source: Draft Spatial Development Framework<sup>1</sup>

<sup>1</sup> Knysna Municipality, 2008



### 12.7.3. Implementation of Strategic IDP Objectives

Knysna Municipality recognises its developmental role and thus commits itself to facilitate interventions that are going to ensure the creation of new business enterprises, fostering partnerships with other government entities and the private sector. Through the Strategic Objectives stated below and the 5 Local Government Key Performance Areas (KPAs) the Municipality will always strive to achieve its developmental mandate. Strategies to realise elements of the KPA, which affects the EMF are:<sup>1</sup>

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<sup>1</sup> Knysna Municipality, 2008





Table 22:(Excerpts taken directly from Knysna Municipality, 2008)

WASTE MANAGEMENT			
A caring and contented town	Social Needs Cluster	Deliver an effective and efficient waste management service	Ensure development, implementation and review of a waste disposal strategy for Knysna Municipality
			Effective collection and removal of waste
			Ensure adequate provision of waste disposal site, bulk transfer site and user friendly waste disposal facilities
			Investigate alternative strategies for waste disposal
			Devise effective waste minimisation strategies
			Encourage and implement waste avoidance strategies
			Provide adequate instruments for the regulation of waste management
HERITAGE PROMOTION			
A caring and contented town	Social Needs Cluster	Collect, record, preserve and promote Knysna's diverse history	Ensure preservation, maintenance and upgrades of physical sites that are historically significant
			Engage in product development by

			undertaking additional audit of heritage sites
<b>DISASTER MANAGEMENT</b>			
A caring and contented town	Social Needs Cluster	Provision of reliable disaster management services	Provide adequate infrastructure for prompt response to disaster situations
			Development, implementation and review of the Knysna Disaster Management Plan
<b>LOCAL ECONOMIC DEVELOPMENT</b>			
A Successful and Respected Town	Development & Planning	To realise greater agricultural potential of the Knysna area, thereby providing economic growth for the poorer areas and rural communities	Engage in a comprehensive analysis to determine the potential of the rural economy
			Identify AGRO PROCESSING potential of the Knysna area
			Facilitate the commercialisation of the existing agriculture project by facilitating markets and access to capital
		To realise greater tourism potential in the Knysna area and build internal links, thereby providing shared economic growth and employment	Market Knysna as a tourism destination
			Enhance the tourism value of the Knysna area through product development and branding
			Create an enabling environment for tourism growth through investment in additional tourism infrastructure

			Facilitate the development of tourism entrepreneurs with a particular focus on the disadvantaged communities
		To facilitate and assist the community in the provision of opportunities to reduce unemployment and create an environment for job creation.	Engage in a comprehensive analysis to determine economic sectors that could play a leading role in the resuscitation of the local economy
			Feasibility study of the leading sectors as determined by ASGISA – with specific reference to initiatives with macro scale impact
		Provide access to land for agricultural, settlement and commercial purposes to residents, in order to promote employment and security	Undertake a land audit to ascertain land availability for economic development
		Enter into partnerships with strategic role-players in economic development – i.e. parastatals, international organisations and provincial and national government	Develop partnership proposals for a potential economic development project geared at alleviating poverty and facilitating municipal infrastructure investment
<b>INTEGRATED DEVELOPMENT PLAN</b>			
A Dynamic and	Development & Planning	Knysna Municipality seeks to ensure that a sound, comprehensive and highly responsive	Development of a comprehensive Integrated Development Plan

Welcoming Town		development planning environment is created to ensure environmentally sustainable development with particular focus on the historically disadvantaged communities	Review of the Spatial Development Framework
			Development of comprehensive Sector Plans
			Design and implementation of an effective Performance Management System
			Design and Implementation of a proper feedback system through Annual Reporting
<b>TOWN PLANNING</b>			
An attractive and Sustainable Town	Development and Planning	Ensure that Knysna Municipality has got adequate capacity to diligently discharge its responsibility with regard to town planning.	Provision of adequate Human Capital capacity for successful and quick processing of town planning applications.
			Investigate and deploy state-of-the-art systems to improve the Municipality's capacity to deal with town planning applications.
			Provide sufficient plans for spatial development
<b>ENVIRONMENT MANAGEMENT</b>			
An attractive and Sustainable Town	Development and Planning	Ensure that a proper and functional framework is developed for the successful preservation of the Knysna's pristine environment balanced with effective socio-economic emancipation of the people of Knysna	Engage in environmental awareness programmes to ensure that communities of Knysna understand and appreciate the value of environment protection.
			Design, Implement and review the Environment Management Systems Framework

The Garden Route  
Environmental Management Framework



			Identification and Implementation of the EMS Pilot projects
			Development and Implementation of the EMS Roll Out Plan

## 13. HISTORICAL DEVELOPMENT

### 13.2. Historical attractions

The most well known attraction is the Knysna heads - two great sandstone cliffs guarding the mouth of the lagoon which connects the estuary with the sea. A lookout has been erected on the Eastern Head, commanding spectacular views of the lagoon, Leisure Isle and Knysna. The Western Head is a privately owned nature Reserve - Featherbed Bay (AA travel guide).



Photo: Western Heads

Millwood House Museum in Queen Street houses material relating to the history of the town, and includes artefacts once owned by George Rex. It was built from yellowwood at the end of the previous century during the gold rush.

Another historical attraction is the Millwood Gold Mines. Alluvial gold was found here in 1885, which caused a rush to the area. At Jubilee Creek, the exact spot where gold was found provides a tranquil and beautiful picnic area, with many enjoyable forest walks in the area.

The town of George was established as a result of the growing demand for timber and the woods used in building, transport and furniture. In 1776 the Dutch East India Company established an outpost for the provision of timber; its location is thought to be near the western end of York Street. As the Timber Post had its own Posthouer (manager), some 12 woodcutters, a blacksmith, wagon maker and 200 oxen plus families and hangers on there was already a community of sorts here. After 1795 and the British occupation of the Cape, a caretaker of the forests in the area was appointed. Then after the second British occupation in 1806, it was decided that Swellendam magistracy was too large and so that of George Town was carved out of it. In 1811 Van Kervel was appointed as Landrost (magistrate) and the town was proclaimed by the Earl of Caledon, governor of the Cape Colony on St. George's Day (23 April) and named after the reigning British monarch, George III.

### 13.3. History of Knysna and the Garden Route

Exploitation of the forests started around 1763 with the arrival of the white settlers in the form of woodcutters, farmers, and hunters. Till then the only inhabitants of the Garden Route were the Khoikhoi (Hottentots) and the San (Bushmen). As early as 1770 the timber resources of the Cape were under significant pressure. The Swedish naturalist and collector (student of Linnaeus) did a reconnaissance of the eastern and southern Cape and produced reports of lush forests. This induced a rush of settlers to the region where the exploitation of the forests and wildlife began<sup>1</sup>.

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<sup>1</sup> Mackay, 1996



Timber supplies in the Cape had already become exhausted in 1770, which prompted the search for new lumber resources. In 1772 a lush forest was found in the eastern and southern Cape. The yellowwoods and stinkwoods were felled for flooring, furniture and railway sleepers. The town of George was founded in 1811. This saw an increased demand for timber and the destruction of the forests accelerated. The Royal Navy further ordered more timber supplies a year later, which put additional strain on timber supplies. In 1836 the “Great Trek” was about to begin and large quantities of wood was required for the construction of wagons, which prompted the opening of the Tsitsikama (later called Tsitsikamma) forest for logging. In 1846 the worked-out forests were closed by the Government, divided into lots and sold to the public<sup>1</sup>.

The protection of forests did not last long as a timber shortage in 1856 prompted the reopening of most of the forests, with a cyclic timber harvesting system. This coupled with the Millwood gold rush in 1856 increased the pressures on the forest and local wildlife<sup>1</sup>.

Hooper, a farmer in Ruigtevlei, discovered a gold nugget on his farm, in a tributary of the Karatara River. News of the find spread and prospectors poured in from all over the world. The Cape Government however would not approve prospecting rights before the prospecting capacity of the field could be assessed, but failed to act against the prospectors who invaded the forest creeks (van der Merwe, 2002).

By 1885, 2000 claims had been pegged and some 200 diggers lived in tents around Millwood. The search for gold increased when the first gold-reef was discovered in the quartzite-veins above the creeks. This caused Millwood's population to increase further and the establishment of the Millwood town proper. In 1886 the Cape Government ordered the prospectors to leave as they were trespassing, which almost caused a riot. This forced the government to submit to the miner's demands and Millwood was officially declared a gold-field in January 1887. By then almost a thousand people were living in Millwood (van der Merwe, 2002)

The Millwood fields lay in the Outeniqua Mountains, closed off at the north by high ridges and in the south by lower hills and dense forest. The promised massive gold-fields

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<sup>1</sup> Mackay, 1996

never materialised and Millwood became a ghost town overnight as prospectors left for the Witwatersrand<sup>1</sup>. This ultimately led to the unsuccessful exploitation of the gold fields. Mining for gold finally ended in 1905<sup>2</sup>. The gold fields were finally deproclaimed in 1924<sup>1</sup>.

Knysna and George did not grow substantially until the construction of the "Passes Road" in 1868. This road remained the only pass between George and Knysna until 1950. The first permanent bridge, built to replace the drift in Knysna was built in 1915. As the roads improved, the outside world began to show an interest in Knysna<sup>1</sup>. In 1951 the Outeniqua Pass was built, which linked George to Oudtshoorn. This allowed visitors and holiday makers to enter Knysna, and thus the tourist and property markets were born<sup>1</sup>. In 1972, a National route was built, passing through the Tsitsikamma forest to reduce traffic congestion; the road was however met with great public outcry. Today this National road is at the centre of the Garden Route 's scenery<sup>1</sup>.

#### 13.4. Conservation history

In 1880, Count M. de Vasselot de Regne<sup>1</sup>, a French forestry officer, was appointed Superintendent of Woods and Forests, which was to be the first real progress in conservation. The Cape Forest Act was passed eight years later, which improved conservation. In 1939, the registered woodcutters system was disbanded, and the forest closed to all exploitation. In 1964 the effective management of the forests began with the establishment of indigenous forest management station at Saasveld. Very little of the state owned forest was lost, and the most forest clearing occurred on privately owned land<sup>2</sup>.

Patches of remnant forest still exists at Brenton , Ashmead and Pledge Nature Reserve near Oakhill School. With the increase in knowledge it would have been expected that the forest would have been preserved, however development pressure caused further loss<sup>1</sup>.

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<sup>1</sup> van der Merwe, 2002

<sup>2</sup> Mackay, 1996



Photo: Forest stream

### 13.4.1. Forest Management

The management program includes conducting research into forest dynamics and the regulation of timber yields. No active replanting is done, since the forest regenerates itself adequately. Visitors are also allowed to enjoy and appreciate the forest. The key concept here is sustainability, since the future safety of the forest is questionable. Sale of timber still takes place for the manufacture of furniture, under strict supervision to minimise the damage to the environment. Large numbers of people are dependent on this controlled timber supply, maintained by the Department of Forestry. Strain on the indigenous forests is further increased by alien invasive species such as Australian Blackwood (*Acacia melanoxyton*), Black Wattle (*Acacia mearnsii*). The control of these species represents one of the most expensive conservation measures in the Southern Cape forest region. The wood of these alien trees is in high demand and provides much revenue, but its growth in indigenous forests must not go unchecked<sup>1</sup>.

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<sup>1</sup> van der Merwe, 2002  
environment & tourism



Gouna State Forest is demarcated by Government Notice 1049 of 1894, and is one of the indigenous forests that been left in its natural state. The management objective is to allow the forest to exist in its naturally dynamic state for fauna and flora with no human interference<sup>1</sup>.

### 13.4.2. The Great Fire

The Great fire in 1869 had a great negative impact on the forests' flora and fauna. The fire decimated the forest belt between George to Humansdorp in the east. It did however fail to penetrate the main forest. The outskirts of the forests and particularly forest along rivers were destroyed (Mackay, 1996). This area never fully recovered from the damage<sup>1</sup>.

### 13.4.3. Knysna Elephants

In past centuries the Knysna Elephants roamed the sheltered forests for centuries. The semi-nomadic Khoikhoi hunted the elephants as their staple food source. BY the 18<sup>th</sup> century settlers pushed the elephants into their forest retreats. In 1876 there were still about 500 elephants as estimated by the Conservator of Forests, Captain Harrison. Their number rapidly declined as increasing numbers of woodcutters and hunters invaded the forest. Today only three elephants survive. In 2000 the second sighting was confirmed and in 2001, a third elephant sighting was confirmed. The elephants belong to the same species (*Loxodonta Africana*) as those found in the Kruger National Park and are the only free roaming elephants in South Africa. In the past this has brought the elephants into conflict with landowners and small farmers. Numerous elephants were hunted during the nineteenth century<sup>2</sup>.

The last hunt occurred in 1920, when Major P J 'jungle' Pretorius obtained permission to shoot one Knysna elephant, for the South African Museum. Five animas died during the

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<sup>1</sup> SANParks & ff, 2003

<sup>2</sup> van der Merwe, 2002

bugled hunt. Nick Carter studied the elephants during 1968/9 and 1970, where he managed to locate eleven surviving elephants. In 1981 an elephant working group was established and found that poaching and a restricted habitat were the main causes of their ever decreasing numbers. In 1991 the Minister of Water Affairs and Forestry gave approval for the introduction of three young elephants from the Kruger National Park, but they were unable to adjust and consequently the 2 surviving elephants were relocated to Shamwari Game Reserve in 1997<sup>1</sup>.

## 14. NATIONAL PARKS CONSERVATION STATUS

### 14.2. Knysna National Lakes Area

The current area of 15 000ha (1985) is under SANParks jurisdiction, this includes the lower portions of the Knysna River basin and the entire Knysna Water body<sup>1</sup>. “The area includes about 150 macrofaunal species, and is classified as the most important for conservation”<sup>1</sup>. “The estuary is S-shaped and approximately 19km long<sup>1</sup>. It broadens and deepens to form an embayment over 3km wide and 6m deep (SANParks & ff, 2003). The two rocky headlands form the mouth of the estuary”<sup>1</sup>. The placement of the heads also prevents marine sediments from entering the estuary<sup>1</sup>. “This also means that the estuary is permanently open, and is only one of a very few such estuaries in South Africa”<sup>1</sup>.

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<sup>1</sup> SANParks & ff, 2003





Photo: Knysna Estuary Mouth

Extensive eelgrass (*Zostera capensis*), which occur at and below the tidal waters. Salt marches occur at higher levels<sup>1</sup>. "The benthic macrofauna includes 310 species, with rich beds of mud prawn (*Upogebia Africana*) and bivalves"<sup>1</sup>. "Over 50 fish species have been recorded. The Knysna seahorse (*Hippocampus capensis*) is an estuarine specialist and only found in Knysna and two adjacent estuaries"<sup>1</sup>.

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