

**APPENDIX 2:  
DEVELOPMENT PROPOSAL**

## 2.1 NEED FOR THE DEVELOPMENT

Moreland Developments (Pty) Ltd have motivated that there are a number of factors relating to the “need” for development to occur in the Sibaya Precinct, namely:

1. The development of the Sibaya Casino
2. The development of major infrastructure (services and roads)
3. The fact that there are existing zoning rights
4. The relatively poor agricultural soils (on particularly the area to the east of the M4)
5. The King Shaka International Airport and Dube Tradeport
6. The need for new investment and economic growth
7. The significant potential of the precinct given its physical and natural attributes and characteristics
8. The site’s strategic location, visibility and accessibility
9. The lack of back of beach activities and facilities in the sub-region

According to Moreland, the first two, related to the Sibaya Casino and construction of major new infrastructure are particularly relevant and important. Sun International’s decision to develop the Casino in this location was based on a variety of issues but a key factor was the significant development potential of the wider node, of the potential for resort hotel developments, commercial developments, recreational developments as well as residential developments. The Casino developers (Sun International) saw the Casino as the main catalyst that would kick-start the development of the node and ultimately have it as just one of the attractions into a large tourist, recreational node (Moreland, 1998).

In terms of infrastructure that has been constructed in the sub-region, this includes bulk sewerage reticulation, bulk water supply, bulk electrical supply, traffic circle enabling access off the M4, a massive new interchange on the N2 as well as a link road between the M4 and N2. All of these services have been designed and planned to be able to accommodate the future development of the subregion and many will only become viable once the remainder of the node has been developed. Moreland’s viewpoint is that in this regard, in the context of scarce government resources for facilitating investment and economic growth, full advantage should be taken of the investments that have already been made by both the local authority as well as the private sector.

As part of the development approvals for the Casino and in order to ensure and provide for associated resort/hotel developments, three additional sites were rezoned in the precinct to provide for such development potentials (Moreland, 1998). Whilst the development of such sites requires approvals in terms of this EIA, the fact that they have existing zoning rights must be taken into consideration.

An increasing amount of land on the east of the M4 is being removed from sugar cane production as a result of its poor productive capacity. This area is therefore becoming invested with alien weeds and a haven for dumping and illegal occupation. Some would argue that this is an increasing threat for the security of Umdloti but also is a major negative factor in terms of the future development potential of the subregion.

The decision that the new King Shaka International Airport and Dube Tradeport are to be developed has been taken into account in the need for development in the Precinct. This is obviously significant, not only for the north coast, but, possibly even more significantly, for the site. The site is located 5 minutes away from the future airport and situated en route from Durban and Umhlanga. As such it is likely that its role will be transformed from that of an agricultural farm with an international Casino situated on it, to what could be argued is a strategically located, highly visible and accessible development node that will need to provide activities and facilities in support of the airport such as hotels, residential developments, appropriate commercial developments as well as increasing the tourist and recreational attributes. Moreland's contention is that the land will simply become too prime and too strategically located not to be developed.

At both the provincial and local level, there is an explicit, significant requirement for new investment and for economic growth that leads to employment creation in an effort to wipe out poverty levels. In order for this to have a major impact, large new investment opportunities need to be provided. This will be most effective in well located and situated land with the appropriate physical and natural attributes. Moreland suggest that the Sibaya precinct is just such a piece of real estate. Its location as discussed above, its visibility and accessibility and the incredible natural and physical components all contribute to the fact that this site has immense potential to the extent that it is virtually unparalleled in the greater metropolitan area. The potential socio-economic and environmental benefits that can be realised through the development of the precinct are significant.

Moreland feel that, in the broader context, location, situation and physical and natural attributes of the site, an option of retaining as sugar cane is totally unrealistic. The site is located within the heart of a rapidly growing city metropole; a major new tourist facility has been completed and is attracting, and requires, new development investment and complementary uses to be developed in the area.

## **2.2 PROPOSED ACTIVITY**

The potential land uses of the new alternative (Figure 8) can be described as follows (numbers refer to corresponding numbers on the concept layout):

- The development of a new town centre (1) in the northeast corner of the Precinct (behind Umdloti). The new town centre will offer commercial, residential and recreational facilities.
- Office (6), retail (10) and medium density residential (14) in the northwest section of the precinct.
- Residential (23), resort residential (18), hotel/ resort (20), entertainment/ recreation facilities (20, 21, 22, 26, 28) on the land surrounding the Sibaya Casino (24).
- South of the casino-related developments and leading south to the Ohlanga River, the proposed land uses are medium/ low density residential (23), recreation (32, 39, 40, and 41) and new forest matrix (33).
- Medium density residential developments (14), a resort (13) and a forest estate (15) are proposed for the land south of the proposed new town centre, east of the M4 and west of the Mhlanga Forest.
- A resort (42) is proposed for the parcel of land west of the N2, north of the Ohlanga River.
- In the south east corner of the Precinct, land uses such as a family resort, (35), public parking (36) and public space (37) have been proposed.
- Within the Mhlanga Forest, at the current location of the ski boat club facilities, a niche resort and spa (29) has been proposed.
- Further recreational developments proposed include a beach groyne (30), bathing beach (31), dune boardwalk (25) and a gondola link over the Mhlanga Forest (27).

The specific land uses are defined as follows (Table 1).

**Table 1.** Land use descriptions (see Figure 8).

LAND USES	
LAND USE DESCRIPTION	LAND USE DETAILS
Low Density Residential – 10Du/Ha	Single dwelling units
Medium Density Residential – 40Du/ha	Cluster/Townhouse units
High Density Residential - 80Du/ha	Apartments
Resort/Hotel/ Residential	Hotels, Resort developments that include hotel and residential at low and medium densities
Resort/HD Residential	Hotels, Timeshare, flats
Commercial	Shops, Offices, Restaurants
Offices	Offices and limited shops
Recreation/Entertainment	Open Space, Walks, Running, Boardwalks, Gondola, Luge, White Water rafting, Lazy river ride, Forest Trails, Botanic Gardens, Butterfly, Monkey sanctuary, Animal Farm, open air concerts, fishing dams, wetland habitats, pedestrian bridges, etc.
Mixed-use	Retail (shops) on the ground floor, with possibly offices above and residential above that - or just the shops and residential or offices and residential

The proposed heights will vary according to the topography but will generally include two to six storey buildings with an iconic building of 10-15 storeys at key locations (Figure 9, Heights map).

In summary, the proposed development could potentially consist of:

- 6000 Residential Units
- 8 Hotels/Resorts
- 186 000m<sup>2</sup> commercial bulk (commercial and offices)
- Conservation/ Recreational/ Leisure activities – examples could include any or all of the following (some of which may require additional investigation) - luge, botanic garden types of activities, white water experience, water bodies, animal farm, monkey sanctuary, butterfly farm, gondolas, boardwalks, foofy slides, animal hides, forest trails and boardwalks, estuary trails and boardwalks, beach access and public facility, swimming beach.

## 2.3 DEVELOPMENT NODES

Moreland have divided the Precinct into 5 development nodes/ precincts (Figure 10). Node 1 comprises the development area south of Node 5, between the M4 in the west and the Mhlanga Forest in the east (Figure 10). It consists of medium density residential/ mixed use developments (14), offices (6), a resort (13) and a forest estate (15) (Figure 7).

Node 2 comprises the south and south west of the Sibaya Casino (Figure 10). It consists of hilltop resort residential (18), mixed use/ commercial (17), hotel/ resort/ entertainment (20), butterfly hilltop (22), medium/ low density hilltop residential (23) and a riverside resort (42) (Figure 7).

Node 3 comprises the area to the east of Node 2 and bordered by Forest 31 in the east (Figure 10). It consists of medium/ low density hilltop residential (23) and a new forest matrix (33), a family resort (35), public parking (36), public space (37) and a boardwalk link (38) to the beach (Figure 7). Moreland included the niche resort and spa (29, Figure 7) within their node/ precinct 3; however, we have decided to deal with this separately with environmental considerations for this node described under Node 6.

Node 4 comprises the north western section of the Precinct bordered by the MR 96 in the north, the N2 in the west, the M4 in the east and the Sibaya Casino in the south (Figure 10). It consists of mixed use - retail and offices (10), offices (6) as well as medium density residential/ mixed use developments (14) (Figure 7).

Node 5 comprises the hill behind Umdloti, and constitutes the north east corner of the Precinct (Figure 10). It consists of mixed use, commercial, hotel, high density residential, higher order civic facilities (1) as well as offices (6) (Figure 7).

Moreland are also proposing a number of back-of-beach activities for the Precinct, the environmental considerations of which are also discussed below.

## **2.4 INFRASTRUCTURE**

Major infrastructural investments have already been made including:

- The N2 interchange
- The M4 traffic circle
- Bulk sewer (Sibaya to Phoenix Treatment Works)

- Bulk electricity – sub-station and reticulation
- Bulk water

Infrastructural requirements and proposals are discussed below.

#### 2.4.1 Traffic

(The following information has been extracted from the Sibaya Precinct Traffic Aspects Report (Updated) prepared by Dave McFarlane & Associates cc, August 2006 and acts as a summary thereof, for full details see Appendix XXIV.)

The report is an update on the earlier report prepared by Vela VKE, “Sibaya Precinct Traffic Aspects”, June 2005 (Appendix XXV).

The overall approach adopted in this assessment was localised in nature. The new infrastructure being considered is not seen as providing major through routes for long distance trips in the Municipal area, rather access to specific localised developments. The impact on the surrounding road network is addressed, however.

##### 2.4.1.1 Future Land Use

The proposed future land uses (broken down into 5 nodes) for the precinct area as shown on Figure 10, used in the determination of the traffic requirements are detailed in Table 2 below.

**Table 2.** Future land use

Node	Commercial (m <sup>2</sup> )	Offices (m <sup>2</sup> )	Residential (DU's)	Hotel*		Entertainment/ Recreation (m <sup>2</sup> )
				Area	Beds	
1	29 150	29150	845	6 508	130	0
2	19 877	0	1180	24 512	490	15 646
3	0	0	605	11 477	230	9 590
4	0	34 347	1 970	0	0	0
5	26 368	0	1 400	5 239	105	11 546
<b>TOTAL</b>	<b>75 395</b>	<b>63 497</b>	<b>6 000</b>	<b>47 736</b>	<b>955</b>	<b>36 782</b>

\* Assuming 40 m<sup>2</sup> per room

##### 2.4.1.2 Trip Generation

The various land uses being considered are:

- The Sibaya Casino
- Petrol Filling Station (existing)

- Commercial
- Residential
- Hotels
- Offices
- Entertainment / Recreation

The trip generation of the Sibaya Casino was extracted from earlier investigations (VKE

*Engineers, "Traffic Impact Assessment for a reduced scale Entertainment Complex north of Umhlanga, KwaZulu-Natal" (Report No. DR98/15), March 1998.)* as shown below. We are confident of these figures as the assumed trip generations in this earlier investigation were compared to actual counts at the Sugar Mill Casino, with a good correlation found.

Weekday AM Commuter peak: 420 in / 160 out

Weekday PM Commuter peak: 680 in / 570 out

For the petrol filling station, 4 percent of passing traffic was assumed to visit the facility.

For commercial, relatively high trip generation retail was assumed (food stores, cafes etc.). The trip generation assumed was based on 4/100m<sup>2</sup> GLA (PM peak) with the AM peak 25% of the PM peak, a 50/50 split and 25% reduction for pass-by trips.

For residential, a slightly lower rate than normal was used due to less permanent residents, as has been found in surveys of up market residential developments such as MECCE 1 and 2, and a high proportion of high density residential (HDR) being cluster housing/apartments rather than SR units.

Residential = 0,9 /DU (25/75 split)

For the hotels, the trip generation rate assumed was as below.

Per occupied room = 0,7 /room

Assumed occupancy = 70%

Assumed rate = 0,5 /room (50/50 split)

For the entertainment / recreational, it was assumed that low traffic generators (in weekday commuter peaks) would be developed. Based on American literature, the assumed trip generations were as below:

AM peak hour = 0,3 /100 GLA (75/25 split)

PM peak hour = 0,6 /100 GLA (50/50 split)

For offices, standard trip generation rates were applied.

Offices = 2,3 /100 GLA (85/15 split)

The results of these assumptions as applied to the land use are shown in the Appendix (see Appendix XXIV).

#### *2.4.1.3 Trip Distribution*

The route trips would take to enter and exit the area was based on a subjective assessment by area, details of which are contained in the Appendix (see Appendix XXIV).

#### *2.4.1.4 Traffic Impact*

##### Internal Road Network

Based on the proposed land use and applying the assumed trip generations and trip distributions, the predicted commuter peak hour trips on selected links (as extracted from the spreadsheet assignment model) are shown in Figure 2 and 3 (in Appendix XXIV) for the AM peak and PM peak respectively.

Based on the above, the following road links will ultimately need to be four lanes (2 + 2)

- Sibaya link road (N2 interchange to main access circle). Although currently a two lane two-way road, the ultimate cross section is 4 lanes (2 + 2) with a median island. This road is seen as the main backbone of the road network for the precinct.
- The main spine road from the Sibaya link road as far as the proposed northern traffic circle on the M4.
- West side of the existing M4 circle (already constructed).

The ultimate layout for the Sibaya N2 interchange is 5 lanes over the N2 and double on and off south facing ramps. What is currently in place is the first phase, which allows for the ultimate layout when required.

The remaining roads can operate as two lane facilities. Localised widening at intersections and accesses to major developments will be required, but this can only be determined at the detailed layout stage of the development. This is particularly relevant to the east of the existing M4 circle where commercial developments are planned.

With the two traffic circles planned (plus existing) on the M4, the main benefits will be ease of access to the various planned land uses from the M4.

#### External road network

The size of the Sibaya Precinct (and hence the traffic it will generate) is significant. Listed below are the external road network elements, which will need to be addressed.

- Widening of the N2 to 6 lanes south of the Sibaya interchange. If acceptable to SANRAL, this could be achieved by simply repainting the lanes at relatively low cost, as was recently done on the N2 south of the Umhlanga N2 interchange.
- Modifications to the Sibaya N2 interchange (as discussed under Internal Road Network above).
- Localised widening on MR96 between the new access position and the M4.
- Widening of the M4. The intention is not to widen the M4 in this vicinity for the following reasons:
  - The impact on the environmentally sensitive Hawaan Forest on both sides of this section of the M4. It is highly probably that permission will not be obtained (from an environmental control viewpoint) to encroach into the forest in order to widen this road.
  - The character of this section of the M4. This road is arguably one of the most scenic roads in the entire eThekweni Municipal area, with huge tourist potential. To widen this road to a high capacity facility will impact severely in the role this road currently has.
  - Knock on effects. This road as a 4 lane facility (2 + 2) can only be effective if more capacity is provided on the M4 further south. This would effectively mean a 6 lane facility (3 + 3) on the M4 from MR94 (M41) all

the way to the Umgeni River crossing, a massive undertaking and something unlikely to happen in the medium to long term.

- The impact of the Tongaat Toll plaza on the N2 to the north. Much of the existing traffic on this section of the M4 is bypassing the N2 toll. Addressing this problem would have many long term benefits for the north coast to beyond Ballito.
- With more capacity available on the N2, commuters from the west on MR96 (M27) will start using the N2 rather than the M4.

#### Phasing of road infrastructure

In broad terms, the road infrastructure that can be phased is that which will ultimately be four lanes (2 + 2), which initially can be constructed as two lanes (1 + 1), (which is currently the case with the Sibaya Casino link road). The remaining road infrastructure will effectively also be the ultimate.

#### **2.4.2 Electricity**

The area will be serviced out of the Umdloti Major Substation. The existing feed from this feeder point will be strengthened by adding another feeder cable to feed separate distributors within the development area. The estimated total future load for the development is about 20MVA (see Appendix XXVI for letter and associated layout drawing indicating proposed distributors and positions).

#### **2.4.3 Water Reticulation**

(The following information has been extracted from the Sibaya Node Engineering Report in Respect of the Bulk Services for the Development prepared by Vela VKE Consulting Engineers & GOBA, May 2006 and acts as a summary thereof, for full details see Appendix XXVII.)

##### *2.4.3.1 Existing Infrastructure*

The existing Waterloo reservoir to the west of the development currently supplies water to Umdloti and the Sibaya Casino. An existing 250mm diameter water main, from the Waterloo reservoir, runs parallel to the existing MR96, crosses the N2 and M4 and feeds the existing Umdloti reservoir. At the M4 crossing, the water main splits into two 250mm diameter mains. One is a direct feed into the Umdloti Reservoir and the other a direct feed to Sibaya Casino which runs parallel to the M4 until the traffic circle.

#### *2.4.3.2 Proposed Infrastructure*

eThekwini Water and Sanitation Department has confirmed that they will be able to supply a portion of Node 1, comprising 373 residential units and 16 422m<sup>2</sup> (area is after application of the floor area ratio FAR) of commercial area, from their existing bulk water network (250mm). Other nodes within the development will be supplied from the proposed Umdloti Reservoir. A portion of land is currently being negotiated between Moreland and eThekwini Municipality Water and Sanitation. eThekwini Municipality Water and Sanitation indicated that they are in the process of appointing an engineer for the design of the reservoir.

The proposed bulk water reticulation and the existing 250mm diameter main, feeding Sibaya Casino, will feed off the proposed new reservoir. The existing 250mm diameter water main along the M4, running south, will be extended along the Sibaya Link Road in a westerly direction.

The existing and proposed new bulk water reticulation is indicated on drawing DH835-SERV-01. The design and construction of the bulk and internal water mains from the proposed reservoir will be done in accordance with eThekwini Water and Sanitation guidelines and most likely constructed by eThekwini Water and Sanitation.

#### **2.4.4 Sewerage Reticulation**

(The following information has been extracted from the Sibaya Node Engineering Report in Respect of the Bulk Services for the Development prepared by Vela VKE Consulting Engineers & GOBA, May 2006 and acts as a summary thereof, for full details see Appendix XXVII.)

##### *2.4.4.1 Existing Infrastructure*

eThekwini Municipality Water and Sanitation has recently installed a sewer trunk main that feeds the majority of the Sibaya node. The Sibaya node is bisected by a ridge that runs north to south. The existing trunk sewer runs on the western side of the ridge in a southerly direction towards the Ohlanga River and is collected at pump station on the Ohlanga River.

##### *2.4.4.2 Proposed Infrastructure*

It is proposed that the Sibaya node will be serviced with waterborne sewerage. This is an acceptable method by eThekwini Municipality Water and Sanitation for the disposal of sewerage.

The proposed majority of the water borne sewerage reticulation connects into the existing trunk sewer. The sites north of the trunk sewer will connect into the head of the existing trunk sewer at Point A. The sites to the east of the ridge will gravitate southwards to the Ohlanga River and connect into the existing trunk sewer at Point B as indicated on drawing DH835-SERV-01.

There is an isolated portion of the Sibaya node in the north and the south that will not be able to gravitate to the existing trunk main, unless pumped. It is proposed that this portion gravitates to a low point and then pumped towards the trunk main. The proposed pump stations C & D respectively are indicated on drawing DH835-SERV-01.

A portion of the Sibaya Node in the north east gravitates seaward and falls into the adjacent catchment at Point E, called the Goba catchment. The flows from this area have been incorporated into Goba's design. Similarly, a portion on the east of the M4 near the existing M4 traffic circle at Point F within Goba's portion of the works flows into Vela VKE's catchment. These flows have been incorporated into our design.

The existing sewerage pump station on the Ohlanga River, where all the sewerage from the VVKE catchment and a small portion of the Goba catchment flows into, is sized to cater for a peak flow of 58 l/s based on the original concept layout dated March 2000. The pump station was designed by HR Africa Consulting on behalf of eThekweni Municipality Water and Sanitation based on the concept layout dated March 2000. The attached sheets called SIBAYA NODE – Sewer Flow Generations for VVKE Catchment indicates the updated peak flow flowing into this pump station of 119 l/s based on the updated layout and units serviced. Based on the updated information the pump station will have to be upgraded to take into account the increase in flow. A detailed investigation will have to be undertaken by eThekweni Municipality Water and Sanitation to determine the upgrade requirements.

The existing and proposed trunk sewerage reticulation is indicated on the drawing DH835-SERV-01. The design and construction of the trunk sewer mains will be done in accordance with eThekweni Water and Sanitation guidelines.

Sewage from Nodes 1 & 5 and a portion of Node 4 will discharge at 3 separate points into the existing sewerage system. The 3 discharge points are shown the attached

drawing called Sibaya Precinct (Node 1 & Portion of Node 5) Bulk Services Layout - Figure 11.

Discharge Point 1: To existing Casino Outfall (refer to Figure 11 & Table 1 (in Appendix XXVII))

A new 3.6km long sewer outfall is to be constructed collecting sewage from a portion of Node 1 (Blocks 1.1, 1.2, 1.3, 1.9, 1.10, 1.11, 1.12 & 1.13) and Nodes 2 & 3. This outfall will connect into the existing Casino outfall.

Discharge Point 2: To existing Umdloti Reticulation, discharging into South Pump Station (refer to Figure 11 & Table 2 (in Appendix XXVII))

A new 0.6km long sewer outfall will connect into the sewerage reticulation of existing Umdloti at discharge Point 2. This existing reticulation flows to the “South Pump Station” via a gravity sewer line. Blocks 1.7, 1.8, 1.14, 1.17, 1.18 & 1.19 of Node 1 will discharge at Point 2. The pipeline through the forest connecting to the existing reticulation will most likely be installed using micro tunnel boring or pipe jacking methods. From investigations carried out, the pumps at the existing “South Pump Station” can accommodate a maximum inflow of some 0.8 MI/d and currently receives in the order of 0.17 MI/d from the existing residential portion of Umdloti. The pumps have hence spare capacity to accept the anticipated flow from the proposed development blocks.

Discharge Point 3: New Pump Station, Rising Main and Outfall into existing Umdloti Reticulation, discharging into Central Pump Station (refer to Figure 11 & Table 3 (in Appendix XXVII))

A new 0.6km long rising main discharging into a 0.5km long sewer outfall will connect into the sewerage reticulation of existing Umdloti at discharge Point 3. This existing reticulation flows to the “Central Pump Station” via a gravity sewer line. It is proposed to discharge Blocks 1.4, 1.5, 1.6, 1.15 & 1.16 from Node 1, Blocks 4.15 to 4.20, 4.54 to 4.56, 4.60, 4.61 & 4.65 from Node 4 and all of Node 5 will discharge at Point 3. From investigations carried out, the sump at the existing “Central Pump station” can accommodate a maximum inflow of some 1.9 MI/d and currently receives in the order of 0.8 MI/d from the existing residential portion of Umdloti. The sump of this pump station has hence spare capacity and theoretically, it can accept a further 1.1 MI/d. The pumps however will require upgrading should the sump spare capacity be utilized.

In terms of the development blocks planned within Nodes 1, 4 & 5 of Sibaya Precinct some 1.93 Ml/day of sewage will be generated. In order for Central Pump station to handle all this flow the pump station will need to be upgraded. The upgrading envisaged will involve upsizing the existing pumps as well as upsizing the existing rising main considering that flows from the North and Far North pump stations also feed into this rising main.

The Umdloti Waste Water Treatment Works has a current capacity of 1.5 Ml/d with sufficient land available for future expansion to increase its ultimate capacity to 3 Ml/d. The works currently receives an average daily inflow of some of 0.9 Ml/d, thereby giving an existing spare capacity of 0.6 Ml/d. The expanded Treatment Works, to 3Ml/d, will therefore be able to accommodate the 1.93 Ml/d emanating from the proposed Nodes 1, 4 and 5 of Sibaya Precinct and 0.04 Ml/d emanating from the conversion of the existing septic tanks in Umdloti to a waterborne sewage system.

#### **2.4.5 Stormwater System**

The following information has been extracted from the Sibaya Node Engineering Report in Respect of the Bulk Services for the Development prepared by Vela VKE Consulting Engineers & GOBA, May 2006 and acts as a summary thereof (for full details see Appendix XXVII). Given the importance of stormwater and its potential impact on wetlands and the Ohlanga River and floodplain, the information drawn up by the engineers doing the bulk infrastructure is currently being reviewed by specialists in order to produce a stormwater management plan which will be included in the EIA phase.

The stormwater system needs to be described with major principals rather than detailed flows and calculations. The proposed principals will be abided to during the design and construction of the stormwater system. In general, the proposed layout of the development is suited to the topography of the site. Adequate provision will have to be made for the management and disposal of stormwater runoff from the various internal developments as they are planned and this must be done in an integrated and coordinated process to avoid stormwater damage in the future.

Overland flow may be encouraged where possible, but should be avoided where roads on steep slopes will capture and concentrate cross flows at the local low points in the roads. Plans must take into account probable impact of flow from these points of concentration on the downstream environment.

Steep watercourses will require protection from erosion through the use of appropriate channel lining, detention dams, or controlled drops to dissipate flow energy. All natural and unlined channels should be inspected for adequate binding of soil by sustainable ground cover. Stone pitching should be used to reinforce channel inverts on steep slopes. Existing wetlands and detention areas should be protected from encroachment by the development.

The proposed developments should not adversely impact on the environments of the development node and surrounding areas in terms of erosion and sediment deposition, but the frequency of flooding and the total runoff volume will increase unless adequate provision can be made to maintain the current natural rate of stormwater retention and infiltration in the sub-catchments. A detailed stormwater study should be undertaken, which would include the preparation of a Stormwater Management Plan to guide architects, engineers and contractors during the planning design and construction of commercial and residential buildings and the design and construction of the civil infrastructure.

A preliminary assessment of the stormwater catchment for the Umdloti South Node was carried out by GOBA in December 2003 (refer to report "Preliminary Assessment of the Stormwater Catchment for the Umdloti South Development", Appendix XXVIII). This investigation and subsequent studies highlighted the vulnerability and susceptibility of the existing Umdloti Development immediately downstream of the proposed development to the effects of stormwater runoff generated upstream. Stormwater drainage is hence a crucial aspect of the proposed development which will require careful planning, designing and managing.

The existing stormwater reticulation particularly in the two primary watercourses appears inadequate in handling the present upstream flows (i.e. pre-development flows) and will require upgrading. Apart from the upgrading of the current systems sensitive social and environmental considerations necessitate that stormwater attenuation measures on a macro and micro scale be adopted as far as possible.

The main objectives and principles in the management of stormwater for the proposed development are deemed to be as follows:

- To protect all life and property within and downstream of the development from damage by stormwater and floods. In this regard post development flows will be limited to those existing at pre-development.

- To mitigate soil erosion by wind and water.
- To conserve the flora and fauna of the natural environment (i.e. existing forest in particular)
- To protect and enhance the natural watercourses and ensure that water quality is not compromised by the effects of siltation and pollution.
- To effectively harvest stormwater runoff.

In order to achieve the above objectives the stormwater system will require the provision of macro and micro stormwater attenuation measures as well as an effective reticulation system to safely convey the stormwater runoff within and from the development.

The stormwater attenuation ponds (designed for the 1:100 storm event) will need to be located in the primary watercourses and will need to take account of the necessary geotechnical, environmental and topographical conditions.

Apart from the macro stormwater measures, it is deemed necessary that micro-stormwater measures be implemented on individual sites. The form of this attenuation will be dependant on a number of factors such as topography (natural and artificial slopes), the zoning of the site and soil conditions present. It is envisaged that in the steeper regions attenuation tanks will be the most suitable form of attenuation with outlets to the municipal pipe network. In the less steep areas where soil conditions are favourable, the use of infiltration measures (i.e. soakaways) will be the preferred form of on-site stormwater control and disposal. In certain instances soakaways may need to be supplemented with attenuation tanks with outlets to the municipal pipe network.

In terms of stormwater reticulation a limited stormwater pipe network will be provided to safely convey stormwater runoff from properties and roads to and between the attenuation facilities. The pipe system within the development will be designed for the 1:10 year storm event, in the major events the roads will be used where conditions permit to control and divert the runoff to the attenuation facilities forming part of the major system. To ensure that water quality is not compromised, silt and trash traps will need to be provided within the system. Where conditions permit the use of open drains will be favoured over pipes, the drains will be planted with suitable vegetation

however where the flows and velocities are high the drains will require some form of lining.