

# Phase 1 Bloemendal Arterial Road for Khayamnandi Areas A&B

## For NELSON MANDELA BAY MUNICIPALITY Draft Preliminary Design Report



Prepared for

Nelson Mandela Bay Municipality

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## **1 Executive Summary**

Khayamnandi Areas A and B falls within the jurisdiction of the Nelson Mandela Bay municipality and is located just south of Despatch, between Khayamnandi and KwaDwesi. These areas will form part of a new residential development comprising 7 965 subsidy housing erven and 33 hectares of mixed use development.

The Nelson Mandela Bay Municipality appointed Uhambiso Consult (Pty) Ltd as consulting engineers on 28 October 2008 for the design and installation of civil services to Khayamnandi A and B. The original appointment brief stated that Uhambiso Consult had to do the design, compilation of tender documentation and provide supervision of the construction of the civil services.

The Bloemendal Arterial forms an important part of the long term road network in the Comprehensive Integrated Transport Plan (CITP) of the Nelson Mandela Bay Municipality. This road will link developments to the south of Khayamnandi to the extension of Stanford Road and to the Trunk Road 15 (Uitenhage Road) in the North. The Bloemendal Arterial also forms part of a north/south link which will provide a connection between Motherwell and the N2 Freeway to the south of Port Elizabeth.

The objective of this preliminary design report is to report on the following:

- Scope of works and phasing concept considered in the preliminary design;
- Environmental related matters and aspects that are to be considered and take into account under the preliminary design;
- Geotechnical investigation and results that are to be considered under the preliminary design;
- Stormwater management plan of Khayamnandi Areas A and B;
- The design principles and technical considerations for the arterial road;
- Pavement design proposal and material consideration for the arterial road under the preliminary design;
- Preliminary cost estimate.

SRK was appointed as specialist consultant to undertake the environmental assessment for Khayamnandi A and B which included the Bloemendal Arterial. A Heritage Impact Assessment and Terrestrial Ecological Impact Assessment were done as part of the EIA. It was a condition of the ROD that the Bloemendal Arterial be realigned so as to be in line with the Environmental Authorisation issued for the Mzingisi Development Trust, if necessary. The final EIA approval was received in October 2010.

An Environmental Impact Assessment was conducted by SRK Consulting Engineers in 2009 and the approval was granted by the Province of the Eastern Cape Economic Development and Environmental Affairs on 29 October 2010. (Authorisation No ECm1/387/M/09-24).

A water use licence was issued by the Department of Water Affairs on 2 February 2014. (Licence No: 15/M10D/C1/2397)

SSI was commissioned by Uhambiso Consult in 2009 to prepare a Traffic Impact assessment (TIA) to determine the extent of the traffic related impacts.

The principal objectives were defined as:

- Assess the potential traffic related impacts associated with the construction and operation of the proposed residential project and associated infrastructure;
- Recommend appropriate and practicable mitigation measures to minimize the negative impacts and maximize potential benefits.

Uhambiso appointed Royal Haskoning DHV (Pty) Ltd in 2015 to supplement the information provided in 2009 TIA and to investigate the following traffic and transportation issues that that effect the detailed design of the Bloemendal Arterial in greater detail

SRK Geotechnical consultants, were appointed as geotechnical engineers for the Khayamnandi Areas A and B. The Geotechnical report "*Khayamnandi Area A&B Subsidy Housing Geotechnical Investigation*" was done in September 2013.

The Nelson Mandela Bay Municipality appointed Uhambiso Consult as consulting engineer to compile a stormwater management plan (SWMP) for Khayamnandi Areas A and B to meet the requirements stated under the ROD that was issued by the Department of Economic Development and Environmental Affairs (Eastern Cape Province) on 29 October 2010.

This stormwater management plan recommends a set of best management practices (BMP's) for Khayamnandi Areas A and B during and after construction to ensure that:

- Stormwater runoff is managed in an orderly way;
- Effective erosion prevention and control measures are implemented;
- Conveyed pollution and sediment from the development do not enter the Chatty river system.

The construction of the arterial road are recommended to be phased as follows:

**a) Phase 1 single carriage way:**

It is therefore recommended that as a first phase, the Bloemendal Arterial be constructed as a single 10.5m carriageway road with one traffic lane (3.4m lanes with 1.55m shoulders) in each direction and with an additional turning lane at intersections. A 1.8m side walk with a 1.5m cycle way shall also be allowed for.

Under Phase 1 single carriage way considering the option to construct the earthworks for the future dual carriage way together with the single carriage way would be beneficial from a construction and cost perspective.

**b) Phase 2 dual carriage way.**

The single carriage way under Phase 1 will be sufficient to deal with immediate traffic volumes as reported under report from Royal Haskoning DHV (Pty), March 2015. It is recommended in the longer term that the dual carriage way for the Bloemendal Arterial be constructed.

The proposed Bloemendal Arterial road will be about 1.8km in length and transverses moderate to steep terrain.

The Bloemendal Arterial falls under the Traffic Class E3 range of 3,0 – 12 x 10<sup>6</sup> E80s classified as high volume traffic and or major arterial routes. The Bloemendal Arterial is a primary road and falls under Road Category UA.

The pavement design recommended for the Bloemendal Arterial shall require atleast the following layerworks:

- **40mm thick premix layer** - Type 4a Mix, Compacted to minimum 95% Marshal;
- **150mm G2 base** - Compacted to 86% of apparent relative density. Max. stone size 37mm;
- **150mm C3 upper subbase** - Compacted to 100% Mod AASHTO with UCS 3MPa. G5 natural gravel before treatment. Max stone size 63mm;
- **150mm C3 lower subbase** - Compacted to 100% Mod AASHTO with UCS 3MPa. G5 natural gravel before treatment. Max stone size 63mm;
- **150mm G7 selected layer** – Compacted to 95% Mod AASHTO Density;
- **500mm rockfill** - Compacted at 7 passes with a sheeps foot roller;
- **150mm insitu road bed** prep 93% Mod AASHTO Density.

The construction of the Bloemendal Arterial will be vital to the development of this area and will greatly reduce the pressure on the existing road network, especially upon completion of all developments planned for this area.

Since the projected traffic flows, per direction, on the Bloemendal Arterial fall well within the ultimate capacity of a single traffic lane, it can be concluded that in terms of traffic capacity requirements, the construction of a single lane per direction, single carriage way road will meet the requirements for capacity and access to the Khayamnandi development area for foreseeable future, taking into account normal traffic growth.

It is therefore recommended that as a first phase, the Bloemendal Arterial be constructed as a single carriage way road with one traffic lane in each direction and with an additional turning lane at intersections. From the TIA, this single carriage way will provide sufficient level of service up to 2020-2025 horizon.

It is recommended that ultimately the Bloemendal Arterial be designed with two 10.5m carriageways and a 2.1m median to accommodate two 3.4m lanes and a 1.5mm shoulder or turning lane at intersection.

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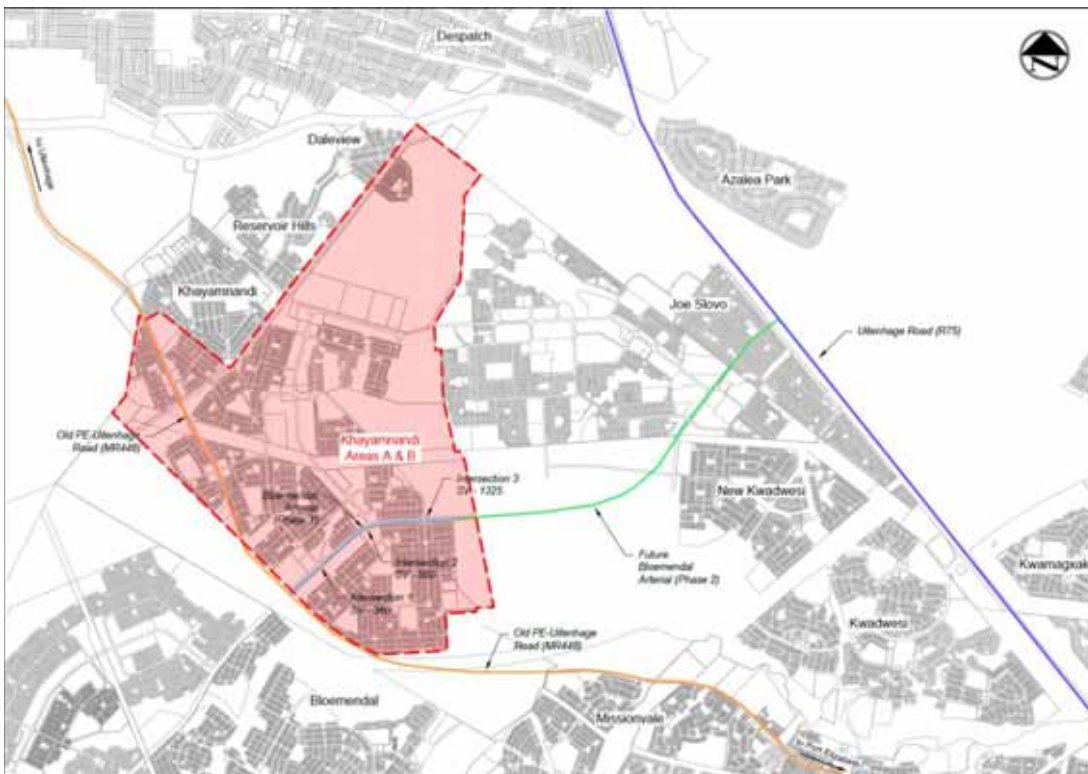
### 3 Background

Khayamnandi Areas A and B falls within the jurisdiction of the Nelson Mandela Bay municipality and is located just south of Despatch, between Khayamnandi and KwaDwesi. These areas will form part of a new residential development comprising 7 965 subsidy housing erven and 33 hectares of mixed use development.

The Bloemendal Arterial forms an important part of the long term road network in the Comprehensive Integrated Transport Plan (CITP) of the Nelson Mandela Bay Municipality.

This road will link developments to the south of Khayamnandi to the extension of Standford Road and to Trunk Road 15 (Uitenhage Road) in the North. The Bloemendal Arterial also forms part of a north/south link which will provide a connection between Motherwell and the N2 Freeway to the south of Port Elizabeth. Bloemendal Arterial bisects the Khayamnandi A and B development and extends from the MR448 to the Provincial Trunk Road 15.

The main access points on the development of Khayamnandi will be located on the Old Uitenhage Road-MR448 and Provincial Trunk Road 15. These two roads will be linked through the development by the proposed Bloemendal Arterial Road. The first stage of the Bloemendal Arterial will provide access to Khayamnandi at a new intersection on the Old Road- MR448 and will extend for 1.8km in a Northerly direction to the boundary of Khayamnandi A&B and Joe Slovo.



**Figure 1:** Locality Map of the Bloemendal arterial Phase 1 and Phase 2. Phase 1 intersecting Khayamandi Areas A&B.



Figure 2: Aerial view of Khayamnandi areas A and B

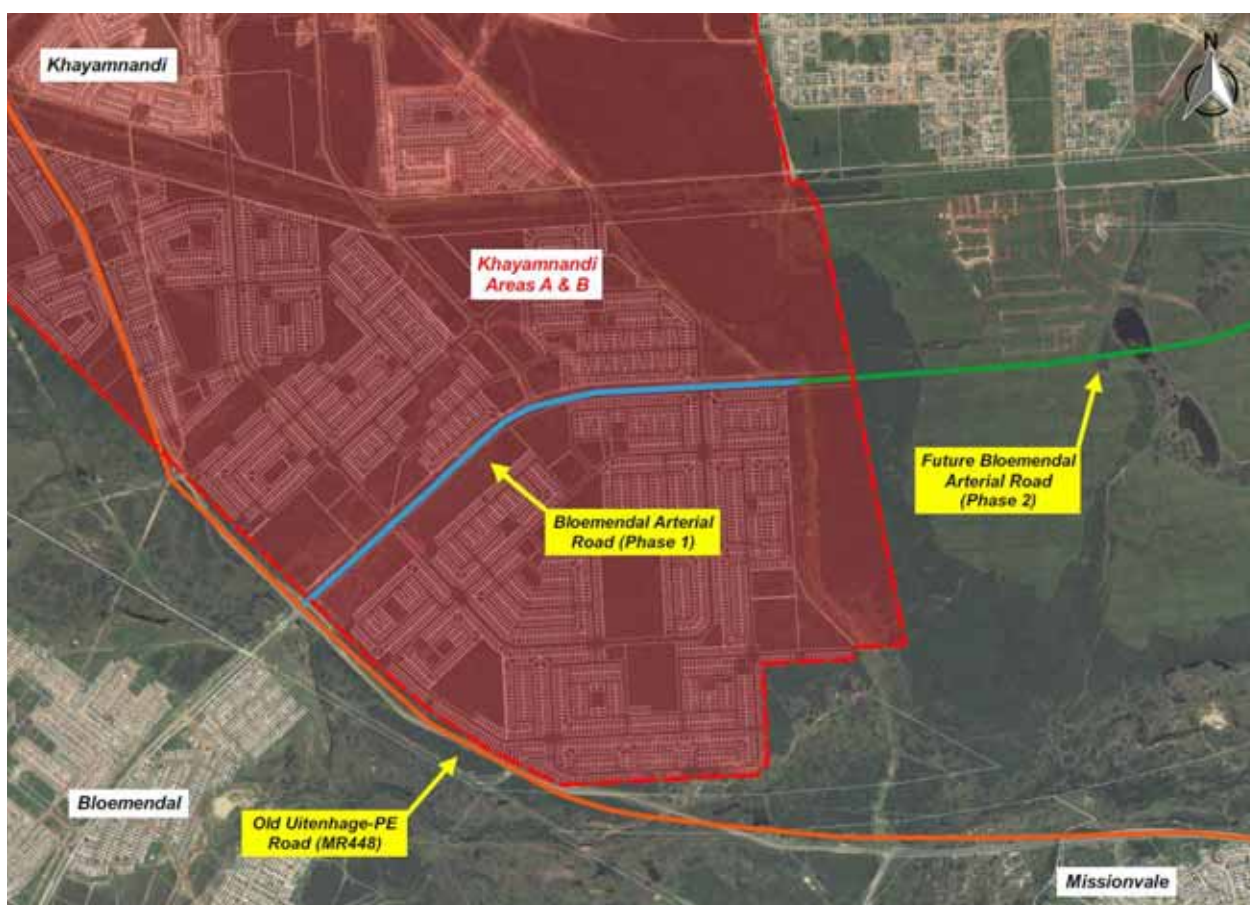


Figure 3: Aerial view of the proposed Bloemendal Arterial intersecting Khayamnandi Areas A&B

## **4 Introduction and terms of reference**

The Nelson Mandela Bay Municipality appointed Uhambiso Consult (Pty) Ltd as consulting engineers on 28 October 2008 for the design and installation of civil services to Khayamnandi A and B. The original appointment brief stated that Uhambiso Consult had to do the design, compilation of tender documentation and provide supervision of the construction of the civil services.

The Bloemendal Arterial forms an important part of the long term road network in the Comprehensive Integrated Transport Plan (CITP) of the Nelson Mandela Bay Municipality. This road will link developments to the south of Khayamnandi to the extension of Stanford Road and to the Trunk Road 15 (Uitenhage Road) in the North. The Bloemendal Arterial also forms part of a north/south link which will provide a connection between Motherwell and the N2 Freeway to the south of Port Elizabeth.

SRK was appointed by Uhambiso Consult in 2009 as specialist consultant to undertake the environmental assessment for Khayamnandi A and B which included the Bloemendal Arterial.

The Nelson Mandela Bay Municipality appointed Uhambiso Consult as consulting engineer to compile a storm water management plan (SWMP) for Khayamnandi Areas A and B to meet the requirements stated under the ROD that was issued by the Department of Economic Development and Environmental Affairs (Eastern Cape Province) on 29 October 2010.

The NMBM appointed Urban Dynamics as the town planners for Khayamnandi A&B. The Layout Plan Drawing No: 1062E/L040/11 Revision No 11 has been approved by the Roads and Stormwater Division and has been submitted by Urban Dynamics to the Metros Town Planning Division on 23 March 2012. A copy of the Layout Plan is attached under the **Annexure A**.

Hemsley and Myrdel was appointed in 2010 for the land surveying services. The SG diagrams were approved by the Surveyor General in October 2014.

SSI was commissioned by Uhambiso Consult in 2009 to prepare a Traffic Impact Assessment (TIA) to determine the extent of the traffic related impacts for the Khayamnandi Areas A and B development. Refer to **Annexure B: Khayamandi Extension Housing Development, Specialist Study: Traffic Impact Assessment**. Uhambiso appointed Royal Haskoning DHV (Pty) Ltd in 2015 to supplement the information provided in 2009 TIA and to investigate traffic and transportation issues that effect the detailed design of the Bloemendal Arterial in greater detail. Refer to **Annexure C: Khayamnandi Area A and B, Traffic Impact Assessment – Extension Bloemendal Arterial: Geometric Design Configuration**.

## **5 Objective of report**

The objective of this preliminary design report is to report on the following:

- Scope of works and phasing concept considered in the preliminary design;



- Environmental related matters and aspects that are to be considered and take into account under the preliminary design;
- Geotechnical investigation and results that are to be considered under the preliminary design;
- Storm water management plan of Khayamnandi Areas A and B;
- The design principles and technical considerations for the arterial road;
- Pavement design proposal and material consideration for the arterial road under the preliminary design;
- Preliminary cost estimate.

## **6 Environmental Impact Assessment**

SRK was appointed as specialist consultant to undertake the environmental assessment for Khayamnandi A and B which included the Bloemendal Arterial. A Heritage Impact Assessment and Terrestrial Ecological Impact Assessment were done as part of the EIA. It was a condition of the ROD that the Bloemendal Arterial be realigned so as to be in line with the Environmental Authorisation issued for the Mzingisi Development Trust, if necessary. The final EIA approval was received in October 2010.

## **7 Environmental Assessment and Public Participation Process**

An Environmental Impact Assessment was conducted by SRK Consulting Engineers in 2009 and the approval was granted by the Province of the Eastern Cape Economic Development and Environmental Affairs on 29 October 2010. (Authorisation No ECm1/387/M/09-24).

A water use licence was issued by the Department of Water Affairs on 2 February 2014. (Licence No: 15/M10D/C1/2397) Refer to **Annexure D**.

## **8 Traffic study**

SSI was commissioned by Uhambiso Consult in 2009 to prepare a Traffic Impact assessment (TIA) to determine the extent of the traffic related impacts.

The principal objectives were defined as:

- Assess the potential traffic related impacts associated with the construction and operation of the proposed residential project and associated infrastructure;
- Recommend appropriate and practicable mitigation measures to minimize the negative impacts and maximize potential benefits.

Uhambiso appointed Royal Haskoning DHV (Pty) Ltd in 2015 to supplement the information provided in 2009 TIA and to investigate the following traffic and transportation issues that that effect the detailed design of the Bloemendal Arterial in greater detail:

- The appropriate carriage way cross section and positioning of the Bloemendal Arterial within the road reserve to allow for possible upgrading to a dual carriageway;

- Design criteria for intersection design;
- Shoulders and provisions if needed for auxiliary lanes;
- Positioning and spacing of public transport stops and embayment's;
- Provision of non-motorized transport.

A complete copy of the Traffic Study Report that SSI and Royal Haskoning DHV has compiled under this appointment is attached under the **Annexure C** to this report.

## 9 Geotechnical investigation

SRK Geotechnical consultants, were appointed as geotechnical engineers for the Khayamnandi Areas A and B. The Geotechnical report “*Khayamnandi Area A&B Subsidy Housing Geotechnical Investigation*” was done in September 2013.

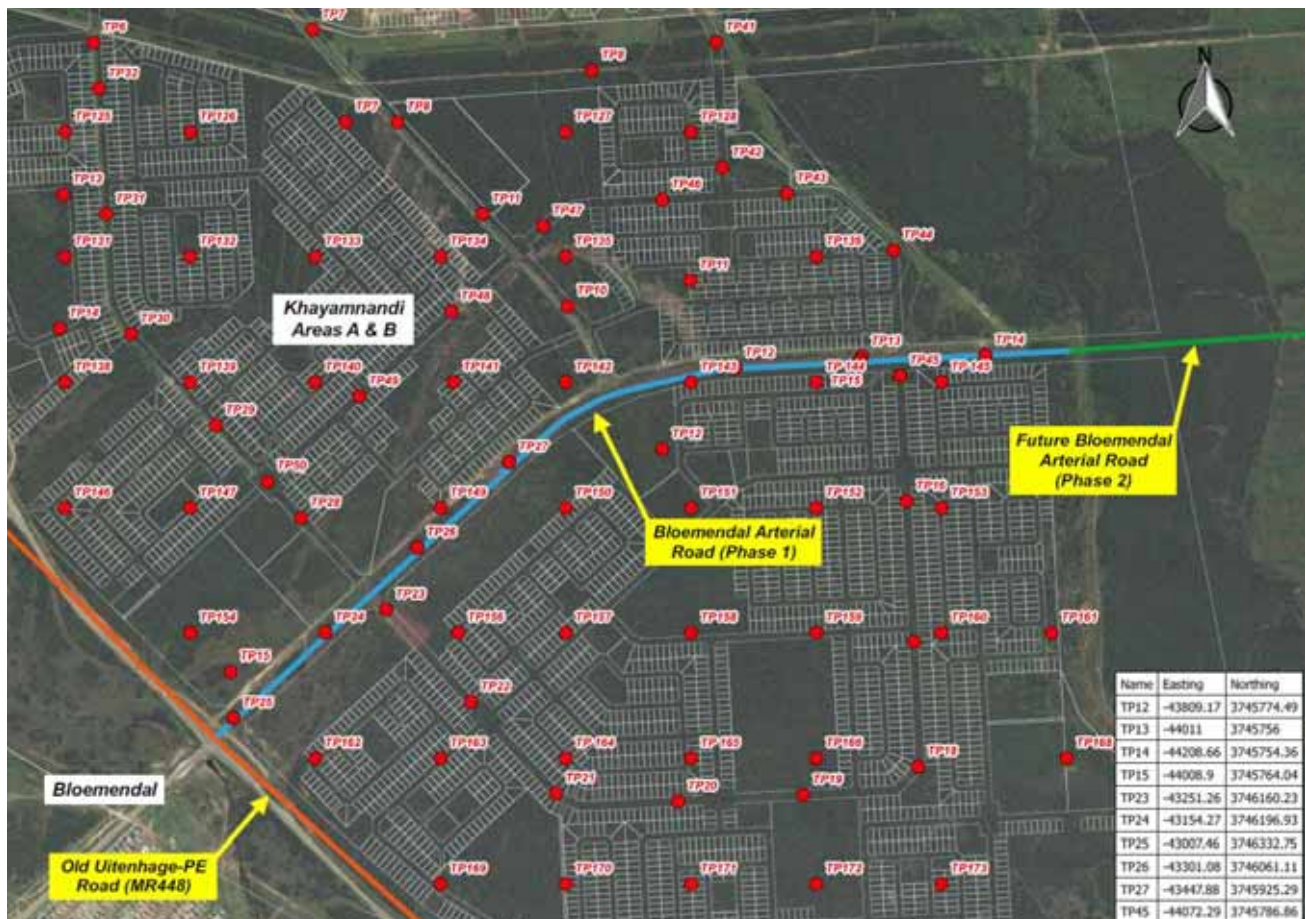


Figure 4: Trial hole positions for the geotechnical investigation done by SRK.

## 10 Stormwater management plan

Khayamnandi Areas A and B falls within the jurisdiction of the Nelson Mandela Bay municipality and is located just south of Despatch, between Khayamnandi and KwaDwesi. These areas will form part of a new residential development comprising 7 965 subsidy housing erven and 33 hectares of mixed use development. The Nelson Mandela Bay Municipality appointed Uhambiso Consult as consulting

engineer to compile a storm water management plan (SWMP) for Khayamnandi Areas A and B to meet the requirements stated under the ROD that was issued by the Department of Economic Development and Environmental Affairs (Eastern Cape Province) on 29 October 2010.

This stormwater management plan recommends a set of best management practices (BMP's) for Khayamnandi Areas A and B during and after construction to ensure that:

- Stormwater runoff is managed in an orderly way;
- Effective erosion prevention and control measures are implemented;
- Conveyed pollution and sediment from the development do not enter the Chatty river system.

## **11 Engineering survey**

A topographical survey was done by Hemsley and Myrdel land Surveyors for the Bloemendal arterial road reserve and the design of the Bloemendal Arterial road was based on this survey.

## **12 Existing services**

The known existing services are shown on drawing under drawing *8254AP-11138\_PO "Bloemendal Arterial Road General Layout Plan Scope of Works Existing Services"*. Uhambiso Consult did follow up with Telkom, Nutel and Nelson Mandela Bay Municipality's Electrical Department in which confirmation were asked for the type and positions of any services respectively in the area across or along the existing and proposed new route of the Bloemendal Arterial Road. These departments confirmed that there are no existing services within 40m the road reserve (excluding widening required for cuts and fills).

### **12.1 Telkom services**

No existing Telkom services are situated within the road reserve.

### **12.2 Electrical services**

No electrical services are situated within the road reserve.

### **12.3 Sewerage**

An existing 300mm diameter bulk sewer main runs parallel to the Bloemendal Arterial within the southern section of the road reserve. The bulk sewer caters for the Khayamnandi Areas A and B development.

### **12.4 Water main**

An existing 315mm diameter bulk water main runs parallel to the Bloemendal Arterial within road reserve. The bulk water main caters for the Khayamnandi Areas A and B development.

### 13 Scope of Works and Phasing

The Bloemendal Arterial is a “road of metropolitan significance” according to the Comprehensive Integrated Transport Plan (CITP) and provides an important north/south link in the metropolitan long term road network.

The Bloemendal Arterial is classified as a mobility arterial road and could ultimately be widened to a full dual carriageway. It is therefore recommended that the Bloemendal Arterial be designed as a dual carriageway to the appropriate geometric standards applicable to a major arterial road. The road reserve for the proposed Bloemendal Arterial is a minimum of 40m wide.

The construction of the arterial road are recommended to be phased as follows:

#### c) Phase 1 single carriage way:

Due to limited funding available, the Bloemendal Arterial will be constructed in two separate phases. The first phase would comprise of the following Works as per **Figure 5**:

The projected traffic flows, generated by the Khayamnandi development, on the Bloemendal Arterial have been assessed and it is concluded that the construction of a single lane per direction, single carriageway road will meet the requirements for capacity and access to the Khayamnandi development area for the foreseeable future, taking into account normal traffic growth.

It is therefore recommended that as a first phase, the Bloemendal Arterial be constructed as a single 10.5m carriageway road with one traffic lane (3.4m lanes with 1.55m shoulders) in each direction and with an additional turning lane at intersections. A 1.8m side walk with a 1.5m cycle way shall also be allowed for.

Under Phase 1 single carriageway it would be beneficial to to construct the earthworks for the future dual carriage way together with the single carriageway. This would add value from a construction and cost perspective.



**Figure 5:** Phase 1 single carriage way.

#### d) Phase 2 dual carriage way:

The single carriage way under Phase 1 will be sufficient to deal with immediate traffic volumes as reported under report from Royal Haskoning DHV (Pty), March 2015. It is recommended in the longer term that the dual carriage way as per **Figure 6** for the Bloemendal Arterial be constructed

ultimately with two 10.5m carriageways and a 2.1m median (all kerb face to kerb face) to accommodate two 3.4m lanes and a 1.55m shoulder or turning lane at intersections.



**Figure 6:** Phase 2 Dual carriage way.

## 14 Road design

The proposed Bloemendal Arterial road will be about 1.8km in length and transverses moderate to steep terrain. The following design input and design standards are recommended when the formal design of the road is executed.

### 14.1 Standards and documentation

Design standards were based on the following:

- “South African Pavement Engineering Manual” October 2014, 2<sup>nd</sup> Edition.
- “Guidelines for road construction materials” TRH14, 1985.
- “Structural design of road pavements” TRH4, 1978.
- “The design of road embankments” TRH10, 1978.
- “Geometric Design of Rural Roads” TRH17, 1988.
- “Structural design of Urban Roads” UTG3, February 1988.
- CSIR (2005), “Red Book - Human Settlement Planning and Design”

### 14.2 Road Geometric

The following basic design parameters were considered under the preliminary design for the Bloemendal Arterial as per **Table 1**.

Parameter	Design value
Design speed	70km/h (speed limit 60km/h)
Minimum road reserve	40m width. (excluding widening required for cuts and fills)
<b>Horizontal alignment:</b>	
Minimum radius:	200m
Minimum curve length:	150m
Maximum super elevation:	6%
Minimum tangent length:	100m
<b>Vertical alignment:</b>	
Minimum crest curve	K=23

Minimum sag curve	K=24
Minimum curve length	120m
Maximum grade	8%
<b>Road Cross section and width</b>	
Road cross fall:	2%
Lane widths:	3.4m
Surfaced shoulders	1.55m
Side walks:	2.0m
Cycle way:	1.8m
<b>Intersections and accesses</b>	
Maximum grade	3%
Minimum site distance:	200m
Minimum intersection spacing:	180m
Traffic signal spacing	540m
Minimum intersection angle	80°

Table 1

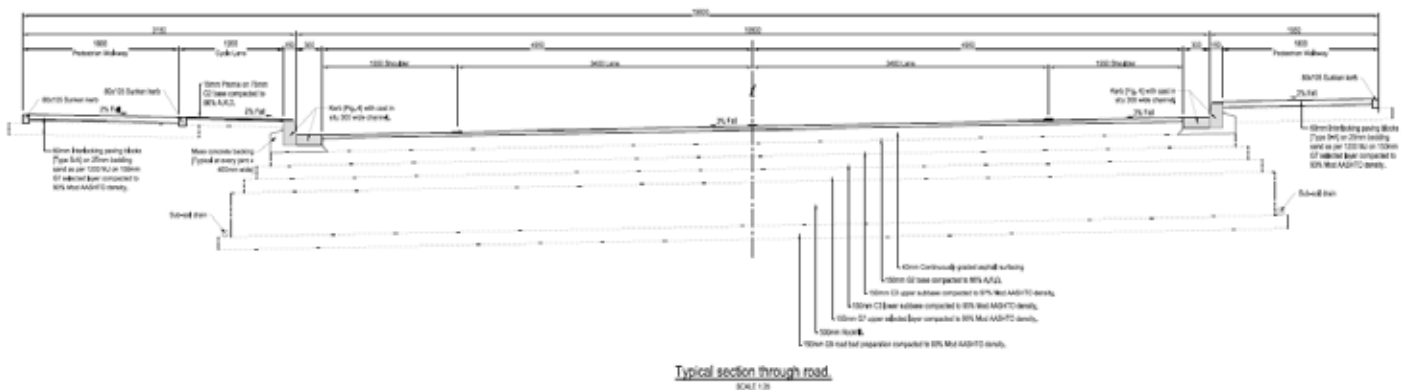


Figure 7: Typical cross section of the single carriage way.

### 14.3 Design E80 traffic

The accumulative E80 traffic expected during the design period of the Bloemendal Arterial for Khayamandi Areas A&B has been based on the traffic projections contained in Traffic Impact Assessment report from SSI “Khayamandi Extension Housing Development Specialist Study: Traffic Impact Assessment, October 2009” and the supplement TIA information from Royal Haskoning DHV (Pty) Ltd in 2015.

The E80 estimates have been based on the following input values under **Table 2**:

Parameter	Input value
Time of traffic survey	October 2009
Date of opening	October 2020
Heavy vehicle volume growth rate (h)	5%

E80/HV	1,5
E80/HV growth rate (v)	3%
Combined heavy vehicle growth and E80/HV growth	0,08
Adjust for lane distribution	1,0
% Heavy vehicles	5%
Structural design period	20 years

**Table 2**

The results of the design traffic calculation predicts approximately  $4.3 \times 10^6$  E80s axles moving along the Bloemendal Arterial during the design period of 20 years.

#### 14.4 Pavement design

The Bloemendal Arterial falls under the Traffic Class E3 range of  $3,0 - 12 \times 10^6$  E80s classified as high volume traffic and or major arterial routes. The Bloemendal Arterial is a primary road and falls under Road Category UA.

From the geotechnical investigation it is evident that the subgrade conditions encountered are classified as soft excavation with a clayey-silt and/or sandy-silt and/or clayey sand and/or clayey gravel characteristics with low CBR values. The material depth at which the design CBR are tested is 1,0m as per the Road Category UA. The design CBR value used for the subgrade considered under the pavement design is 3.

The proposed Bloemendal Arterial falls within the climatic region small wet region in terms of the "Urban Transport Guidelines, UTG 3 Structural Design of Urban Roads". Considering the climatic conditions for this region and taking into account the geotechnical conditions encountered, the use of materials that are excessively water-susceptible shall be avoided.

The use of suitable subsoil drainage systems and structures shall be required.

From Table 13 of UTG3 "Preparation of subgrade and required selected layers for the different subgrade design CBR's" treatment of the insitu subgrade is necessary. Allowance was made in the preliminary design layer works for:

- 150mm selected G7 layer;
- 500mm thick rock fill due to the low CBR values of the subgrade;
- Removal of the unsuitable subgrade material encountered, and shall be replaced with suitable material.

The pavement design recommended for the Bloemendal Arterial shall require minimum the following layer works:

- **40mm thick premix layer** - Type 4a Mix, Compacted to minimum 95% Marshal;
- **150mm G2 base** - Compacted to 86% of apparent relative density. Max. stone size 37mm;

- **150mm C3 upper subbase** - Compacted to 100% Mod AASHTO with UCS 3MPa. G5 natural gravel before treatment. Max stone size 63mm;
- **150mm C3 lower subbase** - Compacted to 100% Mod AASHTO with UCS 3MPa. G5 natural gravel before treatment. Max stone size 63mm;
- **150mm G7 selected layer** – Compacted to 95% Mod AASHTO Density;
- **500mm rockfill** - Compacted at 7 passes with a sheep’s foot roller;
- **150mm insitu road bed** prep 93% Mod AASHTO Density.

### 14.5 Storm water management

From the approved Storm water Management Plan, the proposed arterial preliminary design shall allow for the recommended BMP’s

- For controlling storm water quantity within the development are:
  - Provision of detention ponds to reduce post development flood peak values to predevelopment values;
  - Provision of culverts at road crossings to prevent roadway overtopping and flooding;
  - Provision of flood warning signs in areas vulnerable to flooding.
  
- For erosion prevention and control within the development are:
  - Surfacing of roadways with steep longitudinal slopes to reduce erosion;
  - Grassing or hardening of roadway verges to reduce erosion of the verges;
  - Road embankment protection at points of overtopping;
  - Construction of headwalls to reduce erosion at locations where storm water is concentrated;
  - Establishment of indigenous vegetation to anchor the top soil in areas susceptible to erosion;
  - Provision of silt traps to prevent soils washed away during construction;
  - Provision of detention ponds to reduce erosion caused by increased post development runoff peaks.

The following culvert positions under **Table 3** were approved under the water use licence that was issued by the Department of Water Affairs on 2 February 2014. (Licence No: 15/M10D/C1/2397) Refer to **Annexure D**.

<b>Culvert position</b>	<b>Easting</b>	<b>Northing</b>
A1 Start	-44334.12622	3745718.413
A1 End	-44349.30927	3745770.864
B2 Start	-43250.03076	3746073.929
B2 End	-43218.73053	3746172.385
B3 Start	-42986.40545	3746377.774
B3 End	-42978.63689	3746390.064
B4 Start	-43052.94441	3746445.861
B4 End	-43047.74676	3746458.162

**Table 3**





Figure 6: Culvert positions along the Bloemendal arterial.

### 15 Street lights and cable ducting

Street lighting luminaries will be provided along the median of the Bloemendal Arterial to create a lighted environment which will contribute to the safe and comfortable movement of vehicles and pedestrians.

### 16 Accommodation of traffic

Temporary regulatory signs will be erected along the MR448 during the construction of the Bloemendal Arterial. Prior to Construction commences detailed traffic accommodation plans shall be drawn up at existing areas where traffic might be affected.

### 17 Preliminary design drawings

The following preliminary drawings are attached under **Annexure E**.

Drawing No.	Drawing description
8254AP-11130_PO	Bloemendal Arterial Road General Layout Plan Scope of Works Road Work
8254AP-11138_PO	Bloemendal Arterial Road General Layout Plan Scope of Works Existing Services

<b>8254AP-CV-11151_PO</b>	Layout and Details of Culvert B4 in Reach B
<b>8254AP-CV-11152_PO</b>	Layout and Details of Culvert B3 in Reach B
<b>8254AP-CV-11153_PO</b>	Layout and Details of Culvert B2 in Reach B Phase 8
<b>8254AP-CV-11154_PO</b>	Layout and Details of Culvert A1 in Reach A Phase 11

Table 4

## 18 Cost estimates

The preliminary construction estimate for Phase 1 are shown in **Table 5** below.

PHASE 1			
COLTO SECTION	DESCRIPTION		AMOUNT
1200	GENERAL REQUIREMENTS AND PROVISIONS	R	10,488,223.75
1700	CLEARING AND GRUBBING	R	340,800.00
2100	DRAINS	R	1,800,000.00
2200	PREFABRICATED CULVERTS	R	7,219,940.00
2300	CONCRETE KERBING, CONCRETE CHANNELLING, CHUTES AND DOWNPIPES, AND CONCRETE	R	2,351,250.00
3300	MASS EARTHWORKS	R	9,676,300.00
3400	PAVEMENT LAYERS OF GRAVEL MATERIAL	R	4,753,120.00
3500	STABILIZATION	R	991,625.00
3600	CRUSHED STONE BASE	R	5,117,850.00
4100	PRIME COAT	R	369,000.00
4200	ASPHALT BASE AND SURFACING	R	4,213,800.00
5100	PITCHING, STONEMWORK AND PROTECTION AGAINST EROSION	R	1,264,250.00
5200	GABIONS	R	300,700.00
5400	GUARDRAILS	R	480,000.00
5600	ROAD SIGNS	R	65,000.00
5700	ROAD MARKINGS	R	78,000.00
5800	LANDSCAPING AND PLANTING PLANTS	R	10,000.00
5900	FINISHING THE ROAD AND ROAD RESERVE AND TREATING OLD ROADS	R	93,360.00
6100	FOUNDATIONS FOR STRUCTURES	R	2,030,000.00
6200	FALSEWORK, FORMWORK AND CONCRETE FINISH	R	162,900.00
6300	STEEL REINFORCEMENT FOR STRUCTURES	R	140,000.00
6400	CONCRETE FOR STRUCTURES	R	325,000.00
6600	NO-FINES CONCRETE, JOINTS, BEARINGS, PARAPETS AND DRAINAGE FOR STRUCTURES	R	120,000.00
8100	TESTING MATERIALS AND WORKMANSHIP	R	50,000.00
<b>SUB TOTAL</b>		<b>R</b>	<b>52,441,118.75</b>
ADD 10% CONTINGENCY		R	5,244,111.88
<b>SUB TOTAL</b>		<b>R</b>	<b>57,685,230.63</b>
ADD 15% VAT		R	8,652,784.59
<b>GRAND TOTAL</b>		<b>R</b>	<b>66,338,015.22</b>

Table 5

The preliminary construction estimate for Phase 2 are shown in **Table 6** below.

<b>PHASE 2</b>		
<b>SECTION</b>	<b>DESCRIPTION</b>	<b>AMOUNT</b>
1200	GENERAL REQUIREMENTS AND PROVISIONS	R 8,642,457.58
2100	DRAINS	R 1,800,000.00
2300	CONCRETE KERBING, CONCRETE CHANNELLING, CHUTES AND DOWNPIPES, AND CONCRETE	R 2,351,250.00
3300	MASS EARTHWORKS	R 9,676,300.00
3400	PAVEMENT LAYERS OF GRAVEL MATERIAL	R 4,753,120.00
3500	STABILIZATION	R 991,625.00
3600	CRUSHED STONE BASE	R 5,117,850.00
4100	PRIME COAT	R 369,000.00
4200	ASPHALT BASE AND SURFACING	R 4,213,800.00
5100	PITCHING, STONEMWORK AND PROTECTION AGAINST EROSION	R 1,264,250.00
5200	GABIONS	R 300,700.00
5400	GUARDRAILS	R 480,000.00
5600	ROAD SIGNS	R 65,000.00
5700	ROAD MARKINGS	R 78,000.00
5800	LANDSCAPING AND PLANTING PLANTS	R 10,000.00
5900	FINISHING THE ROAD AND ROAD RESERVE AND TREATING OLD ROADS	R 93,360.00
8100	TESTING MATERIALS AND WORKMANSHIP	R 50,000.00
SUB TOTAL		R 34,569,830.31
ADD 10% CONTINGENCY		R 3,456,983.03
SUB TOTAL		R 38,026,813.34
ADD 15% VAT		R 5,704,022.00
<b>TOTAL</b>		<b>R 43,730,835.35</b>

**Table 6**

## **19 Conclusions and recommendations**

The Bloemendal Arterial forms an important part of the long term road network in the Comprehensive Integrated Transport Plan (CITP) of the Nelson Mandela Bay Municipality. The construction of the Bloemendal Arterial will be vital to the development of this area and will greatly reduce the pressure on the existing road network, especially upon completion of all developments planned for this area.

Since the projected traffic flows, per direction, on the Bloemendal Arterial fall well within the ultimate capacity of a single traffic lane, it can be concluded that in terms of traffic capacity requirements, the construction of a single lane per direction, single carriage way road will meet the requirements for capacity and access to the Khayamnandi development area for foreseeable future, taking into account normal traffic growth.

It is therefore recommended that as a first phase, the Bloemendal Arterial be constructed as a single carriage way road with one traffic lane in each direction and with an additional turning lane at intersections. From the Traffic Impact Assessment, this single carriage way will provide sufficient level of service up to 2020-2025 horizon.

It would be beneficial to construct the earthworks for the future dual carriage way together with the single carriageway. This would add value from a construction and cost perspective.

It is recommended that ultimately the Bloemendal Arterial be designed with two 10.5m carriageways and a 2.1m median to accommodate two 3.4m lanes and a 1.5m shoulder or turning lane at intersection.

## **20 References**

The following documentation was used in the compilation of this preliminary design report:

- SSI. October 2009. *Khayamandi Extension Housing Development, Specialist Study: Traffic Impact Assessment*.
- Royal Haskoning DHV (Pty). March 2015. *Khayamnandi Area A and B, Traffic Impact Assessment – Extension Bloemendal Arterial: Geometric Design Configuration*
- Uhambiso Consult. March 2012. *“Storm water management plan”*.
- *“South African Pavement Engineering Manual”* October 2014, 2<sup>nd</sup> Edition.
- SRK Consulting, *“Final Environmental Impact Report – Proposed Khayamnandi Extension Housing Development, Bethelsdorp”*, Report no 373509/5, January 2010.
- Uhambiso Consult, *“Khayamnandi Areas A and B Engineering Infrastructural Services: Service Facilities and Design Standards”*, September 15<sup>th</sup> 2008.
- South African National Roads Agency Limited, *“Code of procedure for the planning and design of highway and road structures in South Africa”*, February 2002
- CSIR (2005), *“Red Book - Human Settlement Planning and Design”*
- *“Geometric Design of Rural Roads”* TRH17, 1988.
- *“Structural design of Urban Roads”* UTG3, February 1988.
- *“Guidelines for road construction materials”* TRH14, 1985.
- *“Structural design of road pavements”* TRH4, 1978.
- *“The design of road embankments”* TRH10, 1978.

## **Annexures**

**Annexure A: Urban Dynamics, Approved Layout Plan for Khayamnandi Areas A and B, drawing No: 1062E/L040/11 Revision No 11.**

**Annexure B: Khayamandi Extension Housing Development, Specialist Study: Traffic Impact Assessment. SSI. October 2009.**

**Annexure C: Khayamnandi Area A and B, Traffic Impact Assessment – Extension Bloemendal Arterial: Geometric Design Configuration. Royal Haskoning DHV (Pty) . March 2015.**

**Annexure D: Water use licence was issued by the Department of Water Affairs on 2 February 2014. (Licence No: 15/M10D/C1/2397)**

**Annexure E: Preliminary drawings.**