

**APPENDIX 1:
DESCRIPTION OF THE ENVIRONMENT TO BE
AFFECTED**

1.1 EXISTING AND SURROUNDING LANDUSE

The majority of the land making up the Precinct is currently under sugar cane cultivation, with the remaining areas being comprised of the Ohlanga River and floodplain, grassland, the Hawaan Forest, Forest 31 and the Mhlanga Forest (Figure 1.1).

The N2 lies to the west of the precinct, the M4 bisects the development area, the MR96 forms the northern boundary, the Hawaan Forest forms the southern boundary and the Indian Ocean lies to the east (Figure 1.1).

The Sibaya Casino and Entertainment Kingdom is situated in the centre of the Precinct area. The residential area of Umdloti lies to the north east of the Precinct while "Peace Cottage" and Meadowbanks lie to the south of the Mhlanga Forest. South of the Hawaan Forest is the residential area of Umhlanga Rocks and at the northern end of the Forest, between the Forest and the N2 lies the Waste Water Treatment Works (Figure 1.1).

Hawaan Investments (Pty) Ltd own a centrally located portion of the Hawaan Forest and are currently developing a residential development south of the Forest (Figure 1.1).

There are existing zoning rights for 3 hotel/ resort developments in the area. The proposed city lodge and Umdloti South hotel are Special Zone: Hotel, the Peace Accord is Special Zone: Conflict Prevention Centre; the Mhlanga Forest Estate also has existing zoning rights for 69 units while the surrounding land use and its zonation is Agriculture and Single Residential.

1.2 TOPOGRAPHY AND EXISTING DRAINAGE

(The following information has been extracted from the Preliminary Assessment for Stormwater Catchment Plan prepared by Vela VKE Consulting Engineers, July 2005 and acts as a summary thereof, for full details see Appendix XV of the Draft Scoping Report, August 2006.)

The soils making up most of the landforms in the area are sandy with low cohesion and are highly erodable, unless bound by vegetation, or otherwise protected.

From the contour plan of the area, the landforms consist of gentle undulating slopes on the central high ground and watersheds, giving way to steep slopes along the sides of some minor valleys. Flat areas occur at the bottom of the major "U" shaped valleys. While risk of erosion may be low in these locations, development may lead to the creation of zones that would be subject to flooding.

The Berea Red soils are generally permeable, but underlying rock and clay horizons may result in springs and a shallow groundwater table in the valleys. Low lying areas near the Ohlanga River are wet and a steady base flow can be expected in the main drainage channels due to groundwater seepage.

1.3 WETLANDS

(The following information has been extracted from the Wetland Delineation Report prepared by Land Resources International (Pty) Ltd, May 2005, and acts as a summary of the findings thereof, for full details see Appendix XIV of the Draft Scoping Report, August 2006.)

The wetland habitat within the development boundary covers an area of approximately 96 ha (Map L01616/050505/01, Appendix XIV of the Draft Scoping Report, August 2006). The majority of the wetland areas drain into the floodplain and estuary of the Ohlanga River. The wetland systems within the northern portion of the development site drain into systems that flow directly into the ocean.

It should be noted that the development site contained a number of irregularities:

- The wetland habitat within the south-east corner of the development site was noted as extending over the 'saddle' of two hills with vertic soils (heavy clay, 'shrink & swell' soils) being present on both hillsides. It appears that this area comprises of hillside seepage areas with diffuse flow occurring across most of the area. It was noted that the topsoil in these areas appeared to have been washed away, possibly extending the wetland boundary unnaturally.
- Some of the wetland areas within the development site were considered to exhibit marginal wetness characteristics. These areas are shown on Map L01564/050505/02 (Appendix XIV of the Draft Scoping Report, August 2006).

According to the author, it should be noted that the wetland systems within the development site have generally been modified, with sugarcane being cultivated in the majority of the wetland habitat. Additional modifications/impacts are associated

with soil loss adjacent to the wetland and sediment originating from the recently constructed Sibaya Casino.

A number of the wetland systems within the development site have been impacted upon by sediment originating from construction on the Sibaya Casino development site. Storm water and sediment control structures have been constructed, but appear to be unable to accommodate the flow and sediment levels generated from this area.

Sediment accumulation within the wetland habitat has resulted in the 'burying' of wetland habitat in certain areas. This is likely to have significantly modified the hydrological characteristics of the wetland system, having impacts on the level of functioning of the wetland habitat.

The following rehabilitation should be considered within the wetland system, thereby potentially improving the status and functioning of the system:

- Removal of alien vegetation
- Restoration of hydrological conditions within the wetland by plugging the drainage channels utilising rehabilitation techniques.
- The wetland habitat and surrounding buffer zone would require management to maintain the system. This would involve:
 - The well-timed and frequent removal of vegetative matter within the herbaceous wetland areas.
 - The eradication of emerging alien invasive vegetation within the wetland and buffer zones.

Management guidelines for wetland areas within South Africa are outlined by Kotze and Breen (2000).

1.4 GEOLOGY AND SOILS

(The following information has been extracted from the Report on the Geotechnical and Geohydrological Investigation for the proposed Mhlanga Forest Estate housing development prepared by Thekwini GeoCivils cc., March 2004, Appendix XVI of the Draft Scoping Report, August 2006; from the Geotechnical Report – Umdloti Hotel Development prepared by M J-F Bénet of Drennan Maud & Partners, 4 December 1997, Appendix XVII of the Draft Scoping Report, August 2006; and from the

Geotechnical Investigation of Portion of the Olhwan Forest Site, Umdloti, for Proposed Development by Sun International (Pty) Ltd prepared by M J-F Bénet of Drennan Maud & Partners, December 1996, Appendix XVIII of the Draft Scoping Report, August 2006.)

The majority of the Precinct is underlain by Berea Red Formation sands and sandy clays. Soils in the Precinct include hydric soils (Katspruit form) within the drainage lines, alluvium (Willowsbrook form) within the Ohlanga River floodplain and red sand (Hutton form) over the remaining areas of the site.

The predominant bedrock is Vryheid Formation and is expected to underlie the area at an elevation of about 65 a.m.s.l. The bedrock comprises dark bluish grey shales with horizons of greyish brown micaceous shale and grey fine to coarse grained arkosic sandstone.

Minor sheets of intrusive Karoo dolerite are present in the shale and sandstone bedrock and generally comprise weathered corestones in the yellowish brown or reddish brown clay matrix.

Vryheid Formation shales and sandstones and Karoo dolerite occur in the south western sector of the area, on the left flank of the Ohlanga River.

Within the MFE there are localised dolerite intrusions and highly calcareous Bluff Formation Sandstone outcropping in places.

1.5 ECOLOGY

(The following information has been extracted from the Draft Ecological Assessment for the Sibaya Precinct KwaZulu-Natal prepared by Strategic Environmental Focus, Pty (Ltd), June 2005 and acts as a summary thereof, for full details see Appendix XIX of the Draft Scoping Report, August 2006.)

1.5.1 Regional Vegetation Description

While the majority of the site is under sugar cane cultivation, sections of the study site do form part of the Coastal Bushveld-Grassland (Granger *et al.*, 1996), of the Savanna Biome (Rutherford & Westfall, 1994), but consist of floristic elements typical to the Forest Biome. Acocks (1988) classified this vegetation type under Coastal Forest and Thornveld, more specifically that of Dune Forest.

The regional vegetation consists predominately of species such as *Vepris lanceolata*, *Protorhus longifolia*, *Trichilia emetica*, *Celtis africana*, *Chaetacme aristata*, *Mimusops obovata* and *Brachylaena discolor*. An interesting change in vegetation structure is observed on the littoral dunes closer to the seashore where tall canopy species are replaced by evergreen thickets shaped through the consistent wind-pruning and salt laden winds. The typical canopy constituents include *Mimusops caffra*, *Euclea natalensis*, *Brachylaena discolor* and *Apodytes dimidiata*. When disturbed, it is replaced by species such as *Acacia natalitia* (= *A. karroo*) and consists of grassy species such as various *Eragrostis* spp., *Setaria megaphylla* and *Sporobolus africanus*. This vegetation type shares affinities with Lubke & McKenzie's (1996) description of a Coastal Forest type (part of the Forest Biome) consisting of Tongoland-Pondoland and Afromontane affinities. Such vegetation types are well represented within the Havaan Forest and a number of forest patches further inland. Noteworthy species include species such as *Mimusops caffra*, *Euclea natalensis*, *Apodytes dimidiata*, *Protorhus longifolia*, *Strychnos decussata* and *Sideroxylon inerme*.

Herewith, creepers and woody shrubs were also important constituents with dominant species such as *Scutia myrtina*, *Capparis sepiaria* var. *citrifolia*, *Carissa bispinosa*, *Grewia occidentalis*, *Cynanchum* spp. and *Dracaena aletriformis*. The herbaceous layer comprises of species such as *Cyperus albostriatus*, *Dactyloctenium australe*, *Achyranthus aspera* and numerous species of the Acanthaceae.

The mosaic of intraspecific vegetation types or sub-communities within the Coastal Bushveld-Grassland are regulated by the salt spray-fire-grazing interaction as well as the role of the water table in defining vegetation types on these relatively young substrata (Granger *et al.*, 1996).

1.5.2 Floristics

1.5.2.1 Diversity

A total of 246 species were recorded in the Precinct site and adjacent surroundings. The high number of species can be ascribed to the high number of spatial heterogeneity observed from the Precinct site. However, the observed number of species includes a number of species typical of proper coastal dune forest (e.g. *Mimusops caffra*, *Scutia myrtina* and *Laportia peduncularis*), secondary coastal scrub

(e.g. *Canthium inerme*, *Rhus nebulosa* and *Pupalia lappacea*) and recently disturbed areas that consist of transient secondary grasslands (*Eragrostis plana*, *Ipomoea* spp. and various annual herb species). Further, a percentage of the species recorded in the inland hilly slopes (especially on exposed arenite of the Berea Formation) have Afromontane affinities (e.g. *Harpephyllum caffrum*, *Rhus chirindensis* and *Protorhus longifolia*). The coastal foredunes consists of dune pioneers and other species with a high tolerance towards the high salt-laden winds and the most noteworthy species include *Aloe thraskii*, *Scaevola plumieri* and *Ipomoea pes-caprae*. These species are important in stabilising dunes against the salt-laden winds. Other specialised vegetation types include wetland-associated species along the Ohlanga River. Some of these species are able to endure fluctuating levels of salinity (e.g. *Hibiscus tiliaceus*) while the freshwater sections are colonised by various hydrophytes, including members of the *Cyperaceae*, *Phragmites australis*, *Typha capensis* and *Commelina* spp.

Of the approximately 76 plant families recorded in the Precinct site and immediate surroundings, the Poaceae (grasses) was best represented, followed by the Asteraceae (Daisy Family) and Fabaceae (Pea Family).

It should be remembered, that the above figures are only a reflection of two separate instantaneous sampling sessions, and that more species may be added to the species pool through increased periodic sampling.

1.5.2.2 Physiognomy

The vegetation was dominated by an herbaceous and woody component, the former confined to wetlands and disturbed areas (particularly secondary grassland), while the latter was more representative of typical coastal dune forest.

An interesting observation was the high number of climbers representing the herbaceous layer (e.g. lianas, creepers and twiners). The increase in vertical structure with regeneration age facilitates the colonisation of more tall woody species. During later successional stages the demand among species for sunlight intensifies to a point where woody species out-compete most of the herbaceous species, whereby climbers/creepers become more evident. These species are more successful in obtaining light, necessary for photosynthesis, than the other growth forms at mid and ground strata.

1.5.2.3 Red Data Plant Species

According to the Threatened Plant Species Programme (TSP) (2005), two threatened or Red Listed species were recorded in the Sibaya Precinct and the immediate surroundings. Another species, once thought to occur on/near the study site, is considered to be extinct in the wild. The TSP is currently revising all threatened plant species assessments made by Hilton-Taylor (1996) using IUCN Red Listing Criteria modified from Davis *et al.* (1986).

The following species were recorded in the Precinct:

- *Raphia australis* (Kosi Palm)
- *Cavacoa aurea* (Natal Hickory)
- *Kniphofia pauciflora* (Dainty Poker)

1.5.2.4 Protected Plant Species

Five plant species were observed and listed as being protected under Schedule 12 of the Nature Conservation Ordinance of KwaZulu-Natal, 1974 (No 15 of 1974):

- *Haemanthus albiflos* (Amaryllidaceae, geophyte)
- *Scadoxus membranaceus* (Amaryllidaceae, geophyte)
- *Scadoxus puniceus* (Amaryllidaceae, geophyte)
- *Crocasmia aurea* (Iridaceae, corneus herb)
- *Dietes butcheriana* (Iridaceae, Corneus herb)

Further, four tree species (*Barringtonia racemosa*, *Ficus trichopoda*, *Mimusops caffra* & *Sideroxylon inerme* subsp. *inerme*) appear on the new national list of declared protected tree species under the recent Government Gazette Notice 1012 of 27 August 2004 of the National Forests Act, 1998 (No 84 of 1998).

1.5.2.5 Medicinal Plant Species

A number of plant species were observed to have medicinal properties with evidence of utilisation within the site. It is therefore imperative that the population demographics (such as a decrease in abundance) of these species be closely monitored and utilised in a sustainable manner. Although most of these plant species are regionally widespread and abundant, some of the more economically important plant resources should be envisaged as conservation entities.

1.5.2.6 Declared Weeds and Invader Plants

A number of exotic species (49 species of the 246 species recorded (19%)) were recorded in the Precinct area. The majority of these species are declared weeds and invaders and some of these species (in particular *Chromolaena odorata*) are a serious problem in the coastal region of KZN. These species are however, mostly confined to areas that have experienced recent disturbances but have invaded most of the remnant forest corridors.

Some minor ruderal weeds (Henderson, 2001) were also observed and include species such as *Argemone ochroleuca*, *Bidens pilosa* and *Ricinus communis*. These species are all annuals, and are of temporary nature.

1.5.3 Mammals

A total of 44 mammal species could occur within the Precinct site. Of these, about 22 species are likely to occur within the Precinct site, while another 17 species may occur, although they will occupy suitable habitat from the surrounding areas such as the secondary grassland or more specialised habitat types such as wetlands. Lastly, 5 species have low occurrence probabilities and are therefore unlikely to occur. The majority of species likely to occur are typical of coastal forest environments and should occur in high densities within the Mhlanga-Mdloti corridor.

The Precinct site is largely unsuitable for colonisation of larger mammal species, and those confirmed during the site visits should be regarded as those species with the largest body sizes. These include *Cercopithecus aethiops cloeti* (Vervet Monkey), *Cephalophus natalensis* (Red Duiker), *Philantomba monticola* (Blue Duiker) and *Mungos mungo* (Banded Mongoose). It was unfortunate that the small mammal trapping session proved to be unsuccessful, although a number of shrew (Genus *Crocidura*) and rodent species (e.g. *Mastomys natalensis*, *Mus minitoides* and *Otomys angoniensis*) are anticipated from the Precinct site.

1.5.3.1 Threatened and Data Deficient Species

Shrews (*Crocidura spp.* and *Myosorex spp.*) – “Data Deficient”

Blue Duiker (*Philantomba monticola*) – “Vulnerable”

Single-striped Mouse (*Lemniscomys rosalia*) – “Data Deficient”

Water Rat (*Dasymus incomtus*) – “Near-threatened”

Bats (Order: *Chiroptera*)

1.5.4 Herpetofauna (Amphibians & Reptiles)

1.5.4.1 Amphibians

Of the ± 69 species of amphibians recorded in KwaZulu-Natal (data obtained from the latest South African Frog Atlas (Minter *et al.*, 2004)), only 17 are fairly widespread within the province and likely to occur on the Precinct site. Another 5 species have distributions that are peripheral (at the edge of their distribution) to the Precinct site, while 2 rare species have very localised distributions with specialised habitat requirements.

Most species of frogs tend to be closely tied to the habitats in which they breed. Thus, protection of relatively small areas of land that include viable breeding sites and areas for foraging and aestivation can be very effective in maintaining populations of these species, so by enhancing their conservation. However, some species do have fairly specific requirements for breeding (such as *Hyperolius pickersgilli*), and suitable conditions can easily become disturbed or disrupted by human development.

In general, the Precinct site is bordered by the Ohlanga River and support a large floodplain area with dense stands of associated emergent vegetation (*Typha capensis*, *Carex* sp. and dense *Phragmites australis* beds). These have been augmented by numerous drainage lines within sugar cane plantations. This wetland forms an important amphibian breeding habitat and dispersal corridor. The adjacent secondary grasslands along many of the forest corridors make up the remainder of the natural amphibian habitat in the area. The grasslands are important ephemeral foraging habitat for several of the frog species in the area.

1.5.4.2 Potential Red Data Amphibian Species

Currently, 3 of the 24 frog species under consideration are Red Data listed (Minter *et al.*, 2004) and may occur within the Precinct, namely:

- Spotted Shovel-nosed Frog (*Hemisus guttatus*) – “Vulnerable”
- Natal Leaf-folding Frog (*Afrivalus spinifrons*) – “Vulnerable”
- Pickersgill’s Reed Frog (*Hyperolius pickersgilli*) – “Endangered”

1.5.4.3 Reptiles

A number of reptile species (n=57) are likely to occur on the Precinct site and include 2 chelonians, 38 snake species and 17 lizard species. Only 38 of these reptile

species are considered to be widespread species and likely to occur within the Precinct site. The rest of the reptilian assemblages consist of species with *low-medium* probabilities of occurrence. The Precinct site provides thus marginal habitat for these species since they exhibit geographic distribution ranges peripheral to the Precinct site. In addition, 15 are South African endemics.

The vegetation of the Precinct site, being coastal dune forest, secondary grassy scrub and emergent vegetation associated with the Ohlangua River are able to support a number of reptile species. However, the majority of species are highly cryptic and some exhibit fossorial habits, making it difficult to observe these species in the wild. Typical species that inhabit the coastal dune forest and scrub corridors (e.g. Mhlanga Forest and Forest 31) will include a guild of fossorial species residing within the Aeolian sandy substrates (e.g. *Amblyodispas concolor*, *Macrelaps microlepidotus*, *Atractaspis bibronii* and species of the genera *Leptotyphlops* and *Typhlops*), while the tree canopy provide for an additional arboreal guild comprising of *Dendroaspis angusticeps*, *Dispholidus typus*, *Thelotornis capensis* and *Philothamnus semivariatus*.

The emergent vegetation, dense *Phragmites* and *Typha* beds provide shelter and breeding habitat for species with a preference towards moist and damp climatic conditions such as *Philothamnus hoplogaster* and *Lycodonomorphus rufulus*. Apart from these specialised habitat types, the artificial and transient habitat types (e.g. sugar cane fields and secondary grassland) provide ideal microclimatic and ephemeral conditions favoured by more opportunistic species such as *Crotaphopeltis hotamboeia*, *Naja mossambica* and *Pseudaspis cana*.

1.5.4.4 Potential Red Data Reptile Species

Branch (1988) has listed all the threatened and rare reptile species occurring in South Africa. However, this publication is now outdated and in need of revision since more information and research are available on a number of species, including a number of recently described species that warrant conservation measures. Red Data categories used in this report were retained according to Branch (1988). The following species possibly occur within the Precinct:

- *Mashona Hinged Terrapin (Pelosios rhodesinaus)* – “Peripheral”
- *Southern African Python (Python natalensis)* – “Vulnerable”
- *Forest Cobra (Naja melanoleuca)* – “Peripheral”

A number of additional species warrant conservation measures since they have restricted distribution patterns and are sought-after by reptile collectors. These include species such as the Aurora House Snake (*Lamprophis aurora*) and the Black-headed Dwarf Chameleon (*Bradypodion melanocephalum*).

Please note that all reptile species, including all snakes, are considered protected game as listed under Schedule 2 of Nature Conservation Ordinance of Transvaal (No 12 of 1983).

1.5.5 Avifauna

The province boasts an impressive list of approximately 690 species (Goodman, 2000), of which 110 were recorded in the Precinct site during the site visits (see Appendix 4 of Appendix XIX of the Draft Scoping Report, August 2006). A further analysis of the study site would illustrate that another 113 species could occur within the various habitat types available, including adjacent areas such as the Hawaan Forest (see Appendix 3 of Appendix XIX of the Draft Scoping Report, August 2006).

The East Coast Littoral is well known for its rich avifaunal diversity as a result of the varied number of habitat types (Barnes, 1998). The varied mosaic of habitat types, stable climate and the dispersal of species typical of temperate assemblages from the south and tropical assemblages from the north contributed to the expected species diversity. The recorded species are typical of the region and relatively widespread with a number of species representative of coastal forest and scrub (e.g. *Trochocercus cyanomelas*, *Stactolaema leucotis* and *Camaropectera brachyura*), secondary grassland and forest edge (e.g. *Serinus mozambicus*, *Cisticola chenianus* and *Lonchura [b.] nigriceps*) and artificial landscapes such as cane fields (e.g. *Euplectes axillaries*, *Lagonosticta rubricata* and *Motacilla capensis*). To augment the observed species diversity, the existence of wetland vegetation (dense reedbeds, open water and sedge) provides habitat for a number of aquatic species including *Acrocephalus gracilirostris*, *Ardea goliath* and *Haliaeetus vocifer*.

A number of species expected to occur are important conservation entities. These species are either endemic to South Africa or near-endemic (Barnes, 2000). Also, some of the species have Afromontane affinities with assemblages typical of the inland scarp forests while other are only found along the East Coast littoral of the African continent. Two other species have Zambezian affinities (Barnes, 1998). It was also interesting to note that two of the species expected to occur have been

identified with very small global range sizes while another two species, both vagrants to the wetlands of the area are peripheral (marginal) to South Africa (Barnes, 2000).

1.5.5.1 Potential Threatened Bird Species (Red Data Species)

The following species potentially occur within the Precinct:

- Spotted Ground Thrush (*Zoothera guttata*) – “Endangered”
- Pinkbacked Pelican (*Pelecanus rufescens*) – “Vulnerable” & Great White Pelican (*Pelecanus onocrotalus*) – “Near-threatened”
- Mangrove Kingfisher (*Halcyon senegaloides*) – “Vulnerable”
- African Marsh Harrier (*Circus ranivorus*) – “Vulnerable”
- Woollynecked Stork (*Ciconia episcopus*) – “Near-threatened”
- African Crowned Eagle (*Stephanoaetus coronatus*) – “Near-threatened”
- Broad-tailed Warbler (*Schoenicola brevirostris*) – “Near-Threatened”
- Black-throated Wattle-eye (*Platysteira peltata*) – “Near-threatened”

Three other species, *Microparra capensis* (Lesser Jacana), *Glareola pratincola* (Redwinged Pratincole) and *Spermestes fringilloides* (Pied Mannikin) historically occupied the region but it is unlikely that these species still occur on the Precinct. They are regarded as being vagrant to the study site (Barnes, 2000; Harrison *et al.*, 1997; Bennett *et al.*, 1995).

1.5.6 Invertebrates

A number of butterfly species were recorded in the Precinct site (a total of 81 species, see Appendix 4 of Appendix XIX of the Draft Scoping Report, August 2006). Most of these species are widespread and common throughout the East Coast Littoral, but some of the recorded species have their main population stronghold centred within Precinct site and surroundings areas (e.g. *Azanus mirza*, Family Lycaenidae).

The majority of species preferred ecotones and forest edge that resulted in fixed flight patterns. Some of the species were also attracted to the year round supply of nectar provided by a well-developed herbaceous layer along the forest edge. The secondary grassland along the forest corridors enhanced Lepidopteran diversity since a number of species belonging to the Satyrinae and HesperIIDae were recorded (all breeding on grass species).

1.5.6.1 Potential Threatened Invertebrate Species

None of the butterfly species recorded are considered to be threatened (according Henning, 2004).

The following insects may occur within the Precinct:

- *Heteracris zulu* – (Acrididae: Eyprepocnemidinae)
- *Sphecodemyia natalensis* (Diptera: Tabanidae)

1.5.7 Ohlanga River Catchment

The Ohlanga River has a catchment area of 135km² with the mean annual run-off of 25 million cubic metres per annum. The estuarine area is 11 hectares and the length of the river is 28km. The Ohlanga River provides one of the greater outputs of water per unit area of catchment although the total area and total discharge is smaller than that of both the Mdloti and Tongati rivers. The river channel is normally 10m to 15m wide but during floods may open up to 100m or more. In most places the lagoon is 1,5m to 2m deep, and was 3,5m deep below the national bridge in April 1977. The balance between freshwater inflow and seepage through the porous sand bar maintains a near-constant water depth averaging 1,5m.

The lagoon lies in a valley with a relatively narrow (500m) floodplain composed of alluvium of the Willowbrook form, on which *Phragmites* reed swamp is present. The lagoon has shown little morphological change over recent decades suggesting that a state of dynamic equilibrium has been reached between sediment accumulation when the lagoon is closed and scour when the mouth is open. Modern lagoonal sediments include marine sand derived by barrier overwash, onshore winds and incoming tides when the mouth is open and catchment derived sediment comprising mainly fine-grained sand and mud. Erosion of surrounding sediments, including aeolian dunes, contributes a minor portion of the lagoonal sediments.

Heavy rains in the catchment during summer result in the flooding of the estuarine lagoon and breaching of the sand bar. During flood conditions, estimated current velocities in the lagoon reach 50 to 60 cm per second. The strong outflow of turbid water decreases after a few days, allowing seawater inflow into the estuary. The mouth closes quite rapidly, normally within 10 days, due to littoral drift and wave action, and the lagoon again fills due to freshwater input from the river. The inlet does not migrate because of rapid closure. The estuary remains closed to the sea for most of the year because the inflow of freshwater from the river is insufficient to counteract

the effect of longshore drift, and therefore a sand bar is maintained across the mouth. The Ohlanga lagoon is suffering from sedimentation as is apparent when the bar at the mouth is breached; otherwise the high level of impounded waters masks this feature.

Sugar cane cultivation is the predominant agricultural activity in the river basin and has been associated with increasing suspended solids, excessive nutrient loads, and toxic organic chemicals, notably pesticides and herbicides reaching the streams and rivers. Poor quality stormwater runoff from large high density low cost housing schemes (e.g. the Waterloo Low Cost Housing development) alter base flow patterns, peak flow discharges, and response time ultimately impacting on the estuarine mouth dynamics and therefore the ecology of this coastal system.

During the late 1970s the N2 highway was constructed and for approximately 2½km, the N2 is graded towards the river valley, thus creating a vast catchment area which drains directly into the river.

There are two waste water treatment plants in the Ohlanga River basin, the Phoenix and Umhlanga Sewage Treatment Works. The Umhlanga Sewage Treatment Works (STW) situated on the southern bank of the river near the N2 bridge crossing discharges treated effluent into the river. The works are operated by the eThekweni Municipality who has had a regular water quality monitoring programme running over recent years.

There has been a significant impact on the ecology of the estuary due to the flows from the two treatment works which, due to the potable water being utilised within the Ohlanga catchment originating from the Umgeni catchment, has resulted in there being too much water within the river. This has caused, according to DWAF, the estuary to breach more often than it naturally would, thus impacting upon the estuary's ecological integrity.

1.5.7.1 Water quality of the Ohlanga River

1.5.7.1.1 Historical information

In 1964 the river was found to exhibit only slight organic enrichment and faecal pollution was noticeable above the sewage works, probably originating from small villages in the catchment.

Bilharzia: Physopsis snails were collected in the upper reaches of the Mhlanga River in 1964 and in several localities in the catchment in July of 1970. Staff of the Institute of Parasitology have recovered bilharzia snails from the reeds within the confines of the lagoon itself. The discharge of a sewage effluent into the river above the lagoon probably makes conditions particularly favourable for these snails. Consequently one can assume that the Mhlanga lagoon is not bilharzia free.

The Report by Begg (1978) includes a description of the chemistry of the lagoon, the characteristics of which can be obtained from the analyses of samples taken 2,4km upstream of the lagoon in 1964. An outstanding characteristic of the water was the high degree of mineralization, apparent from its conductivity and proportions of chloride and carbonate, possibly the result of excessive run-off of water used for irrigation. Salinity measurements taken in February 1975 indicate that the system can exhibit salinity stratification (7‰ at surface, 32‰ at bottom). In April 1977 surface salinities throughout the system were less than 1‰. The Umhlanga sewage works discharge a treated effluent into the river 2km above the lagoon. Begg (1978) states that although the lagoon does not appear to exhibit any of the eutrophic characteristics which would normally result, tertiary treatment should be considered to minimize the nutrient loading.

The Phoenix waste water treatment plant became operational after the 1983/84 summer season. Water quality was monitored and in 1986/87 the conditions were regarded as satisfactory when chlorinated but the effluent was algal laden which produced a substantial oxygen demand in the river.

1.5.7.1.2 Present status

The river valley is characterised by large tracts of reed beds. A condition which is unlike most of the sandy river beds of neighbouring catchments. Bacterial decomposition of the excessive plant litter (dieback) may be responsible for the low oxygen levels when the river flow is low. The river is not regarded as a turbid system because of the filtering activity of the reed beds which allow for self-purification to a large degree of the muddy waters which are generated from soil erosion in the upper catchment after rain events.

The bacteriological levels of the river are not high when compared with other streams of the region which are exposed to runoff from informal settlements. The Ohlanga

River is relatively "healthy" due primarily to residual effects of chlorination of the effluents at two points and the effective "screening" by the reed beds.

Salinity in the lagoon varies from totally fresh to hypersaline, averaging less than 10 parts per thousand (ppt), i.e. less than 30% seawater. Low salinities of around 3 ppt have been measured in the river up to 1.5km inland. Conductivity values increased markedly in the estuarine zone where marine intrusions occur during periods of low river flows set against high tides and contribute to the increased mineralization of the water. Leaching from irrigation practices could also contribute to the high conductivity.

The oxygen regime of the river has been shown to be stressed. Previous studies by the CSIR (1994) on the Ohlanga River showed that the oxygen regime was stressed by the low main channel flows and by the continuous inputs of oxygen-demanding substances from the Phoenix and Umhlanga Sewage Treatment Plants.

The Umhlanga STW does not have a significant effect on water quality in the river. Pollution problems are experienced in the area upstream of the works, and are generated in the wider catchment of the river.

1.5.7.2 Fauna of the Ohlanga River System

1.5.7.2.1 Aquatic Invertebrates

The aquatic fauna of the Ohlanga River was found to be generally impoverished in the SASS4 survey, in terms of insect life but productive in terms of the sand prawn *Callinassa kraussi*. It seems from this and the high conductivity of the water that there is a residual salinity, even on streams draining the present sugar cane field that restricts their suitability for purely freshwater insects.

Zooplankton

Plankton was sampled in May 1977 and the results showed that densities of plankton in the Mhlanga system exceeded figures obtained from St Lucia (Begg, 1978).

The composition of zooplankton in the estuary was shown by Whitfield (1980) to be dominated by calanoid copepods (micro-crustaceans) during the closed phase and decreased dramatically in number when the estuary opened. Larval forms also constituted a significant proportion of the zooplankton including fish larvae, copepod

nauplii, gastropod larvae, bivalve spat and macruran larvae. Fish larvae were most abundant after the estuary had opened up and were marine in origin.

Benthos

A study was conducted on the sand prawn *Callinassa kraussi* in the lagoon in 1975. It is significant that these animals were confined to a sand bank on the western shore, considered to be an indication of the low silt volumes. The benthic community in 1964 was not particularly diverse or numerous 2,5km above the lagoon, and was dominated by Chironomid larvae.

Fauna of marginal vegetation

This niche was dominated by *Simulium* 2,5km above the lagoon in 1964. Bilharzia snails have been collected amongst reeds in the lagoon and crab life is prolific (observed by Begg, April 1977).

Fish

Juveniles of eight of the main species of estuarine fish in KwaZulu-Natal were present in the Mhlanga lagoon (netted in 1975). In May 1977 there were a minimum of 15 species present and a large number of juveniles. Much earlier than this Campbell recalls that "all types of fish were plentiful" and specifically mentions bream, grunter and rock salmon. In May 1977 a few small kingfish, pouters and mullet were caught in seine nets.

Harrison and Whitfield (1995) made a study of the fish in the estuary over a 20 month period. A total of 7961 specimens representing 19 families and 47 species were captured with *Gilchristella aesturia* (round herring) being by far the most abundant species (45.7% of the total catch). *Oreochromis mossambicus* (17.8%), *Valamugil cunnesius* (8.9%), *Vulamugil sp.* (6.1%) and juvenile mugelids (mullet) (4.7%) were the next most abundant species present. Most species present were either totally estuarine (47.6%) or estuarine-dependant marine species (43.2%) with freshwater species accounting for 17.9%. The number of individual fish species was found to peak in the summer months and, amongst other factors, were related to the opening of the river mouth to the sea.

According to Ezemvelo KZN Wildlife, there is a Red Data Book catfish *Clarias theodora*, which reaches the southern limit of its distribution in the Ohlanga River. There are no recordings of this species, however, in the published literature.

Begg (1992) includes the Freshwater Mullet and Burrowing Goby as Red Data Species occurring in the lagoon. These are however, classified as "indeterminate" species which might be worthy of inclusion in one of the above categories, but for which insufficient information is available to assess their status.

Benthic fauna and flora

The benthic fauna and flora (mainly macroalgae) living between the high and low tide lines on the shore, either in sediments or attached to hard surfaces such as rock. There is a paucity of published information on the marine inter-tidal flora and fauna on the KZN coast.

Rocky Shores

Due to the gradient of physical stresses to which inter-tidal organisms are subject, such as the high part of the shore being generally more stressed due to increased periods of exposure to the air, they tend to be found in distinct zones or bands according to their respective adaptations. On most South African rocky shores, four distinct zones are recognised (Branch and Branch, 1993).

On the East Coast, the highest is the Littorina zone consisting of *Littorina* and *Nodlittorina spp.* and the alga *Bostrichia*. Immediately below this occurs a dense band of the Natal rock oyster, *Saccostrea cucullata* which gives way to the Ballanoid zone consisting of barnacles such as *Tetraclita* and *Octomeris spp.*; limpets such as *Cellana* and *Patella spp.*; and brown mussels, *Perna perna*. The lowest part of the shore is typically dominated by algae such as *Hypnea spp.* and *Spiridia*, zooanthid anemones and corals. A number of animals such as urchins, fish and crabs can be found in rock pools (Branch and Branch, 1993).

No rare or endangered species were highlighted in the above studies. Furthermore, there is no systemised method, such as Red Data Book listings, of designating and protecting coastal marine invertebrates or seaweeds.

Sandy Beaches

Zonation on sandy substrates is often less distinct than on rock shores due to generally shallow beach angles and greater homogeneity of the environment within the body of the sediment. Branch and Branch (1993) describe a general east coast zonation, comprising: high-shore scavengers such as *Ocypode spp.* crabs; low-to

mid-shore migrating carnivores such as the molluscs, *Bullia rhodostoma* and *B. natalensis*, the crustaceans, *Pontogeloides* and *Excirolana sp.*, and filter feeders such as the bivalve mollusc, *Donax madagascarensis* and the crustaceans, *Emerita sp.*, *Hippa sp.* and *Gastrosaccus sp.*

1.6 ARCHAEOLOGY

(The following information has been extracted from the Archaeological Survey for Tongaat-Hulett on the Proposed Casino Site prepared by Gavin Anderson of the Institute for Cultural Resource Management of the Natal Museum, 4 June 1997, and acts as a summary of the findings thereof, for full details see Appendix XX of the Draft Scoping Report, August 2006.)

A total of 27 archaeological sites were noted during the course of the survey (which included both a desktop study and field investigation). These sites date to the Iron Age (IA), Stone Age and Historical Period and are depicted on Figure 1.2.

Only two Stone Age sites were recorded in the survey. The Middle Stone Age site was of low archaeological significance, while the Late Stone Age (LSA) site is of medium significance. The low frequency of Stone Age sites in this area makes the recorded LSA site significant.

Two Early Iron Age (EIA) sites were recorded. While several of these types of sites occur along the coast, few have been fully excavated and/ or studied. These sites (site 15 & 2931CA98) would need to be excavated.

The majority of the recorded sites date to the early phase of the Late Iron Age (LIA), a time period of which little is known. Furthermore, there are several sites that have archaeological deposits and well preserved artefacts and features. These will thus require mitigation if they are to be affected by development. These sites tend to be significant since they may provide a unique opportunity to study the use of a small defined area through time. This has the potential to provide information regarding resource use and exploitation, differences in pottery styles, and the socio-economic patterns from this time period. This information has the potential to further our understanding of the origins of the LIA and its relation to the people of the EIA and Historical Period. It is for this reason that several of the LIA sites will require test-pit excavations or sampling strategies, while two will need to be excavated (site 3).

The occurrence of Indeterminate Iron Age sites is probably a result of preservation and dense vegetation. Seven of these sites were recorded, and all have low archaeological significance. Two sites will need to be revisited once the vegetation has been cleared, or thinned out, since they could not be thoroughly assessed. One site has possible deposit and well preserved artefacts. This site (site 22) should be excavated to determine its position in the chronological sequence of the area.

Only four sites dating to the Historical Period were recorded. Little analyses of the material remains from these sites, especially those belonging to European colonists, has occurred in KZN. Archaeological excavations in the Western Province have clearly shown the benefits of undertaking archaeological excavations, as well as written sources, to understand the colonial impact on the landscape and other people. The interaction between European colonists, Zulu society, and indentured labourers, is a small but significant part of this country's (and province's) history. These sites will first require a deeds survey to indicate their approximate age, ownership, and so forth. If the sites are older than 60 years, then three should have test-pit excavations, and one should be sampled. If the test-pit excavations yield valuable information then further excavations should be undertaken.

During the course of the survey, several areas were inaccessible due to dense vegetation. Most of these areas occurred along the dunes. If development is to occur in these areas, further archaeological work will be required after the vegetation has been cleared – preferably not by bulldozers.

1.7 SOCIO-ECONOMIC ENVIRONMENT

(The following information has been extracted from the report, Socio-Economic Impacts of the Development of the Sibaya Precinct: Expanded Analysis by Dr Jeff McCarty, May 2006. See Appendix XXI of the Draft Scoping Report, August 2006 for full details).

The existing socio-economic environment can be looked at on a national, provincial and local level. The following summarises the provincial standpoint before giving summarised details of local level components.

1.7.1 Provincial Level

The indicators of provincial economic progress since 1996 are unfortunately also not auspicious. Despite growth parity over a longer period, provincial research, for example by the Department of Finance shows that, even within the (challenged) national context, KZN has tended to fall behind on most indicators of prosperity, since 1996. According to year 2003 reports from the KZN Department of Finance:

- KZN had the largest incidence of poverty in the country with 50% of all households in poverty by 2001 (by comparison with 45% in 1996)
- Between 1996 and 2000 the number of those unemployed in the province rose by some 135 000 to reach over 1 million unemployed
- Between 1996 and 2000 KZN provincial GGP growth was only some 1% p.a., about one half of national average, with only a slight improvement in provincial growth performance in 2001 and 2002.

Related to this, the province's major metropolitan area (eThekweni/Durban) has been experiencing decreasing economic competitiveness, as was reflected *inter alia* in the 2002 Monitor Group/Unicity report, Durban at the Crossroads. It was observed there, amongst other considerations that:

- "Few companies are leveraging their advantages...(and) Head Offices have migrated to Johannesburg" (pp. 20-21)
- "Durban needs to serve and compete in global markets where there is greater potential for growth..." (p. 30)
- "Durban must grow in parts of the economy which have high multiplier effects..." (p. 31).

These signs of underperformance, and lack of confidence, in metropolitan Durban are not necessarily the product of any recent policy factors, but are rather mostly the reflections of longer term trends in terms of which the province has become something of a 'branch economy', practicing business in often uncompetitive industrial sub-sectors. As an illustration of the former (branch economy) problem, in 1965 Durban hosted the headquarters of 19% of SA's top 100 companies; this fell to 15% in 1970; 9% in 1980; and 5% in 2000(Centre for Development and Enterprise: Johannesburg: Africa's World City, CDE, Johannesburg, 2002, p. 20)

1.7.2 Recreational Opportunities

The wider precinct currently has little recreational value, except for its rare (and illegal) use by the public for purposes such as “scrambling” on motorbikes through private farm roads. The only use to which the site is put at present is agriculture, although southwards of the site itself birdwatchers sometimes use the Ohlanga River and Hawaan bush. There is however potential from a recreational perspective given the precincts physical and natural attributes, characteristics, location and access.

1.7.3 Tourism

Data from Tourism KZN reveals that there has been a steady decline in both share and absolute numbers of international air arrivals to SA visiting KZN. Attracting these tourists with products that focus on their declared interests (first nature, then culture), and providing them with enhanced safety is the key to reversing this trend. Similarly with, and possibly associated with, the recreational potential, there is also tourism potential in the precinct which should be maximised.

1.7.4 Residential

There is currently a shortage of middle income housing in the Metropolitan area according to Jeff McCarthy’s report (Appendix XXI of the Draft Scoping Report, August 2006).

1.7.5 Economic growth

As we have observed earlier, however, after 2003 the pace of economic growth picked up nationally and in KZN, so that during 2000-2004, growth in GGVA for example in Trade, Transport and Real Estate and Finance, Real Estate and Businesses services were all above 6% p.a. in this period in both KZN and Gauteng. (By contrast in provinces like Northwest, Eastern Cape, Limpopo and Free State same the rates in these sectors were less than half at about 3%, in certain cases lower still). It is this new growth momentum against a background of relative stagnation that the proposed Sibaya precinct, together with the Dube Tradeport, plans to build around, accommodate and extend.

1.7.6 Employment

At present there are 40% of Durban’s people living in the North and North Central Council areas of Durban, but there are only some 27% of metropolitan jobs in the same area. This has led to the observation inter alia in the Metropolitan Council’s Spatial Development Framework that such job imbalances contribute towards

transport inefficiency, which can be alleviated by encouraging job creation to the north of the city.

1.8 TOWN PLANNING SCHEME

The entire precinct is within the Umhlanga Town Planning Scheme No. 1 in the course of preparation and, apart from the 3 Hotel sites and the Mhlanga Forest Estate is zoned Undetermined.

1.9 BULK SERVICES INFRASTRUCTURE

The existing bulk services infrastructure is discussed in Appendix 2 where the infrastructure pertaining to each service (water, sewers, roads, electricity, and storm water) is discussed and necessary upgrades proposed.