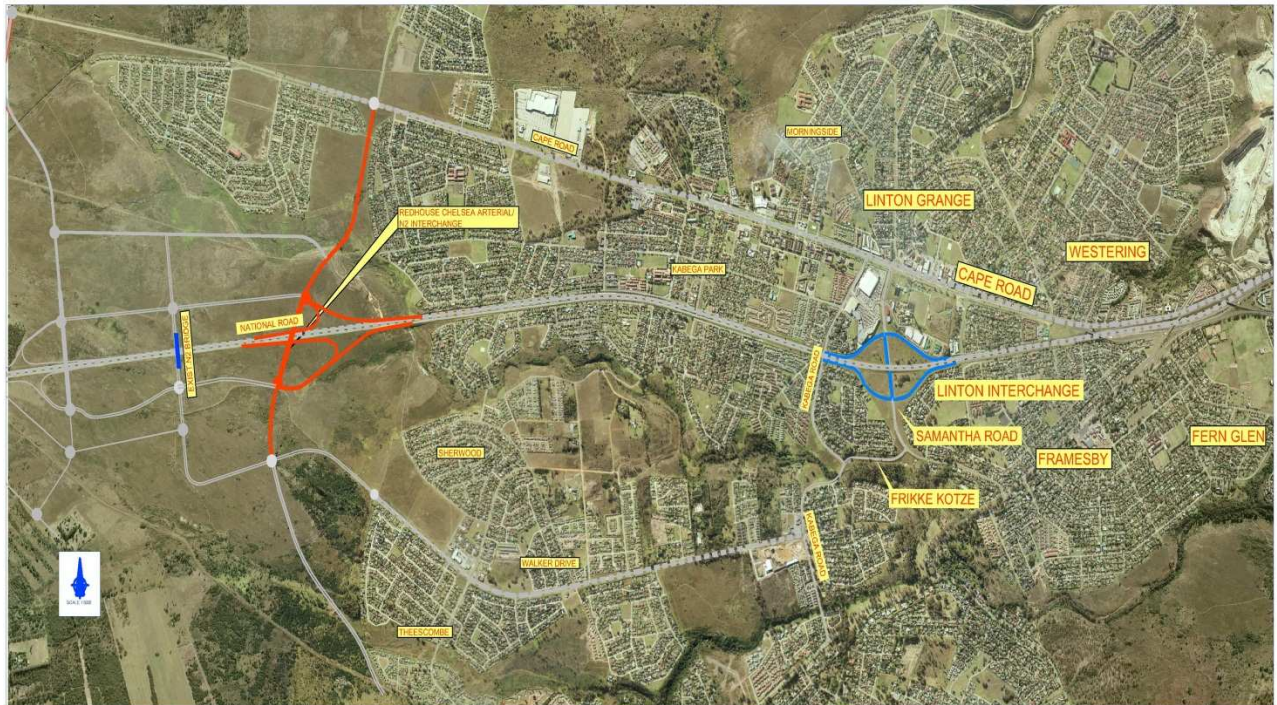


NELSON MANDELA BAY MUNICIPALITY
PROPOSED REDHOUSE CHELSEA ARTERIAL ROAD FROM
PROPOSED EXTENSION OF WALKER DRIVE
TO CAPE ROAD



Preliminary Design Report: Final
August 2012

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TITLE : **PROPOSED REDHOUSE CHELSEA ARTERIAL ROAD FROM
PROPOSED EXTENSION OF WALKER DRIVE TO CAPE ROAD**

: *BKS (Pty) Ltd*

Client : *Nelson Mandela Bay Municipality*

BKS Project No : *J00488*

Status of Report : *Final*

BKS Report No : *J00488/01*

Key Words : *Walker Drive, Redhouse Chelsea Arterial*

Date of this Issue : *August 2012*

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EXECUTIVE SUMMARY

1. *NMBM resolved in 2004 to appoint BKS to carry out the drawings, tender and construction monitoring of the Redhouse Chelsea Arterial from the present end of construction of Walker Drive to Cape Road. This included the proposed interchange with the N2 at the existing Rowallan Park Bridge and the upgrading of Kabega Road between Kragga Kamma and Frikkie Kotze Drive to Linton interchange (Ref: NMBM No. 902).*
2. *In February 2008, the NMBM informed BKS (Pty) Ltd. that the abovementioned appointments of 2004 has been amended to include the Redhouse Chelsea Arterial link from the present end of construction to Cape Road traversing through the existing Redhouse Chelsea Arterial reserve and to incorporate an overpass over N2 and its associates ramps. (Ref: NMBM No. 902).*
3. *In September 2008, based on the abovementioned assignment, BKS submitted a preliminary design report for the Redhouse Chelsea Arterial road which was then situated in the municipal road reserve provided. Refer to Option 1 on Fig 2, Annexure A.*
4. *On submission it was found that this municipal reserve was environmentally unsuitable and the scheme along this route was abandoned when the Local Spatial Development Framework (LSDF) for the Western Suburbs was commissioned during the last quarter of year. Refer to Option 1 on Fig 2, Annexure A.*
5. *The transportation study entitled the "Transportation Study for the Western Suburbs Local Spatial Development Framework (LSDF) dated March 27 March 2009 prepared by Engineering Advice and Services (Pty) Ltd (EAS) determined the proposed optimum road network which includes both the Walker Drive Extension and Redhouse Chelsea Arterial in the Western Suburbs LSDF area. This road network was designed to cater for the traffic generated by the land-use proposals as contained in the LSDF study. Refer to Annexure C.*
6. *The Comprehensive Integrated Transport Plan (CITP) made provision for the construction of the Redhouse Chelsea Arterial as a north-south road on the western perimeter of the presently developed areas of the Metro Urban Area.*
7. *The abovementioned transport plan (CITP) also envisaged the extension of Walker Drive and the linking of the existing un-used overpass bridge over the N2 to form an integral roadway system with the Redhouse Chelsea Arterial.*

8. *This present report covers the preliminary design of the Redhouse Chelsea Arterial in its new proposed location. The report entitled "Proposed Redhouse Chelsea Arterial Road from proposed Extension of Walker Drive Extension to Cape Road" was originally submitted in December 2010 and reviewed during October 2011 and July 2012. Due to a change in scope of the works the report has been amended and is now resubmitted as the final revision dated August 2012. The report covers the various technical aspects, route selection, transportation planning, environmental and contractual aspects.*
9. *The traffic impact studies carried out by SSI for Bay West City and Aurecon supporting the LSDF transportation study (**Refer to Annexure C**) and the availability of funding for the implementation, recommended that the Redhouse Chelsea Arterial road be implemented in the following phases:*
 - a) **Phase 1A (Two lane scheme):** *This phase comprises the construction of one carriageway from Walker Drive Extension to Cape Road, two overpass bridge structures as well as on and off ramps of the interchange together with the earthworks for the second carriageway.*
 - b) **Phase 1 (Four lane scheme):** *This phase comprises the construction of the second carriageway layerworks from Walker Drive extension to Cape Road to complete the construction of Phase 1A to comply with Phase 1 as indicated in the transportation and traffic studies. Refer to Fig. 8: Sheet 1 on Annexure A. Also refer to Annexure C and D.*
 - c) **Phase 2 (Six lane scheme or Four lane scheme with BRT lanes):** *This phase the will entail the conversion of the non-motorized facilities into a third vehicular traffic lane or BRT lane. Separate non-motorized lanes will be provided at this phase. Refer to Fig. 8: Sheet 1 on Annexure A. Also refer to Annexure C and D.*
 - d) **Phase 3:** *This phase comprises the future extension of the Redhouse Chelsea Arterial from Walker Drive Extension to Kragga Kamma Road and to Mondmendy Road / Fairview Arterial. i.e. if future transportation planning studies will warrant such a need.*
10. *Terratest (Pty) Ltd. were appointed together with wetland and vegetation specialists to conduct a full Environmental Impact Assessment (EIA) for the Redhouse Chelsea Arterial and Walker Drive Extension. The final Environmental Impact Report (EIR) was submitted in May 2012 to Department of Economic Development and Environmental Affairs (DEDEA). The Environmental department of NMBM and comments received from DEDEA indicated that there are some items that must be revised and be included in the EIR and the report must be re-submitted. The final*

amended EIR incorporating the comments from the interested and affected parties will be submitted on the 05 October 2012. The environmental authorisation is now anticipated to be obtained during November 2012 the latest.

11. *The route selected has followed an evolutionary process taking into account environmental, transportation Planning, road geometrics, river crossings and future town planning requirements in the area. **Refer to Fig 2: Sheet 1 and 2, Annexure A.***
12. *Phase 1 of the proposed Redhouse will consist of approximately 2500m of dual carriageway roadway, each carriageway having an 8,4m tarmac surfaced width separated by a 5,0m wide median. **Refer to Dwg. No. 701, Annexure G.***
13. *Land will have to be acquired from various land owners in order to create necessary reserves for the roadway and interchange. The affected parties are Engen, N2 Gateway, Department of Housing and NMBM. Negotiations regarding this matter are underway. **Refer to Fig. 5, Annexure A.***
14. *The road encompasses an interchange with the N2 comprising overpass bridges over the N2 with on and off ramps in each direction. It also involves the construction of a bridge or culvert over the Baakens River north of the N2 and its tributary south of the N2. **Refer to Annexure E, G and L.***
15. *The interchange will be owned by the South African Roads Agency SOC Ltd (SANRAL) and therefore its bridges and associated ramps will be designed to SANRAL's geometric and structural standard requirements. **Refer to Dwg. No.: 007 on Annexure G and L.***
16. *A four span prestressed concrete overpass bridge is envisaged. The bridge will be provided with the necessary vertical clearances over the N2 and column spacing is sufficient to allow for an additional lane to be provided along the N2 in the present median space or outer edge of the existing lanes. It is also sufficient space to accommodate alterations to the on and off ramps under the bridge. **Refer to Annexure L.***
17. *The interchange will also incorporate a single span bridge or culvert (Cyclopa Bridge) over the northern watercourse and a culvert where the southern ramp system crosses this watercourse. This watercourse is situated parallel to approximately 160m south of the N2. A culvert is the preferred option however this decision rests with DEDEA. **Refer to section 6.2.2 of this report.***
18. *The Redhouse Chelsea Arterial has been designed for 60km/hr between the proposed traffic circle at the Walker Drive intersection and the 4 way traffic signalised intersection at the*

intersection with the southern ramps. Thereafter the design standards are for 80km/h through to Cape Road. Refer to section 11.1.1 of this report.

19. *A culvert is proposed for the road crossing of the Baakens River. A bridge crossing as an alternative to the culvert has also been investigated but is approximately R10, 9 million more expensive and the culvert is therefore the preferred option. This decision rests with DEDEA. Refer to Fig.3 on Annexure A. Also refer to Annexure B.*
20. *A flood line and hydraulic performance analysis along the Baakens River in the vicinity of the crossing has been carried out to ensure that the proposed culvert option will operate efficiently and satisfactorily during the 1:100 year post-development flood. A bridge structure would not affect the existing natural conditions and a detailed hydraulic performance study for this option is therefore not necessary. Refer to Annexure E.*
21. *Normal road stormwater drainage comprising pipelines and kerb inlets will be installed along the road. Where cut occurs concrete lined side drains will be installed. Refer to Dwg. Nos. 001 – 006, Annexure G.*
22. *The developers of the Bay West City Development will install a stormwater ponding system adjacent to the northern water course which is situated between the N2 and the proposed South CD road. The southern section of the Redhouse Chelsea Arterial road stormwater will discharge into this ponding system. Refer to Annexure M.*
23. *An extensive geotechnical investigation has been carried out approximately along the route of the Redhouse Chelsea Arterial and along the interchange ramps. This investigation shows that the whole area is underlain by the table mountain sandstones of the peninsular formation. This rock is encountered at various depths over the site from surface level to over 2m in depth. The rock is generally overlain with coluvial and fluvial sands and silts. This material is weak in places but can generally be utilised as fill material for the road embankments.*
The trial hole excavations and core drilling for overpass bridges and culvert foundations have been completed and information obtained therefrom has been incorporated into the bridge designs. The drilling for the Baakens culvert / bridge has not yet been undertaken and is awaiting environmental approvals to do so. Refer to Annexure H.
24. *The cumulative E80 traffic expected during the 20 year design life period along the most heavily utilised lane of the Redhouse Chelsea Arterial is 7.3×10^6 E80 axles.*

25. *The recommended pavement design is based on the Catalogue Method applicable to the traffic class and expected E80 axles. The design comprises the following:*

- **40mm Asphalt:** *Type 4a Mix, Compacted to Min. 95% Marshal*
- **150mm Base Course:** *G1 crushed stone max. size 37mm compacted to 88% of apparent relative density.*
- **125mm Subbase:** *C3 cemented natural gravel (G5 before treatment) UCS 3Mpa at 100% Mod AASHTO. Max size 63mm.*
- **125mm Lower Subbase:** *C4 Cemented natural gravel (G5 before treatment) UCS 1,5Mpa at 100% Mod AASHTO).*

Refer to section 14 of this report.

26. *Due to the more complex operations employed in constructing the proposed cement stabilised subbase alternative designs omitting the use of the stabilised subbase and replacing with unstabilised layerworks has been investigated.*

*For this purpose the Cyrano Pavement Analysis program was utilised to predict the long term performance of the road using unstabilised subbase layers as opposed to the recommended cement stabilised subbase. The results show that it is not feasible to construct an unstabilised flexible pavement which can carry the design 7.3×10^6 E80s traffic loading without the riding surface deteriorating below the acceptable levels within about 12 years. **Refer to section 13 and 14 of this report.***

27. *Detailed Accommodation of Traffic plans will be compiled for each section where existing traffic will be affected by construction activities as part of the detail design. After discussion with local authorities, SANRAL and NMBM, it was agreed that the existing traffic flows of the N2 can be temporarily accommodated on one carriageway during the phased construction of the bridges.*

28. *There are a number of existing services which will be affected by the road construction. The most important of these are the existing sewers in the vicinity of the Baakens River which will have to be relocated and large sleeves or culverts installed under the future roadway to contain the sewers. **Refer to Dwg. No.: 004, Annexure G.***

29. *Future services and ducts will be provided where required by the relevant authority.*

30. *Street Lighting is envisaged for the whole of the Redhouse Chelsea Arterial route including the interchange and a section of the N2 from the end of the existing N2 street lighting up to the interchange including the ramps.*
31. *The interchange section of the project will belong to SANRAL and the remainder of the road north and south of the interchange to the NMBM. The planning process undertaken to construct this road dictates that the N2 interchange and Redhouse Chelsea Arterial road will have to be constructed as one contract. It has therefore been agreed in principle by SANRAL and NMBM, that SANRAL will implement the construction all of the roadworks and interchange bridges under a SANRAL contract. The interchange and all road works will be to SANRAL standards and COLTO documentation will apply. SABS 1200 will apply to all the services to be provided within the road reserve under this contract. **Refer to Fig. 6, Annexure A.***
32. *The necessary agreements and Service Level Agreement (SLA) for this procedure to take place are presently being drawn up by NMBM and SANRAL.*
33. *NMBM originally appointed BKS as their consulting engineers on the project and this appointment will now be taken over by SANRAL after the approval of this preliminary design report. i.e. SANRAL will take over the detail design, tender, construction and completion of this project.*
34. *The funding model for the project has been tentatively determined during consultative process; and certain agreements have now been drawn up. Tentative participants in the funding arrangements are as follows:*
 - a) *Redhouse Chelsea Arterial Road – NMBM, Bay West City and possibly Eastern Cape Department of Roads and Public Works (ECDRPW).*
 - b) *Interchange – NMBM, SANRAL and Bay West City.*
 - c) *Walker Drive – NMBM. This is the subject of a separate report however the road construction will be included in the Redhouse Chelsea Arterial contract as agreed to at the project meeting with NMBM/BWC/SANRAL of 15 June 2012.*
35. *The Redhouse Chelsea Arterial Road has not yet been categorized by the Eastern Cape Department of Roads and Public Works (ECDRPW) as a road of metropolitan significance and therefore their involvement is uncertain at this stage.*
36. *Due to funding constraints of NMBM it has been agreed that only one carriageway, the western carriageway, C – E – F – G, of the road will be constructed from the outset as Phase 1A of the project.*

37. *For both practical and economic reasons the full earthworks for both carriageways will be constructed under Phase 1A.*
38. *SANRAL has decided to construct both N2 overpass bridges for both carriageways from the outset. This second bridge will be funded by SANRAL.*
39. *All interchange ramps will be fully constructed during Phase 1A. **Refer to drawings on Annexure G.***
40. *The programme requires that the road and interchange construction is completed by end of July 2014. **Refer to drawings on Annexure F.***
41. *At present this is only achievable if all environmental aspects funding arrangements and agreements are in place prior to calling for tenders which date is mid September 2012, as the construction period is very limited. The completion date may not be achieved if these requirements set out above are not met on time. This programme was agreed to by parties in a meeting held on 22 June 2012. **Refer to Annexure F.***
42. *A rocky outcrop is situated within Redhouse Chelsea Arterial road in the vicinity of the intersection with Walker Drive at C. The possibility exists that in order to preserve this outcrop, the alignment of Redhouse Chelsea Arterial, C – E, will have to be altered by moving the intersection point C eastwards. Motivations are provided in the EIA Report to keep this section of the road on the current alignment, but the final decision depends on DEDEA. **Refer to Annexure K.***
43. *A report entitled “Transportation and Environmental Planning Evolution Report: Discussion Document - February 2012.” was also prepared and submitted to DEDEA setting out the implications of moving the alignment to the east. The report recommended that the road be kept in its current alignment. **Refer to Annexure K. Also refer to Fig. 9, Annexure A.***
44. *Section 10 of this report sets out the consequences of having to re-align the road to the east. If this is required considerable time delays to the project will result. The cost implications as a result of these delays for the redesign of engineering works, survey diagram amendments, revision of reports etc. are difficult to assess in monetary terms but the cost will be considerable. **Refer to Fig. 9, Annexure A.***
45. *The horizontal alignment of the Redhouse Chelsea Arterial requires the use of 3 large radius horizontal curves, starting from the Walker Drive intersection C. These curves are required to ensure that the road crosses the N2 at the correct position to satisfy bridge spacing requirements along the N2 and also to cross the Baakens River at the optimum position before*

intersecting Cape Road at the Bishops Way / Bridgmead intersection. Refer to Dwg. No.: 002, Annexure G.

46. *The N2 overpass bridge requires the use of high approach fills to the bridge, up to a maximum of 8m of fill on both sides of the N2. The vertical curve over the bridge and its approach embankments satisfies the sight distance requirements for 80 kmph design speed. Refer to Dwg. No.: 003, Annexure G. Also refer to Annexure L.*
47. *The Baakens River crossing will require the use of fills. In the case of the bridge design option the maximum height of the fills will be approximate 4m and if preferred culvert is utilised the fill will be approximately 8m. Refer to Dwg. No.: 008, Annexure E.*
48. *A vertical sag curve is utilised over this river crossing where the length of curve has been designed to satisfy the headlight sight distance at an 80kmph vehicle speed. Refer to Dwg. No.: 008, Annexure G.*
49. *Detailed Accommodation of Traffic plans will be compiled for each section where existing traffic will be affected by construction activities as part of the detail design. After discussion with local authorities, SANRAL and NMBM, it was agreed that the existing traffic flows of the N2 can be temporarily accommodated on one carriageway during the phased construction of the bridges.*
50. *The estimated cost of the works based on the preliminary design for Phase 1, which is a dual carriageway assuming the use of culverts instead of bridges over the Baakens River and Cyclopia watercourse, is set out below:*

| | |
|---|-----------------------------|
| • Redhouse Chelsea Arterial (C – E) | R 14 145 181 |
| • Redhouse Chelsea Arterial Interchange (E - F) | R 23 256 452 |
| • Redhouse Chelsea Arterial (F – G) | R 46 409 043 |
| • Cyclopia Culvert (E – F) | R 5 199 352 |
| • Overpass Bridge (E – F) | R 43 848 996 |
| • Retaining Structures (E – F) | R 0 |
| • South Off-Ramp | R 17 770 996 |
| • South On Loop-Ramp | R 13 474 074 |
| • North On-Ramp | R 7 161 801 |
| • North Off-Ramp | R 9 541 351 |
| • Baakens River Culvert | R 12 717 534 |
| • <u>Street Lighting</u> | <u>R 9 523 344</u> |
| <u>TOTAL ESTIMATED COST PHASE 1</u> | <u>R 200 786 172</u> |

Note:

- *If a bridge is required over the Baakens River in place of assumed culvert crossing the cost will increase by R10,9 million.*

- *If a bridge is required for the cyclopa crossing the cost will increase by R4,4 million.*
- *If cyclopa bridge is required the cost will increase by R3,8 million for the retaining structure.*

51. *The estimated cost of the works based on the preliminary designs for the immediate construction Phase 1A which is a single carriageway including complete earthworks for a dual carriageway assuming the use of culverts instead of bridges over the Baakens River and Cyclopa watercourse, is set out below:*

| | |
|--|-----------------------------|
| • <i>Redhouse Chelsea Arterial (C – E)</i> | <i>R 11 456 691</i> |
| • <i>Redhouse Chelsea Arterial Interchange (E - F)</i> | <i>R 20 020 297</i> |
| • <i>Redhouse Chelsea Arterial (F – G)</i> | <i>R 38 327 774</i> |
| • <i>Cyclopa Culvert (E – F)</i> | <i>R 5 199 352</i> |
| • <i>Overpass Bridge (E – F)</i> | <i>R 43 848 996</i> |
| • <i>South Off-Ramp</i> | <i>R 17 770 996</i> |
| • <i>South On Loop-Ramp</i> | <i>R 13 474 074</i> |
| • <i>North On-Ramp</i> | <i>R 7 161 801</i> |
| • <i>North Off-Ramp</i> | <i>R 9 541 351</i> |
| • <i>Baakens River Culvert</i> | <i>R 12 717 532</i> |
| • <i>Street Lighting</i> | <i>R 7 261 394</i> |
| <u>TOTAL ESTIMATED COST PHASE 1A</u> | <u>R 186 780 259</u> |

Note:

- *If a bridge is required over the Baakens River in place of assumed culvert crossing the cost will increase by R10,9 million. This is the preferred option but has to be confirmed by DEDEA.*
- *If a bridge is required for the cyclopa crossing the cost will increase by R4,4 million.*
- *If cyclopa bridge is required the cost will increase by R3,8 million for the retaining structure.*
- *In this estimate section C – E assumes a single carriageways and 2 lanes scheme. If this section is to be provided with 2 carriageways and 4 lanes at the discretion of Bay West City an addition cost of R3,4 million will apply which will be the responsibility of Bay West City.*

52. *It has been agreed between NMBM and SANRAL that the Extension of Walker Drive will be included in the Redhouse Chelsea Arterial contract, so that access to the site can be made easier for both the Walker Drive Extension project as well as the Redhouse Chelsea section as there will be no cross-traffic through different construction sites. The cost for the construction of Walker Drive Extension is R 21,9 million.*
53. *SANRAL has agreed to allow construction vehicles access to the N2 under controlled conditions. It is envisaged that the southern off ramp and north on ramp of the interchange to the N2 will be constructed to subgrade level to afford access to both sides of the N2. Refer to Fig. 6, Annexure A.*
54. *Large volumes of material will have to be moved from the north side of the N2 to the south side to be utilised as fill for the overpass bridge embankments. SANRAL has agreed to allow the use of the existing N2 bridge over the N2 for haul traffic. This means that the north CD road reserve will have to be constructed as a haul road from Redhouse Chelsea Arterial to the existing bridge.*
55. *The south CD Road which is earmarked for construction by Bay West City will also have to be utilised from the existing bridge to the Redhouse Chelsea southern embankments. A special arrangement will have to be entered into between the Bay West Contractor and the Redhouse Chelsea Arterial road Contractor for the use of this road. The south CD Road is only scheduled to be constructed during a later phase of the Bay West project. Refer to Fig. 6, Annexure A.*

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Annexure B: Preliminary Estimated Costs

Annexure C: Transportation Study for the Western Suburbs Local Spatial Development Framework, March 2009

Annexure D: Revised Traffic Impact Assessment for Proposed Mixed Use Development on Erf 426 Hunters Retreat and Portion 131 Farm Little Chelsea No. 10, October 2009.

Annexure E: Proposed Redhouse Chelsea Arterial Road Baakens River Crossing: Report on Bridge vs. Culvert Option, November 2010 (REV01 – 16 November 2010)

Annexure F: Preliminary Implementation Programme

Annexure G: Preliminary Design Drawings

Annexure H: Geotechnical Investigation for Redhouse Chelsea Arterial and Walker Drive Extension, Port Elizabeth, Eastern Cape (May 2010)

Annexure J: Minutes Of The Meetings Held By The Authorities Between June 2010 and February 2011.

Minutes of the MDTTT meeting held on the 1 June 2010, 17th Floor Lillian Diederick Building.

Minutes of the Technical Meeting held on 28 October 2010, to discuss the Cost Apportionment of the Redhouse Chelsea Arterial / N2 Interchange at SANRAL Offices.

Minutes of the Technical Meeting held with East Cape Department of Roads Public Works (ECDRPW) on the 29 November 2010, to discuss the Preliminary Design Drawings of the Redhouse Chelsea Arterial.

Minutes of the Technical Meeting held with South African National Roads Agency (SANRAL) on the 30 November 2010, to discuss the Preliminary Design Drawings of the Redhouse Chelsea Arterial.

Minutes of the Technical Meeting held with Nelson Mandela Bay Municipality (NMBM) on the 01 December 2010, to discuss the Preliminary Design Drawings of the Redhouse Chelsea Arterial.

Minutes of the Technical Meeting held on 08 December 2010, to discuss the Technical and Financial Aspects of the Redhouse Chelsea Arterial / N2 Interchange at SANRAL Offices.

Minutes of the Technical Meeting held on 13 December 2010, to discuss the Contractual Aspects of the Redhouse Chelsea Arterial / N2 Interchange at SANRAL Offices.

Minutes of the Technical Meeting held on 14 February 2011, to discuss the Technical and Financial Aspects of the Redhouse Chelsea Arterial / N2 Interchange at SANRAL Offices.

Minutes of the Project Management Meeting – 13 April 2012, at SANRAL offices.

Minutes of the Project Management Meeting – 18 May 2012, at SANRAL offices

Annexure K: Transportation and Environmental Planning Report: Feb 2012

Annexure L: Bridge Report: Proposed Redhouse Chelsea Arterial Overpasses: March 2012

Annexure M: Bay West City: Engineering Services Stormwater Management Masterplan, November 2010.

LIST OF ABBREVIATIONS

| | |
|---------------|--|
| BRT | Bus Rapid Transit |
| CETT | Co-operate EIA Task Team of NMBM |
| DEDEA | Department of Economic Development and Environmental Affairs |
| DWAF | Department of Water Affairs and Forestry |
| EAS | Engineering Advice and Services Consultants |
| EIA | Environmental Impact Assessment |
| LSDF | Local Spatial Development Framework |
| MDTTT | Multi Disciplinary Technical Task Team |
| NMBM | Nelson Mandela Bay Municipality |
| ROD | Record of Decision |
| TIA | Traffic Impact Assessment |
| SANRAL | South African National Roads Agency SOC Ltd |
| LOS | Level of Service |
| BWC | Bay West City |
| SLA | Service Level Agreement |
| AOT | Accommodation of Traffic |

1. INTRODUCTION AND TERMS OF REFERENCE

The Municipal Manager resolved on 5 August 2004, to appoint BKS (Pty) Ltd to carry out preliminary design, detail design, tender process and construction monitoring of the Redhouse Chelsea Arterial from the present end of construction of Walker Drive to Cape Road. This included the proposed interchange with the N2, and the upgrading of Kabega Road between Kragga Kamma and Frikkie Kotze Drive, the Linton interchange, Frikkie Kotze Drive and Samantha Way from Frikkie Kotze Drive to the Linton interchange. (*Refer: NMBM reference B902*).

The Executive Director: Infrastructure and Engineering, informed BKS (Pty) Ltd on 1 February 2008 that the previous appointment to design and prepare contract documentation for the portions of Redhouse Chelsea Arterial from Walker Drive to Cape Road had been amended to include the link from Walker Drive to Cape Road traversing through the existing Redhouse Chelsea Arterial reserve and to incorporate an overpass over N2 and its associated ramps. (*Refer: NMBM reference B902*).

Based on the assignment described above, on 13 October 2008 BKS submitted a report to NMBM (entitled "*Extension of Walker Drive to Cape Road: Redhouse Chelsea Arterial (Phase 1) Preliminary Design Report: Final Draft dated September 2008*") on the proposed Redhouse Chelsea / Arterial Road. This design was based on locating the proposed road within the originally allocated road reserve provided for the facility. This reserve was situated immediately to the west of the Sherwood urban area passing through Rowallan Park to the Cape Road / Bishops Road intersection. The construction of this road was to be Phase 1 of the road network implementation programme for the area which was approved by both NMBM and South African National Roads Agency SOC Ltd (SANRAL).

Subsequently Setplan town planners were appointed by the NMBM to prepare a LSDF for the Greater Hunters Retreat and Engineering Advice and Services (EAS) were appointed as sub-consultants to Setplan to undertake the transportation planning for the greater area. This study indicated a new road network for the area with the proposed Redhouse Chelsea Arterial and its interchange with the N2 in a new position. *Refer Annexure C: Transportation Study for the Western Suburbs Local Spatial Development Framework dated 27 March 2009*.

On submission of the draft Redhouse Chelsea Arterial Preliminary Design Report dated October 2008 (*in terms 1 February 2008 appointment*) to the environmental consultants for comment, the location of the proposed road was found to traverse environmentally sensitive riverine areas. The construction of the road in this location was therefore not recommended and a new position for the road reserve needed to be investigated. After discussions with

the officials of the municipality BKS were requested to investigate a new route for the Redhouse Chelsea Arterial and Walker Drive.

After an evolutionary process, taking into account the now available EAS transportation report and other factors such as the optimum position for the Redhouse Chelsea Arterial to cross the Baakens River, SANRAL requirements regarding the spacing of interchanges, geometric and environmental considerations such as avoiding rocky outcrops where possible, and the proposed Bay West City and Utopia developments the final alignment of the Redhouse Chelsea Arterial, and the location of the Walker Drive Extension as well the configuration of the associated major roads was fixed and agreed upon. These roads are shown on **Fig 2 sheet 1 and sheet 2, Annexure A**.

Discussions between NMBM and the Bay West City developers resulted in proposals being considered by NMBM regarding the funding responsibilities for the Redhouse Chelsea Arterial and N2 Interchange, Walker Drive Extension and associated roads. **Annexure A Fig 3** shows proposed funding responsibilities.

NMBM since decided to proceed with the implementation of this section of Walker Drive Extension shown B–C on **Fig 3** during the 2010/2011 municipal financial year and requested that BKS prepare the necessary documentation estimates and drawings so that this section of Walker Drive may be constructed and completed before end June 2011 financial year. This section of road would form the link between the present end of construction of Walker drive and the proposed Redhouse Chelsea Arterial.

A preliminary engineering report has therefore been prepared which encompasses inter alia, the route location and selection, land acquisition, geotechnical investigation, pavement design, stormwater management and cost estimates applicable to this section of Walker Drive extension, which forms a component of the proposed future major road configuration in the area. The BKS Report entitled "*Extension of Walker Drive to proposed Redhouse Chelsea Arterial*" has been re-submitted in June 2012.

As the section of Walker Drive from present end of construction up to the intersection with the proposed Redhouse Chelsea Arterial road has been the subject of the separate abovementioned report, this section of road will not form part of this report on the Redhouse Chelsea Arterial Road. This report is therefore applicable to the section of road shown C-E-F-G on **Fig 3** known as **Redhouse Chelsea Arterial** and includes the N2 / Redhouse Chelsea Arterial Interchange.

Walker Drive (C – D) will also be extended through the Bay West City development, intersecting with the arterial roads and the CD roads, and will use the existing bridge across

the N2 which is located midway between the proposed interchanges. This section of Walker Drive will be constructed as part of the Bay West City development.

2. PURPOSE OF REPORT

The purpose of this report is therefore to describe the technical considerations, environmental aspects and land issues taken into account in the preparation of the preliminary design of the Redhouse Chelsea Arterial Road from its intersection with the proposed Walker Drive Extension (C) to its intersection with Cape Road (G), **(Fig 3)**.

3. ROUTE LOCATION AND DESCRIPTION

A new interchange which will have 4 ramps with a bridge over the N2 will be constructed to serve all traffic movements to and from the N2 and the Redhouse Chelsea Arterial. The Redhouse-Chelsea Arterial is planned to run from Cape Road to Walker Drive Extension and eventually to Kragga Kamma Road. **(Fig 4, Annexure A)**

The original section of the Redhouse Chelsea Arterial Road Reserve as selected some number of years ago was found to be unsuitable because of it encountering constraints where it crossed the Baakens River. Refer to EAS transportation study dated 27 March 2009 which formed part of the LSDF report for the western suburbs.

A section of the route in terms of the EAS report determined that it would pass through the property comprising the Bay West City development (formerly N2 Gateway) and the developers agreed to make the land available for this section of the road reserve. The scope of the EAS report however did not encompass the optimization of the position of the Baakens River crossing or the required distances between off and on ramps between 2 interchanges in terms of SANRAL requirements namely the Redhouse Chelsea and western interchange *Refer Fig 4 Annexure A*.

The alignment of the Redhouse / Chelsea arterial was thus amended by BKS by moving the interchange 70 meters eastwards but still crossing the Baakens River at the optimum position. The route was then flagged and verified on site for suitability by both the wetland and vegetation specialist consultants, Mr Pote of Blue Sky and Dr Peter Illgner. These specialists were appointed as sub-consultants to Terratest who are the environmental consultants for Redhouse/Chelsea Arterial road.

The road position chosen for the main Baakens River crossing is also optimum with regard to both environmental and engineering aspects. The slight movement of the crossing position up or downstream will considerably increase the cost of the bridge and will also intercept numerous minor wetlands on the northern bank of Baakens River. This shifting exercise was

communicated to NMBM (*Refer letter: 028LKB*) dated 25 June 2009. This selected position of the proposed bridge should therefore be regarded as fixed.

At this juncture BKS were in a position to arrange for a new strip survey and geotechnical investigation on the revised alignment. However, during the submission process of the Environmental Impact Report for the Bay West City Development it became apparent that the extent of the cyclopa endangered species along the watercourse immediately to the south and parallel to the N2 was more extensive than originally anticipated according to the report of Dr Eileen Campbell dated 2008 commissioned by the Nelson Mandela Bay University. This report was forwarded to NMBM and Setplan as LSDF Consultants to be aware of the changes on Redhouse Chelsea Arterial on 2 July 2009.

A meeting was held at Setplan Offices on 15 July 2009 between Setplan and BKS representatives. The purpose of this meeting was to present the proposed relocation of Redhouse Chelsea Arterial route due to Cyclopa Pubescence. Although the cyclopa were not growing along the planned route at the time of the Terratest survey, the Campbell report showed that cyclopa had historically been present along the proposed alignment and that seeds could this be present in the ground.

A new alignment was therefore again selected in conjunction with the specialist environmentalists to avoid the most densely historically populated cyclopa area. This has been accomplished by moving the N2 crossing point 160m eastwards, but leaving the main Baakens crossing in the optimum position. The route was then re-flagged and verified for suitability by both the wetland and vegetation specialist consultants, on 24 July 2009. Both Specialists produced route assessment reports about the suitability of the main route and the ramps. On 4 August 2009 BKS requested both the environmental specialists to directly send their comments on the suitability of the revised route to Setplan as the town planning consultants for the LSDF for the Greater Hunters Retreat Area.

Certain rocky outcrops were also intercepted by the proposed road in the vicinity of the proposed shopping mall. It has been indicated by the environmental specialist that the specific rocky outcrop that intersects with the road alignment is already damaged and degraded and therefor the alignment route was indicated as suitable.

It should be noted therefore that a section of the proposed new Redhouse/Chelsea alignment is now not in the position as originally determined by the EAS report dated 27 march 2009 i.e. the position of the Redhouse/Chelsea overpass bridge over the N2 has in total moved 230 m eastwards from the original EAS selected position.

A meeting was held with SANRAL on 7 July 2009 to discuss the spacing between the Redhouse Chelsea /N2 interchange and Western Interchange. SANRAL approved the reducing of this spacing in principal keeping in mind that the future signage of the Western Interchange would be clear and give ample warning by making use of the existing bridge for the signing.

4. REGISTRATION OF ROAD RESERVE AND LAND ACQUISITION

Annexure A, Fig 5 shows the land which has to be acquired for the Redhouse Chelsea Arterial and the associated N2 interchange. The proposed land acquisition drawing is based on the geometric requirements of the Redhouse Chelsea Arterial and interchange ramps. The land required is shown on the table below:

Table 1: Land Acquisition

| ERF No. | OWNER | TITLE DEED No. | ZONING | TOTAL REQUIRED LAND (m ²) |
|---------|------------------------------------|----------------------------------|--------|--|
| 425 | Engen | 10 00425 0000 Port Elizabeth | TRAN1 | 63,925.00 |
| 426 | N2 Gateway | 10 00426 0000 Hunters Retreat | BUS1 | 67,090.00 |
| 447 | Department of Housing | 10 00447 0000 Hunters Retreat | TRAN1 | 12,544.00 |
| 448 | Department of Housing | 10 00448 0000 Hunters Retreat | TRAN1 | 5,373.00 |
| 449 | Nelson Mandela Bay Municipality | 10 00449 0000 Hunters Retreat | TRAN1 | 7,258.00 |
| 456 | Nelson Mandela Bay Municipality | 10 00456 0000 Hunters Retreat | TRAN1 | 39,342.00 |
| 668 | National Public Works | 10 00668 0000 Rowallan Park | UND | 9,685.00 |

| | | | | |
|--------------|-----------------------|--------------------------------|-----|-------------------|
| 437 | Department of Housing | 10 00437 0000 Rowallan Park | UND | 2,204.00 |
| TOTAL | | | | 207,421.00 |

A number of meetings between the interested parties have already taken place to discuss the acquisition of the land and the process to be followed has been agreed to in principle.

5. TRANSPORTATION PLANNING AND ROAD NETWORK

Setplan were appointed by the NMBM to prepare a local special development framework LSDF for the Greater Hunters Retreat Area and Engineering Advice and Services (EAS) were appointed as sub-consultants to Setplan to undertake the transportation planning for the greater area. This study indicated a new road network for the area with the proposed Redhouse/Chelsea Arterial and its interchange with the N2, in a new position.

Engineering Advice and Services (Pty) Ltd (EAS) was commissioned by Nelson Mandela Bay Municipality (NMBM) during October 2008 to provide transportation planning input into the Western Suburbs Local Spatial Development Framework (LSDF) carried out by Settlement Planning Services (SETPLAN).

Before the compilation of the abovementioned LSDF for the Western Suburbs report, road network and land-use proposals for the LSDF study were assessed and documented in the report entitled *“Transportation Study for the Western Suburbs Local Spatial Development Framework, December 2008”* prepared by EAS with network demand modelling input carried out by Africon Pty Ltd (now Aurecon).

The EAS report of 2008 investigated a number of road networks (including both Walker Drive Extension and Redhouse Chelsea Arterial road) and land-use options which included provision for both the proposed Westpoint and Mandela Bay Precinct developments. These two developments were later combined to form one development called N2 Gateway Development project (now Bay West City Development).

During March 2009 a report entitled *“Transportation Study for the Western Suburbs Local Spatial Development Framework”* was prepared by EAS (**Refer Annexure C**). The purpose of this study was to define the final proposed road network as determined in the 2008, study and in consultation with SANRAL. The report also took into consideration the land-use proposal contained in the *“Rezoning Application for the N2 Gateway Development Proposal”* (now Bay West City Development) as submitted to NMBM during December 2008 after

completion of the transportation study dated December 2008. The Bay West City's rezoning application was submitted subsequent to the EAS 2008 report hence the March 2009 report was also required to take into account the rezoning.

The EAS *"Transportation Study for the Western Suburbs Local Spatial Development Framework" March 2009* report determined the appropriate road network (which includes both Walker Drive Extension and Redhouse Chelsea Arterial) in the Western Suburbs LSDF area. This road network was designed to cater for the traffic generated by the land-use proposals as contained in the LSDF study. The March 2009 EAS report determined the cross sections of the various components of the LSDF road network. The report includes the required cross sections for both Walker Drive Extension and Redhouse Chelsea Arterial.

The EAS report of March 2009 also made the following recommendations relevant to Walker Drive and Redhouse Chelsea Arterial:

- a) When considering the escalated existing traffic situation (i.e. excluding the Bay West City Development and other developments as indicated in the LSDF) then the NMBM will be required to provide a lane configuration of one lane in each direction for both the Walker Drive and Redhouse Chelsea Arterial.
- b) That the road network Option D as defined in the EAS report of March 2009 be adopted as the preferred road network for both the Comprehensive Integrated Public Transport Plan (CITP) and Western Suburbs LSDF of NMBM.
- c) That the optimum route alignments for both Redhouse Chelsea Arterial and Walker Drive Extension be determined as a matter of urgency.
- d) That the ultimate road cross sections which will be required for the road network Option D as depicted in the LSDF study, would be three lanes per direction. The third lane would be converted to function as a public transport route in the future.
- e) That a detailed Traffic Impact Assessment be prepared for certain proposed developments within the LSDF area such as Bay West City Development. This TIA would be required to determine the required cross sections of roads immediately adjacent to these developments and also taking into account the impact of the proposed development on peak hour traffic.

As a result of the above, Bay West City appointed consulting engineers SSI to prepare a traffic impact assessment, the amended version of which was submitted to NMBM. This subject TIA was initially submitted to NMBM on the 30 April 2009 and was amended based on the comments received from NMBM in letters dated 11 August and 05 October 2009 respectively.

The TIA also examined the access requirements for the proposed developments in relation to the surrounding road network, determined the amount of traffic that will be generated by the development and analysed the impact on the capacity of the affected roads and intersections. This took into consideration the cumulative effect of traffic which will be generated by other proposed developments in the area as modelled in the *“Transportation Study for the Western Suburbs Local Spatial Development Framework”* (27 March 2009 by EAS). The traffic model which was developed for this Transportation Study by Aurecon/EAS was used to test alternative road networks and to determine the number of lanes required for each road for the full development scenario.

The TIA also considered the need for public transport to serve the adjacent developments and made recommendations to ensure pedestrian and traffic safety. The TIA investigated and determined the cross-sections for the roads immediately adjacent to their development as per the recommendations contained in the *“Transportation Study for the Western Suburbs Local Spatial Development Framework”* dated March 2009.

Both TIA content and the recommendations contained in the Bay West City TIA were *“approved in –principle”* by the South African Road Agency (SANRAL) and Eastern Cape Department of Roads and Public Works (ECDRPW) on the 25 January and 02 February 2010 respectively. It was then approved by the NMBM on the 03 March 2010.

In terms of the revised NMBM appointment issued to BKS during February 2008, BKS were instructed to proceed with the determination of the routes for Walker Drive and Redhouse Chelsea Arterial taking into account the recommendations contained in the *“Transportation Study for the Western Suburbs Local Spatial Development Framework”* dated March 2009. Refer to point c above.

From the above it can be seen that, various transportation reports were developed to motivate the Redhouse Chelsea Arterial road and interchange with the N2 as well as the associated major roads which, includes the extension of Walker Drive and also to assess the impact of the proposed land-use on the proposed road layout.

SSI representing Bay West City were requested by the NMBM to amend their TIA to take into account the results of the Aurecon September 2009 report to determine the number of lanes required on each road link in the proposed network for two scenarios, namely:

- a) Full development of Bay West City but assuming no other development occurs in the Western Suburbs LSDF area. (*Scenario 1*)
- b) 75% Development of all developable land in the Western Suburbs LSDF area, including the Bay West City development. (*Scenario 2*)

NMBM approved the Bay West City TIA dated 15 October 2009 and sent copies to SANRAL and the Province of Eastern Cape, Roads and Transport Directorate on 17 November 2009. An “*approval in-principle*” was obtained on 25 January 2010 from SANRAL and 2 February 2010 from the ECDRPW. The formal letter from NMBM incorporating SANRAL and the Provinces approval were issued on 3 March 2010.

It was found that the number of lanes required on each road link for both of these scenarios, based on the traffic model volumes and applying the road reserve widths prescribed by NMBM, is shown in the table below. NMBM stipulated that it wanted 40m road reserves for all future 6 lane roads, 35 m reserves for 4 lane roads and 25m reserves for 2 lanes. Along certain sections of the Redhouse Chelsea Arterial the road reserve will have to be widened to 60m to accommodate the fill slopes. These widened sections however occur within the commonage along the Baakens River and the N2 interchange.

Table 2: Lanes required for Redhouse Chelsea Arterial

| Road | Description | Required Lanes per Direction | | Minimum Road Reserve |
|----------------------------------|-------------------------------------|------------------------------|------------|----------------------|
| | | Scenario 1 | Scenario 2 | |
| Redhouse Chelsea Arterial | From Cape Road to Kragga Kamma Road | 2 | 3 | 40m |

The traffic modelling that was done by Aurecon/EAS for the Western Suburbs LSDF as explained above for the 2018 escalated background traffic on the road network, assuming no development of Bay West City, showed that NMBM is required to construct one lane in each direction for the Redhouse Chelsea Arterial between Cape Road and Kragga Kamma Road, and one lane in each direction for Walker Drive Extension from its existing end point to the Redhouse Chelsea Arterial, to accommodate the background traffic growth.

The 2018 traffic forecasts indicate the number of lanes which must be provided per direction on the Redhouse Chelsea Arterial to accommodate the 2018 traffic forecasts for Phase 1 of the Bay West City development including escalated background traffic.

6. GENERAL DESCRIPTION OF THE PROPOSED REDHOUSE CHELSEA ARTERIAL AND N2 INTERCHANGE

(Refer to Fig 3 Annexure A).

Phase 1 of the Redhouse Chelsea Arterial road project will comprise the section of road C-E-F-G. The Redhouse Chelsea Arterial commences at the Walker Drive intersection and ends with an intersection at Cape Road. It will cross the N2 National Route and an interchange (E – F) will be constructed to provide linkage between these two roads. The section of road F – G will include a crossing of the Baakens River ending at the intersection with Cape Road. Phase 2 will comprise the addition of an extra lane to both carriageways as described below. Future Phase 3 will consist of the extension of Redhouse Chelsea Arterial from Walker Drive to an intersection with Kragga Kamma Road. **(Fig 4 Annexure A).**

The whole section of Redhouse Chelsea Arterial from C – G will comprise 2 carriageways each consisting of a 3,8m and 3,4m lane with a shoulder of 1,2m and a 2,6m non motorised transport facility. **(Refer to Fig 8: Sheet 1, Annexure A).** This will comprise Phase 1 of the

implementation programme as prescribed in the approved TIA report dated 15 October 2009.

Phase 2 will comprise the conversion of the non-motorised transport facility and pedestrian walkway to one additional lane in each direction. A separate pedestrian way and non motorised bridge will also be provided. **(Refer to Fig 8: Sheet 2, Annexure A).**

Each component of the proposed roadworks is described in more detail hereunder. *Refer to Annexure G showing the preliminary design drawings.*

6.1 REDHOUSE CHELSEA ARTERIAL ROAD SECTION C – E

This section of road passes through property belonging to the Bay West City Developers who have provided a 40m wide road reserve for this purpose. A traffic circle will be provided at the ultimate 4 way intersection with Walker Drive at C. It is the intention of Bay West City Developers to extend Walker Drive from C to D under a separate private road and services contract. This work might be carried out simultaneously with the construction of the Redhouse Chelsea Arterial road contract but by other contractors.

Bellmouths will be provided on the Redhouse Chelsea Arterial approximately midway between C – E at the proposed intersection for entrance to the Bay West City development. The spacing of this access from the intersections at C and D are dealt with in the TIA Report entitled “*Revised Traffic Impact Assessment for Proposed Mixed Use Development on Erf 426 Hunters Retreat and Portion 131 of Farm Little Chelsea No. 10 dated October 2009*”. **(Annexure D)**

6.2 REDHOUSE CHELSEA ARTERIAL / N2 INTERCHANGE: SECTION E – F

Refer to typical cross sections shown on Drawing No J00488-00-10-701-P-00 (Annexure G).

The original concept was for Redhouse Chelsea Arterial to cross the N2 at chainage 19.675km of the N2 shown as Option 1 on **Fig 2: Sheet 2, Annexure A**, with an off-ramp from the west bound N2 carriageway onto the Redhouse Chelsea Arterial and with an on-ramp from the arterial road onto the eastbound carriageway of the N2. Due to various environmental constraints and subsequent transportation studies the position for the Redhouse Chelsea was moved westwards and after a process was fixed in its present position to cross the N2 at chainage 18.987km Option 4, as described in section 3 above.

At a meeting held on 7 July 2009 in the offices of SANRAL at which the proposed interchange was discussed. SANRAL requested that 2 additional loop ramps be provided, namely an on-ramp onto the N2 west bound carriageway and an off ramp from the eastbound carriageway of the N2 onto the Redhouse Chelsea Arterial. These ramps have now been incorporated in

the interchange designs. Option 4 on **Fig 2** shows the proposed layout of the interchange which is considered the optimum configuration when taking into account various factors such as environmental, land, geometric and other constraints.

The various components of the interchange are described in more detail hereunder.

6.2.1 N2 Overpass Bridge

The bridge structure will comprise two 11m wide independent bridges separated by a 4m wide opening between the structures. The opening will replace the 5m wide median provided on the roadway. Relative to the crossing points on the N2 the bridges will be designated as east bridge (B0212A) and west bridge (B0212B) and their intersections are as follows:

Table 3: N2 Bridge intersections

| Item | Bridge | N2 Chainage (on C/Line) | Redhouse / Chelsea Road Chainage |
|------|--|----------------------------|-------------------------------------|
| 1. | East | 18.978km | 810.948m |
| 2. | West | 18.960km | 803.034m |
| 3. | Combined: on centreline of Redhouse Chelsea median | 18.987km | 806.991m |

The bridges will cross the National Route 2 (N2), Section 11 at an angle of 26°.

It will be necessary to provide approach embankments to both sides of the bridges to a height of approximately 8m. This material will be obtained from various sources on site namely:

- Cut from the Redhouse Chelsea road reserve particularly from the section north of the N2.
- Road box-cut excavations elsewhere along the road.

A reinforced earth solution has also been investigated to reduce the fill requirements, but have been shelved after discussions with SANRAL and taking into account their preference.

The bridge vertical and horizontal clearance was determined using the latest Clearance Diagrams for Bridges dated February 2011. The various structural aspects and construction proposals for the bridge are described in the report submitted to SANRAL entitled "Contract

NRA N002-110-2012/1 Redhouse Chelsea Interchange Bridge Report: N2 Overpasses Bridge B0212A and Bridge B0212B". The report is attached as **Annexure L** of this report.

6.2.2 Cyclopa Structure

The Redhouse Chelsea arterial will cross the Northern watercourse situated to the south of the N2 road at approximate chainage 610m of Redhouse Chelsea Arterial centreline. This watercourse is a minor tributary of the Baakens River and carries a limited stormwater flow. The watercourse will be crossed by means of a 5.0m x 3.0m reinforced concrete box culvert or alternatively a 20m single span reinforced concrete bridge. The openings in the structures are considerably in excess of its hydraulic requirements and will have a negligible effect on the 1:100 year floodline.

6.2.3 South Off-ramp and South Loop On-Ramp

The off ramp will lead the westbound N2 traffic to a 4 way traffic signalised intersection with the Redhouse Chelsea Arterial at chainage 503m at E. The south off-ramp takes off from the N2 West Bound at chainage 19.72km with sufficient length to satisfy the deceleration requirements. The south off ramp then combines with the south loop-ramp which in turn conveys traffic from the Redhouse Chelsea Arterial to the westbound N2 traffic. Two directional traffic will thus be conveyed along the combined ramps. The south loop on ramp has been designed to satisfy acceleration requirements, making it possible for traffic from the ramp to merge with the N2 traffic travelling at 120kmph in the left hand lane of the N2 West Bound at chainage 18.46km.

In order to ensure that the two directional traffic is effectively separated and to avoid vehicles from entering the wrong N2 carriageway, a kerbed median island will be provided between the lanes together with a New Jersey barrier. The head of the barrier will have a crash prevention facility.

The combined ramps will cross the northern watercourse at approximate chainage 720m of the south off ramp and chainage 240m of the south on ramp where a reinforced concrete box culvert will be provided. The limited width of roadway and fill height results in a fairly short culvert length of approximately 37m.

6.2.4 North On-ramp and North Loop-Off-Ramp

Traffic leaving the Redhouse Chelsea Arterial at Point F will access the east bound traffic of the N2 along a sufficient acceleration length to attain 120kmph design speed. The existing Baakens River culvert under the N2 at chainage 19.80km does not have to be extended as the acceleration ramp enters the N2 Eastbound carriageway before this point. Eastbound N2

traffic will decelerate along the north loop off-ramp to enter the ultimate 4 way intersection at F. This intersection will be controlled by traffic lights.

The North Collector Distributor road, North C D Road will extend westwards from F in the future when the Bay West City development extends into the areas north of the N2.

6.3 REDHOUSE CHELSEA ARTERIAL SECTION F – G

This section of road is approximately 1240m in length and will take traffic from F through to the intersection with Cape Road at G which is opposite the existing intersection of Bishops Way. Bishops Way is the main access to Bridgemead Township and could form a future northwards extension to the Redhouse Chelsea Arterial. The choice of the alignment of this section of road is described in more detail in Section 3 of this report however the critical points and requirements along the route are as follows:

- Fixed position of the Baakens River crossing point. The river crossing at this point will be approximately at right angles to the river flow and at the narrowest point of the river channel. Fixed position at G to achieve the correct alignment with Bishops Way at the Cape Road / Redhouse Chelsea Arterial intersection.
- Route selected to return to original Redhouse Chelsea Arterial road reserve through Rowallan Park Township to avoid a major expropriation of land on Erf 668 Rowallan Park.
- Route selected to pass through generally environmentally degraded areas wherever possible.

No further intersections are recommended along this section of road, including any connections to the extension of Van der Stel Street on northern side of the Baakens River. These intersections would interrupt traffic flow and also be in geometrically unsuitable areas with regard to sight distance requirements.

Fairly deep cuts and fills will be required on both sides of the proposed Baakens River crossing. Reinforced earth embankments for the fill will not be considered in proximity to the river because of its limited resistance to hydraulic erosion.

6.3.1 Baakens River Crossing

There are two possible methods which can be utilised to take the Redhouse Chelsea Arterial over the Baakens River namely a bridge or a box culvert. In order to assess the relative merits and demerits of both systems a report entitled *“Baakens River Crossing Report on Bridge vs. Culvert Option”* dated November 2010 Revision 01 was prepared and is attached as **Annexure E**. The findings are as follows:

a) Multispan Culvert Crossings

This is the technically preferred solution and comprises the construction of a twin 5,0m span x 3,0m high reinforced concrete box culvert. The hydraulic capacity of the culvert is in excess of the 1:100 year unattenuated flow from the eventual fully developed upstream catchment and has very little impact on the water levels.

The culvert openings have been made larger than hydraulically required in order to decrease the flow velocities to allow the establishment of a “more natural” channel through the culvert. The culvert capacity is also well in excess of the existing downstream Baakens River/ N2 culverts where no hydraulic problems have been experienced in the past.

A detailed floodline study and hydraulic analysis to determine the existing conditions along the river bed during periods of flooding has been carried out together with an analysis of the effect on the river flow due to the construction of the proposed culvert. These effects have been found to be minimal and are described in the attached report in **Annexure E**.

b) Bridge Crossing

In this solution a reinforced concrete post tensioned 3 span bridge each span being 20m would cross the river. This solution would avoid the requirement of the deep fills but be considerably more expensive than the culvert that is, in the order of **R13,9 million**. This therefore is not the preferred option from a technical point of view.

7. TOPOGRAPHICAL SURVEY

A topographical strip survey of the whole of the Redhouse Chelsea Arterial road from Walker Drive intersection to Cape Road together with associated interchange ramps was undertaken by the surveyors Surplan and the designs have been based on this information. This survey included a cross section survey of the Baakens River for a suitable distance both upstream and downstream of the proposed Baakens River bridge / culvert crossing.

8. ENVIRONMENTAL ASPECTS

On 25 March 2010 Terratest was re-appointed by NMBM as consultants to conduct a full Environmental Impact Assessment (EIA) for the Redhouse Chelsea Arterial including the N2 interchange and the Walker Drive Extension. The following is a table showing the EIA progress to date:

Table 4: EIA Progress to date

| Item | Process Description | % to Complete |
|------|--|---------------------------------------|
| 1. | Project Application and Registration | 100% |
| 2. | Registration of I & APs, as prescribed by the EIA Regulations | 100% |
| 3. | Preparation of Draft Scoping Report (DSR) | 100% |
| 4. | Public Review of the DSR | 100% |
| 5. | Authority Review of the DSR | 100% |
| 6. | Consolidate comments and submit a Final Scoping Report with a Plan of Study for EIA | 100% |
| 7. | Authority Review of the Final Scoping Report and approval of the Plan of Study for EIA | 100% and Approved |
| 8. | Specialist Studies (Mr. Jamie Pote and Dr. Pete Illgner) | 100% |
| 9. | Preparation of the Draft EIR | 100% |
| 10. | Presentation of Draft EIR to NMBM CETT | 100% |
| 11. | Release of the Draft EIR for Public Review | 100% |
| 12. | 40 – day Public Participation Period (Including DEDEA Review of Draft EIR) | 100% |
| 13. | Consolidate comments, Preparation and submit a Final EIR to DEDEA on May 18 2012 | 100% |
| 15. | Authority review of the Final EIR | Depends on DEDEA timeframes (Ongoing) |
| 16. | Authority Decision – dependent on information availability | October 2012 |

| | | |
|--|----------------------------|-------------------|
| | and final recommendations. | (Expected) |
|--|----------------------------|-------------------|

The overall EIA progress is approximately 90% complete. The Environmental Authorisation is now anticipated to be obtained during October 2012.

There was a delay that was caused by DEDEA requiring that a route determination and assessment (technical and environmental) of the Redhouse Chelsea Arterial from Walker Drive Extension to Kragga Kamma Road be considered and included in the final Environmental Impact Report (EIR). This letter was e-mailed by Terratest on 13 February 2012

With reference to DEDEA correspondence dated 10 February 2012, and the discussion between the NMBM and DEDEAT at the Bilateral Meeting between the two institutions on 25 May 2012. A document entitled "Desktop Assessment and Route Determination from Walker Drive to Kragga Kamma Road - June 2012" has been prepared as an Addendum to the Final Environmental Impact Report that was submitted to DEDEAT and its purpose is to consider the route determination of the sequent phases. Input has been provided by Terratest, (NMBM) and BKS Engineers.

With reference to a site visit with DEDEA and NMBM officials on Tuesday, 24 July 2012, DEDEA correspondence dated 30 July 2012, and series of meetings with stakeholders to discuss DEDEA correspondence dated 30 July 2012. A strategy and programme for the amendment of the Environmental Impact Report was adopted. Input has been provided by Terratest, NMBM (Transportation and Environmental), Bay West City and BKS Engineers.

9. GEOTECHNICAL INVESTIGATION

9.1 TRIAL HOLE INVESTIGATION FOR ROADWORKS

A geotechnical survey was carried out along the Redhouse Chelsea Arterial road route and the associated interchange ramps, including the extension of Walker Drive, by Terratest Geotechnical Environmental and Earth Science Consultants. The findings of this survey are elucidated in their report entitled "*Geotechnical Investigation for Redhouse Chelsea Arterial and Walker Drive Extension, Port Elizabeth Eastern Cape*" dated May 2010, the summary of which is attached as **Annexure H**. All of the relevant material testing data is included in the report.

The geotechnical study which was carried out approximately along the Redhouse Chelsea road centreline and otherwise generally in the area of the Redhouse Chelsea Arterial road, and the associated ramps indicates that bedrock comprising quartzitic sandstone of the

peninsular formation underlies the whole of the road route. This bedrock can be expected to be found at varying depths averaging approximately 0,7m – 1,5m in depth. The bedrock is overlain by residual weathered sandstone and other variously deposited colluvial and fluvial sands and silts and ferricrete in places.

The design CBR value used for the subgrade is tested at a depth of 1000mm for the road category UA, according to Table 9 of UTG 3 – Structural Design of Urban Roads. The design CBR value used for the subgrade is 3 to 7. Allowance is made in the preliminary design for the preparation of the subgrade to import two selected layers to bring the subgrade to the required CBR value according to Table 13 of UTG3. A final decision regarding the necessity of these layers will be made on site when the subgrade is exposed. Material excavated from the road box cut could be stockpiled for use in the N2 overpass bridge embankments depending on the quality of the material.

Due to the highly folded and weathered nature of the bedrock the type and nature of the materials which will be intercepted by the road can be expected to vary considerably along its length. Experience of the area shows that ground water will also be intercepted in the road excavations. The use of subsoil drains and also the utilization of the stormwater drainage pipes to generally lower the water table will be a necessity. Clay material may also be intercepted in places.

9.2 SUMMARY OF SUBGRADE MATERIALS

A brief description of the materials likely to be encountered along the various sections of the roads is as follows: Refer to **Annexure H** which indicates the approximate position of the trial holes along the route as well as describing the subgrade materials likely to be encountered along the route. Additional subgrade test will be done along the centreline of the road when construction start.

9.2.1 Redhouse Chelsea Arterial

a) Section C – E

This section of road is south of the N2 and the subgrade will comprise residual sandstones, sands, silts and in places hard rock. The maximum cut depth will be approximately 1,5m and subgrade will comprise weathered sandstone and hard rock in places. Selected subgrade should not be required over most of this section. Sandstone and rocky outcrops will generally be intercepted near the surface.

b) Section E – F

This section will be elevated above natural ground level to form the embankments for the bridges crossing the northern watercourse and the N2 overpass. The road bed preparation for the fill will be situated in weathered sandstone, sands and silts and should only require that surface topsoil's vegetation be removed and the in-situ materials compacted to receive the fill.

c) Section F – G

This section of road will include the Baakens River culvert (or alternative Bridge) with associated cuts and fills. The cuts on the south and north sides of the Baakens River will involve excavations in weathered and hard sandstone rock up to a depth of 4,6m. Fills will be founded on silts, sands and pebbles from the peninsular formation the surface layers of which will have to be removed. Some previously dumped fill material such as builder's rubble along the northern escarpment of the Baakens River will be encountered and this material will not be suitable for road fill.

The section of road through Rowallan Park up to Cape Road will generally be in cut and also be in the various residual materials from the peninsular group and coluvial and alluvial silts and sands. Poor quality material occurring between the hard rock will have to be removed and replaced with selected subgrade material.

9.2.2 Interchange Ramps

a) Northern Ramps

The Northern ramps vary from being approximately 1m above ground at the intersection with Redhouse Chelsea Arterial to being in cut in places up to a depth of 1m. The subgrade will comprise residual sandstones, sands, silts and in places where cut occur hard rock. In the areas above the natural ground level the surface topsoil vegetation will be removed and the in-situ materials compacted to receive the fill. Where the ramps are in cut poor quality material occurring between the hard rock will have to be removed and replaced with selected subgrade material.

b) Southern Ramps

The Southern ramps vary from being approximately 3.5m above ground at the wetlands culvert to being in cut in places up to a depth of 1m. Most of the southern ramps will be above the natural ground level which will require that the topsoil vegetation be removed and the in-situ material compacted to receive the fill. The subgrade will comprise residual

sandstones, sands, silts and in places hard rock where the ramps are in cut. Poor quality material occurring between the hard rock will have to be removed and replaced with selected subgrade material.

9.3 GEOTECHNICAL INVESTIGATION FOR BRIDGE AND CULVERT FOUNDATIONS

A contract for the geotechnical investigation for the bridge and culvert foundations has been awarded to Terratest and Terrafound geotechnical consultants and contractor respectively. The investigation will consist of excavating trial holes to refusal and also carrying out selective core drilling to determine depth of rock and quality thereof.

The investigation for the N2 overpass bridge have started but due to funding constraints only half the required boreholes were drilled. The outstanding boreholes will be drilled either once funding is available or during the construction phase.

The surface conditions have been found to consist of medium hard to hard rock at varying depths from 1.0m to 4.1m. The conditions are explained in detail in the bridge report refer to **Annexure L** of this report.

Existing services will be encountered within the area of operation and these were located prior to commencing work.

The investigations for the other structures will be carried out when confirmation is obtained from DEDEA with regard to what type of structure it will be.

9.4 EMBANKMENTS

A substantial portion of the roadworks will be either in cut or fill from the natural ground level and appropriate embankment treatment will be required. Final details will be determined during the detailed design stage subject to alteration during the construction period. The following embankment treatments are envisaged:

a) Fill embankments

Generally all fill embankments will have a slope of 1: 2. i.e. (*one vertical in 2 horizontal*). In the case of the overpass and cyclopa bridges consideration has been given to utilising a reinforced earth solution between the bridges as an alternative, to reduce the fill volumes. This option will not be considered in the case of the Baakens River culvert fill due to its probable susceptibility to erosion during high river flows.

All unreinforced fill slopes will be top soiled and treated with appropriate vegetation as determined by the vegetation environmental consultant on the project. All suitable

topsoil removed for the road construction box cut will be stockpiled for later re-use on the embankments.

b) Cut Embankments

The treatment adopted and embankment slope will depend on the material in which the cut occurs. All embankments will be top soiled and treated with appropriate vegetation or as otherwise advised by the vegetation environmentalist.

Embankments in a cut of more than 2m will have a berm constructed at the top of the embankment to prevent any uncontrolled surface water from running down the embankment.

Benching of embankments in high cuts and in unstable material may also be considered during the construction phase.

All embankment treatment undertaken will also be done in consultation with both NMBM Parks Department and with SANRAL officials.

10. THE EFFECT OF THE POSSIBLE RE-ALIGNMENT OF REDHOUSE CHELSEA ARTERIAL (OPTION 4B) ON THE PROJECT

During the review process of the Environmental Impact Report for the Bay West City Development an environmentally sensitive area was identified in the form of a rocky outcrop along the proposed route of the road. The boundary of this environmentally sensitive area falls partly within the proposed road reserve for Redhouse Chelsea Arterial section C – E in the vicinity of the Walker Drive intersection.

As a result DEDEA requested that an alternative alignment for Redhouse Chelsea arterial should be considered that would minimise the impact on this sensitive area. The alternative alignment considered moves the intersection point of Redhouse Chelsea Arterial with Walker Drive eastwards by an approximate distance of 60m and is referred to as Option 4B. Refer to **FIG 9 Annexure A**.

A report entitled “*Transportation and Environmental Planning Report: Discussion Document*” dated February 2012 was prepared to describe the processes which were undertaken to determine the location and route of the proposed Redhouse Chelsea Arterial. The report also describes in detail what the impact of Option 4B will be. This report is attached as **Annexure K** to this report.

This re-alignment will result in the distance between the entrance to the Utopia north development and the intersection with Redhouse Chelsea Arterial being reduced to less than what is recommended for a signalised intersection. This will be the only entrance to the Utopia north development and the reduced distance between the two intersections will cause traffic congestion on Walker Drive in future and an unacceptable level of service (LOS) with regard to the expected traffic along Walker Drive will occur. Traffic safety along this section will also be compromised.

The TIA for the Utopia development was based on the currently recommended alignment Option 4 and intersection position of Walker Drive and Redhouse Chelsea Arterial. Should the intersection move, then the Utopia TIA, will have to be revised accordingly and re-submitted for approval.

The centre line alignment of Redhouse Chelsea Arterial will be changed from chainage 0m to approximately chainage 500m if Option 4B is implemented and therefore changes to the horizontal and vertical geometrical design of the alignment of Redhouse Chelsea Arterial will be required. Refer to **FIG 9** attached as part of **Annexure A** Figures. As Walker Drive and Redhouse Chelsea Arterial projects form one interrelated project there will be a significant delay due to other aspects as follows:

- a) A topographical survey along the revised route together with new environmental survey will be required.
- b) An amendment to the Environmental Impact Report.
- c) New geotechnical survey along road centreline.
- d) Redesign of Redhouse Chelsea Arterial (C – E), redesign of the Redhouse Chelsea Arterial / Walker Drive turning circle and eastern access into the mall. Redesign of section of Walker Drive.
- e) Revised Preliminary Design Report for Redhouse Chelsea Arterial and Walker Drive. Amendments to township layout.
- f) Survey diagrams would have to be amended and resubmitted to Surveyor General for the removal of existing survey beacons, resurveying and pegging of the area.
- g) New land acquisition agreements with adjacent land owners.
- h) Amendments to approved township layout and Traffic Impact Assessment of Utopia.
- i) Road access to Utopia will have to pass through environmental sensitive areas and will require revisions to the Utopia environmental report as well as town planning revisions.
- j) Revised services design along Bay West City Ring Roads, Walker Drive and Redhouse Chelsea Arterial.

For these reasons the existing alignment is the preferred alignment.

11. ROAD GEOMETRICS

The *Geometric Design Guidelines of the South African National Roads Agency Limited (SANRAL)* has been used for the horizontal and vertical design of the interchange.

The *Guidelines for Human Settlement planning and design* and the *Urban Transport Guidelines 1 (UTG 1)* together with SANRAL's geometric design guidelines have been used for the vertical and horizontal design of Redhouse Chelsea Arterial. The following is a summary of the road geometrics along the selected route, option 4.

(Refer to Fig 2: Sheet 2, Annexure A)

11.1 REDHOUSE CHELSEA ARTERIAL

The zero chainage on Redhouse Chelsea Arterial commences 70m south of the intersection with Walker Drive Extension road median centreline.

11.1.1 Horizontal Alignment

The intersection spacing on Redhouse Chelsea Arterial between the Walker Drive traffic circle and the approved secondary access to Bay West City is less than the 350m for major

arterial roads. To accommodate this layout the operating speed of this section of the road will be a maximum of 60kmph, to ensure safety.

From the southern ramp access point through to the Cape Road intersection G the design speed is 80kmph.

Table 5: Redhouse Chelsea Arterial Horizontal Curves Data

| Curve No. | Direction | Radius (m) | BC (m) | EC (m) | Length (m) | Deflection (Degrees) |
|-----------|-----------|------------|----------|----------|------------|----------------------|
| 1. | Right | 745 | 46.684 | 503.317 | 456.63 | 35.118 |
| 2. | Right | 750 | 955.325 | 1333.863 | 378.54 | 28.918 |
| 3. | Left | 300 | 1454.490 | 1642.097 | 187.61 | 35.830 |

* Minimum radius of 300m is in accordance with UTG 1 (Table 9.1)

11.1.2 Vertical Alignment

Vertical curves have been provided along this section of road in order to achieve the best alignment that the topography allows. It also makes provision for the required height clearance of 5.2m over the N2, an economic crossing over the Baakens River, the minimum earthworks volumes and for effective drainage along the road surface.

The vertical curves along the Redhouse Chelsea arterial are listed below with their relevant required and attained lengths and K values.

The length of vertical curve required of 140m is for aesthetic reasons and where curve 2 does not comply with this length the aesthetics are not affected.

Table 6: Redhouse Chelsea Arterial Vertical Curves Data

| Curve No | Vertical Curve PI Chainage (m) | K Required 80kmph | K Provided | Length Required (m) | Length Provided (m) |
|----------|--------------------------------|-------------------|------------|---------------------|---------------------|
| 1. | 200 | 33 (crest) | 38 | 140 | 160 |
| 2. | 340 | 31 (sag) | 78.9 | 140 | 100* |
| 3. | 500 | 31 (sag) | 32.4 | 140 | 210 |
| 4. | 805 | 33 (crest) | 34 | 140 | 230 |
| 5. | 1105 | 31 (sag) | 88.5 | 140 | 140 |
| 6. | 1430 | 31 (sag) | 33.5 | 140 | 220 |
| 7. | 1700 | 33 (crest) | 104 | 140 | 260 |

| | | | | | |
|----|----------|----------|-------|-----|------|
| 8. | 2120 | 33 crest | 173.5 | 140 | 140 |
| 9. | 2239.678 | 31 (sag) | 58 | 140 | 40** |

Notes:

- * Substandard to conform to approach to bridge over the N2 and Baakens River however K value is more than adequate.
- ** This curve is 40m from the intersection with Cape Road and which will be a 4 way traffic signalised intersection and speeds will be controlled.

From the above it is seen that all vertical curves basically satisfy design standards for both vertical sight distance over crest curve and headlight stopping sight distances in sag curves.

11.2 SOUTH OFF RAMP

11.2.1 Horizontal Alignment

The taper rate from the N2 is 1:27 which provides a taper length of 108m as indicated in the SANRAL Geometric Design Guidelines (Table 7.7). The length of the ramp is sufficient to allow traffic to slow down and stop at the intersection. The total deceleration length required from 120kmph – 0kmph is 280m + 108m (taper length) i.e. 388m.

Table 7: South Off-Ramp Horizontal Curves Data

| Curve No. | Direction | Radius (m) | BC (m) | EC (m) | Length (m) | Design Speed (kmph) |
|-----------|-----------|------------|---------|---------|------------|---------------------|
| 1. | Left | 230 | 329.73 | 528.481 | 192.625 | 80 |
| 2. | Right | 220 | 643.234 | 739.306 | 95.31 | 80 |
| 3. | Right | 190 | 771.38 | 907.758 | 133.47 | 70 |

11.2.2 Vertical Alignment

The vertical curves along the ramp are optimised to accommodate the interchange level with Redhouse Chelsea Arterial, the culvert crossing over the watercourse and the N2 road level. The required and provided lengths and K values are listed below:

Table 8: South Off-Ramp Vertical Curves Data

| Curve No | Vertical Curve PI Chainage (m) | K Required (m) | K Provided | Length Required (m) | Length Provided (m) |
|----------|--------------------------------|----------------|------------|---------------------|---------------------|
| 1. | 190 | 33 (crest) | 288.7 | 140 | 200 |
| 2. | 480 | 33 (crest) | 102.2 | 140 | 180 |
| 3. | 730 | 50 (sag) | 56.8 | 140 | 180 |
| 4. | 960 | 50 (crest) | 154 | 140 | 50* |

Notes:

* Substandard to conform to approach the intersection with Redhouse Chelsea arterial, however K value is more than adequate.

11.3 SOUTH LOOP ON-RAMP

11.3.1 Horizontal Alignment

The ramp controlling design speed is 60kmph – 120kmph. The total acceleration length provided is in accordance with Table 7.6 of the SANRAL manual. A taper rate of 1:50 is used where the ramp enters onto the N2 to provide sufficient decision time for entering vehicles to merge with through vehicles.

Table 9: South Loop On-Ramp Horizontal Curves Data

| Curve No. | Direction | Radius (m) | BC (m) | EC (m) | Length (m) | Design Speed (kmph) |
|-----------|-----------|------------|---------|---------|------------|---------------------|
| 1. | Left | 180 | 77.269 | 205.388 | 125.432 | 60 |
| 2. | Left | 100 | 238.062 | 413.829 | 153.999 | 60 |
| 3. | Left | 150 | 413.829 | 463.829 | 49.769 | 70 |
| 4. | Left | 220 | 463.829 | 575.829 | 110.794 | 85 |
| 5. | Left | 2300 | 575.829 | 712.384 | 136.535 | 110 |

11.3.2 Vertical Alignment

The vertical curves along the ramp are optimised to accommodate the interchange level with Redhouse Chelsea Arterial the culvert crossing over the watercourse and the N2 road level. The required and provided length and K values are listed below:

Table 10: South Loop On-Ramp Vertical Curves Data

| Curve No | Vertical Curve PI Chainage (m) | K Required | K Provided | Length Required (m) | Length Provided (m) |
|----------|--------------------------------|-------------|------------|---------------------|---------------------|
| 1. | 30 | 33 (crest) | 31* | 100 | 60* |
| 2. | 200 | 31 (sag) | 51 | 230 | 280 |
| 3. | 820.404 | 130 (sag) | 1045 | 230 | 400 |
| 4. | 1160 | 130 (crest) | 397 | 230 | 240 |

Notes:

* Substandard to conform to approach and tie in with the intersection with Redhouse Chelsea arterial.

11.4 NORTH LOOP OFF-RAMP

11.4.1 Horizontal Alignment

The taper rate from the N2 is 1:27 which provides a taper length as indicated in the SANRAL Geometric Design Guidelines (Table 7.7). The length of the ramp is sufficient to allow traffic to slow down and stop at the intersection. The total deceleration length required from 120kmph – 0kmph is 280 + 180m (taper length). Additional length has been provided to allow for the stacking length required according to the TIA.

Table 11: North Loop Off-Ramp Horizontal Curves Data

| Curve No. | Direction | Radius (m) | BC (m) | EC (m) | Length (m) | Design Speed (kmph) |
|-----------|-----------|------------|---------|---------|------------|---------------------|
| 1. | Right | 2300 | 417.422 | 501.437 | 84.0011 | 120 |
| 2. | Left | 120 | 588.679 | 661.679 | 71.88 | 80 |

| | | | | | | |
|----|------|----|---------|---------|--------|----|
| 3. | Left | 90 | 661.679 | 740.558 | 76.378 | 60 |
| 4. | Left | 50 | 740.558 | 797.558 | 53.963 | 45 |

11.4.2 Vertical Alignment

The vertical curve along the ramp is optimised to accommodate the intersection level with Redhouse Chelsea Arterial and the N2 road level. The required and provided lengths and K values are listed below:

Table 12: North Loop Off-Ramp Vertical Curves Data

| Curve No | Vertical Curve PI Chainage (m) | K Required | K Provided | Length Required (m) | Length Provided (m) |
|----------|--------------------------------|------------|------------|---------------------|---------------------|
| 1. | 600 | 31 (sag) | 135.429 | 140 | 400 |

11.5 NORTH ON-RAMP

11.5.1 Horizontal Alignment

The ramp controlling design speed is 60kmph – 120ph. The total acceleration length provided is in accordance with Table 7.6. A taper rate of 1:50 is used where the ramp enters onto the N2 to provide sufficient decision time for entering vehicles to merge with through vehicles.

Table 13: North On-Ramp Horizontal Curves Data

| Curve No. | Direction | Radius (m) | BC (m) | EC (m) | Length (m) | Design Speed (kmph) |
|-----------|-----------|------------|---------|---------|------------|---------------------|
| 1. | Left | 750 | 187.509 | 560.767 | 369.418 | 120 |

11.5.2 Vertical Alignment

The vertical curve along the ramp is optimised to accommodate the intersection level with Redhouse Chelsea Arterial and the N2 road level. The required (see table 4.12 and 4.14) and provided length and K-values are listed below:

Table 14: North On-Ramp Vertical Curves Data

| Curve No | Vertical Curve PI Chainage (m) | K Required | K Provided | Length Required (m) | Length Provided (m) |
|----------|--------------------------------|-------------|------------|---------------------|---------------------|
| 1. | 10 | 31 (sag) | 9 | 140 | 20* |
| 2. | 165 | 130 (crest) | 124 | 140 | 140 |
| 3. | 530 | 130 (sag) | 409 | 140 | 400 |

* The curve is situated on the eastern carriageway of the Redhouse Chelsea Arterial and is short to allow for the intersection levels to tie in with the connecting road..

11.5.3 Superelevation

Superelevation will be applied to curves in terms of the SANRAL Geometric Design Guidelines.

12. STORMWATER MANAGEMENT

The factors that must be considered with respect to the provision of stormwater drainage for the Redhouse Chelsea Arterial and the interchange are as follows:

- a) River and watercourse crossings.
- b) Stormwater drainage that needs to cross under the roadways where the levels of the road are above the natural ground level.
- c) Drainage along the road surface and from cut and fill embankments.

12.1 RIVER AND WATERCOURSE CROSSINGS

The proposed road system will intersect and cross over two watercourses viz. the main Baakens River and the northern watercourse which is situated to the south of and roughly parallel to the N2 road. These crossings are described here under.

12.1.1 Main Baakens River Crossing

The Redhouse / Chelsea Arterial will cross the Baakens River at chainage 1440 north of the N2. The proposed crossing point has been selected in conjunction with the wetland and vegetation specialist consultants taking into account the engineering, environmental and cost factors.

Two methods of crossing this river have been investigated namely a three span post-tensioned concrete bridge and a two span reinforced concrete box culvert. In both cases the road level above the river bed would remain the same in order to satisfy the geometric requirements of the roadway.

A hydrological analysis of the river catchment has been undertaken to determine the peak flows expected to occur during various storm frequencies including the 1:100 year un-attenuated storm. The effects of both the bridge piers and culvert on the water profile under the resulting 1:100 year flow conditions were analysed. The hydrological report is attached as **Annexure E**.

12.1.2 Northern Watercourse Crossing

The northern watercourse is crossed in two places by the proposed road system and is described as follows:

a) Cyclopia Structure

Here the Redhouse Chelsea Arterial crosses the northern watercourse. The structure that is proposed for this crossing comprises a 5.0m x 3.0m reinforced box culvert or alternatively a 20m single span reinforced concrete bridge. The 1:100 year floodline will not be affected by these structures.

b) Combined South Off-ramp and South on Loop Ramp Culvert

In this case the watercourse will be crossed by the two abovementioned ramps after they have combined as a single two directional ramp. A twin 5,0m x 2,0m box culvert approximately 32m long is proposed for this crossing. The hydraulic capacity of the culvert exceeds the discharge requirements and the 1:100 year floodline will thus be virtually unaffected. A detailed assessment will be made during the detailed design stage.

12.2 ROAD DRAINAGE

12.2.1 Redhouse Chelsea Arterial

The first section of Redhouse Chelsea Arterial C – E will be situated in a road reserve provided within the Bay West City development. A standard type road drainage system comprising a system of pipes and kerb inlets will be provided along this section with the pipelines discharging into the proposed ponding system to be constructed under the Bay West City Development.

The BKS report entitled *“Engineering Services Report, Stormwater Management Masterplan” November 2010* is attached as **Annexure M**. It shows the proposed stormwater ponding system in proximity to the Redhouse Chelsea Arterial.

Road drainage will also be provided over the elevated bridges by means of longitudinal pipelines with kerb inlets at spacing depending on road gradient. Road Section F to G will also be provided with longitudinal drainage pipelines and kerb inlets.

From the Cape Road intersection southwards the road will be in cut and will therefore intercept overland stormwater flowing from the open areas on the western side of the road reserve. Side drain channels will be provided along all cut sections of the road to control

stormwater from the embankments. These channels will be intercepted by grate inlets and led off to the longitudinal pipeline system. Kerb inlets will be provided along the length of the road at appropriate intervals to intercept the kerb channel flow. In places a berm will be constructed along the top of the cut embankment to control the run-off from the surrounding areas more effectively.

For ease of future maintenance SANRAL type manholes and kerb inlets will be provided within the SANRAL interchange property and standard NMBM manholes and kerb inlets along the remainder of the road.

12.2.2 Interchange Ramps

The finished road levels along the interchange ramps will generally be situated above existing ground level and will therefore intercept the natural overland sheet flow. Numerous pipes will therefore be provided under these ramps at strategic intervals and natural low points to allow stormwater to pass under these roads.

In addition to this where the ramps are joined to the N2 east and westbound carriageways, the existing pipe culverts under the N2 will have to be extended to accommodate the wider surfaced width of the N2 at these points. The longitudinal N2 side drains will similarly be accommodated.

13. E80 DETERMINATION

13.1 REDHOUSE CHELSEA ARTERIAL

The accumulative E80 traffic expected during the design period of the Redhouse Chelsea Arterial and the various connecting and associated ramps has been based on the traffic projections contained in Traffic Impact Assessment report entitled "*Revised Traffic Impact Assessment dated 15 October 2009 for Proposed Moved Use Development on Erf 426 Hunters Retreat Portion 131 of Farm Little Chelsea No. 10*". **Refer to Annexure D.**

The E80 estimates have been based on the following assumptions:

- Ratio E80 / heavy vehicle = 1,8
- Lane distribution factor = 0,95
- Growth factor = 1,1
- Growth rate = 3% pa
- % Heavy vehicles = 5%
- Structural design period = 20 years

The result of the analysis shows that the most heavily E80 lane of the Redhouse Chelsea arterial may be expected to have to accommodate 7.3×10^6 E80 axles moving along the section E – F during the design period of 20 years.

14. PAVEMENT DESIGN AND SUBGRADE PREPARATION

In terms of the “*Urban Transport Guidelines, UTG 3 Structural Design of Urban Roads*” the following pavement design is proposed for the road which falls in the Traffic Class E3 range $3,0 – 12,0 \times 10^6$ E80s. The maximum E80s of $7,3 \times 10^6$ is within this range but considerably in excess of the Traffic Class E2 with a maximum of $3,0 \times 10^6$ E80s.

The applicable Road Category would be a Primary Distributor road, which encompasses the range $0,8 – 50 \times 10^6$ E80s / lane.

An appropriate pavement design would comprise the following layerworks:

- (a) **40mm Asphalt:** Type 4a Mix, Compacted to Min. 95% Marshal
- (b) **150mm Base Course:** G1 crushed stone max. size 37mm compacted to 88% of apparent relative density.
- (c) **125mm Subbase:** C3 cemented natural gravel (G5 before treatment) UCS 3Mpa at 100% Mod AASHTO. Max size 63mm.
- (d) **125mm Lower Subbase:** C4 Cemented natural gravel (G5 before treatment) UCS 1,5Mpa at 100% Mod AASHTO).

It is recommended that irrespective of a lesser number of E80 vehicles utilising the ramps or other sections of Redhouse Chelsea Arterial the above pavement design be adopted for all ramps.

The above pavement design assumes that the required in-situ subgrade CBR of 15% will be achieved at 93% Mod AASHTO density. The Geotechnical investigation shows that with the exception of where Walker Drive is situated in cut in the residual weathered sandstones or ferricrete materials the insitu subgrade materials will generally not satisfy this condition. Two additional selected layers will therefore be required. The extent of the areas will be determined with detailed soil sampling along the centreline of the road once the ROD have been obtained. The in-situ subgrade materials can however be utilised in places provided adequate compaction can be obtained to achieve the required CBRs.

Due to the more complex operations employed in constructing the proposed cement stabilised subbase alternative designs omitting the use of the stabilised subbase and replacing with unstabilised layerworks has been investigated.

For this purpose the Cyrano Pavement Analysis program was utilised to predict the long term performance of the road using unstabilised subbase layers as opposed to the recommended cement stabilised subbase. The results show that it is not feasible to construct an unstabilised flexible pavement which can carry the design 7.3×10^6 E80s traffic loading without the riding surface deteriorating below the acceptable levels within about 12 years. The performance of the road is highly dependent on the stiffness of the subgrade and increasing the thickness of the alternative unstabilised subbase layerworks has very little effect. The stiffened subbase has superior load distribution characteristics which impacts on the lower subgrade layerworks and also ensures the production of a strong basecourse layer which is also of high importance.

The results of the analysis confirm the Catalogue Method that requires the use of stabilised subbases for this particular traffic class. The use of the cemented stabilised subbase layers is therefore recommended.

A detailed report on results of the Cyrano Pavement Analysis is available on request.

The geotechnical investigation indicates that the quality of the in-situ materials is highly variable and that pockets weak materials may be encountered between the fractured and folded underlying sandstone formations. This means that fairly extensive areas of unsuitable subgrade material may have to be removed and replaced with suitable material. Accurate prediction of subgrade treatment required cannot therefore be made prior to excavating and opening up the road bed.

Groundwater will also be a problem due to the fairly shallow underlying quartzitic sandstone formations and subsoil drainage will be required fairly extensively. A stormwater pipeline will be provided longitudinally along the future median. This stormwater pipeline will be utilised to intercept the groundwater drainage system.

Where the roadways are in deeper cut, solid quartzitic sandstones rock ribs may be encountered and blasting may be required. Depending on the rock surface profile, the layerworks design will be adjusted accordingly.

15. ACCOMMODATION OF TRAFFIC

Detailed Accommodation of Traffic (AOT) plans will be compiled for each section where existing traffic will be affected by construction activities as part of the detailed design. These plans will be compiled in conjunction with road and local authorities. Approval of these plans will be obtained before construction starts.

Accommodation of the existing traffic on Walker Drive is addressed in the Preliminary Design report for The Extension of Walker Drive and is there for not repeated below. The accommodation of existing traffic for the N2 and Cape Road is discussed below.

15.1 N2 TRAFFIC

Accommodation of the existing traffic flows on the N2 will be of critical importance during the construction of the N2 overpass bridges and the Southern and Northern ramps. After discussion with local authorities, including SANRAL and NMBM, it was agreed that the existing traffic flows can be temporarily accommodated on one carriageway during construction. This will allow for the proposed phased construction of the bridges as indicated in the N2 Overpass bridge report. Refer **Annexure L**.

The construction of the Southern and Northern ramps will coincide with the phased construction of the bridges to ensure that the traffic for the ramps can be accommodated together with that phase of the bridges construction.

15.2 CAPE ROAD TRAFFIC

Accommodation of the existing traffic flows on Cape Road will be accommodated at the start of construction for heavy vehicles turning to enter the construction site. When construction of Redhouse Chelsea arterial starts next to Cape Road the accommodation of traffic will be revised to also include the construction that will be happening next to the road and not just for heavy vehicles turning.

16. EXISTING SERVICES

Refer to Dwg. No.: 004, Annexure G.

The known existing services which will be affected by the road works are as follows:

16.1 SEWERAGE

There are two major existing sewerage pipelines which run along the banks of the Baakens River which will be affected by the proposed works as well as two 150mm diameter sewers near the Cape Road intersection:

(a) 230 mm diameter sewer on northern bank

This sewer basically runs along the top of the escarpment and will be intercepted by the roadwork's. The exact position of this sewer crossing was not initially determined due to difficulties in locating the manholes and further survey is underway. It is likely however that a diversion of this sewer will be required to ensure that there are no bends or manholes that will be positioned in the road reserve and that it is located at a suitable depth in the road fill. A pipe duct or culvert to accommodate this sewer will be installed to NMBM requirements.

(b) 300 mm diameter Sewer on Southern Bank

This sewer is situated fairly low down along the southern bank of the Baakens River. At the point where it crosses the Redhouse Chelsea Arterial, the sewer is approximately 4,5m deep and also has a manhole situated on a bend which will fall within the road reserve. The depth of fill above existing ground level to the future road level will be approximately 6m which will result in a total depth of sewer of 10,5m below future road level. It will thus be impossible to access this sewer once the road is built or to construct a future additional sewer and it will therefore be inserted into large diameter pipe sleeve of approximately 1 050mm diameter to enable repairs, maintenance or upgrading to be carried out. This sewer will have to be relocated on a new alignment to avoid the bend and manhole which falls within the road reserve. A rectangular box culvert could also be provided in place of the proposed 1050mm diameter pipe sleeve, but this would be considerably more expensive. Discussions have already taken place with NMBM Wastewater Conveyancing Division on this issue and their requirements will be incorporated into the final designs.

(c) 2 No. 150 mm diameter Sewers near Cape Road Intersection

Both of these crossings will occur in sections of Redhouse Chelsea where the road level will be marginally above ground. Those pipes are in straight lines and no manholes or bends will be situated within the road reserve. The pipelines will be installed in 250mm diameter sleeves under the road width of Redhouse Chelsea.

A 150mm diameter sewerage pipeline is also situated along a section of the Redhouse Chelsea Arterial Road Reserve adjacent to Rowallan Park. This sewer will also have to be located and protected during construction.

16.2 WATER SUPPLY PIPELINES

Existing water supply pipelines are situated in the Cape Road / Redhouse Chelsea Arterial intersection and will have to be located and determine whether lowering and / or protection will be required.

16.3 TELKOM SERVICES

An existing Telkom cable crosses the Redhouse Chelsea Arterial at the north side of the Baakens River. This cable appears to terminate on the western side of the road reserve. This cable will be intersected by the road cut and will have to be lowered and inserted through an appropriate sleeve.

Existing Telkom cables are also situated in the Cape Road intersection area which will be investigated prior the detailed design stage. An optic fibre cable is situated in the N2 road reserve which will be precisely located prior to core drilling for the N2 Overpass Bridge structure.

16.4 ELECTRICAL CABLES

No existing cables are situated in the road reserve except at the Cape Road intersection. The design of this intersection has not yet been finalised as the ultimate design forms part of a commission handled by other consultants. The implication of the proposed designs has not yet been ascertained. However as the final road levels will not be substantially below existing ground levels protection of cables in sleeves under the future roads will probably suffice.

17. FUTURE SERVICES AND DUCTS

Certain future underground services will have to be located within the Redhouse Chelsea Arterial Road reserve to serve Section C – E, both the Bay West and future Utopia Estate townships which will be situated both to the west and east of the road.

Future services may also be required to be installed along the length of the Redhouse Chelsea Arterial and ducts will be provided where necessary. Consultation with the applicable service authorities will take place at the detailed design phase.

17.1 WATERMAINS

A 200mm diameter NMBM watermain will have to be installed along the section of Redhouse Chelsea Arterial. Section C – E. This watermain will form part of a ring main serving both the Bay West City and Utopia Developments.

17.2 SEWERAGE

A 150mm diameter NMBM sewerage pipeline will be required along the western verge of Redhouse Chelsea Arterial Section C – E to serve the Bay West Development. A 315mm diameter NMBM approach sewer will also cross the road at E.

17.3 STORMWATER

The stormwater drainage pipelines along Section C – E of the Redhouse Chelsea Arterial will be installed as part of the roadworks.

17.4 ELECTRICAL AND TELKOM SERVICES, DUCTS

An electrical cable will have to be installed within Section C – E and the necessary ducts will be provided under road crossings etc. to the requirements of the NMBM Electrical Department. Similarly any ducts for Telkom Services will also be provided.

18. STREET LIGHTING

Street lighting for the whole of the Redhouse Chelsea roadway is envisaged. This will include lighting over the N2 overpass as well as lighting along the interchange ramps.

The roadway lighting for the road, categorised as an A2 road (Major roads, for speed limits not exceeding 90km/h in terms of SANS 10098), could make allowance for 900 vehicles per

hour per lane during hours of darkness. This design shall therefore provide for a minimum average luminance of 1,5 cd/m² with a minimum overall luminance uniformity of 0,4 and a minimum longitudinal luminance uniformity of 0,7 ensuring a threshold increment not exceeding 20%.

This design can utilise median or side-walk lighting arrangements, or a combination of the two as determined by the lighting study and shall be carried out in consultation with the NMBM to ensure that the preferred arrangement, i.e. configuration, pole type and luminaries. Ramp lighting shall also be installed in compliance with SANS 10098. Consideration should be given by the NMBM to extend the lighting along the N2 up to and including the existing Rowallan Park Bridge.

This section is dealt with in detail in a report entitled "*Proposed Redhouse Chelsea Arterial Road From Proposed Extension of Walker Drive to Cape Road - Roadway Lighting Design Report dated July 2011*". This report was submitted to Mr. Noel Weyer of NMBM (Munelek). The approval is awaited in this regard.

19. CONSTRUCTION METHODOLOGY AND IMMEDIATE IMPLEMENTATION STRATEGY

Prior to 28 September 2011 the NMBM was formally requested to advise on their decision regarding the reduction of the original scope of work from a dual to a single carriageway (one lane in each direction) for Section C-E-F-G. It was explained in this letter that a decision to construct only two lanes of Redhouse Chelsea Arterial and one half of the N2 Overpass Bridge at this stage would have an impact on the designs and NMBM was therefore formally requested to advise of their decision with regard to the number of carriageways which would be constructed for the implementation stage.

At the 23 November 2011 MDTTT meeting the alternative phasing was discussed and, it was agreed that BWC and SANRAL would finalise their proposed one carriageway (two lanes only) scheme service level agreement and then present it to NMBM.

At the NMBM/SANRAL/BWC meeting held on 13 April 2012, the implications of initially constructing one carriageway only, were discussed at length and a decision was made to construct one carriageway but with final earthworks for the eventual dual carriageway road. Although the first and preferred option from traffic recommendation and technical point of view is to construct a dual carriageway with two lanes in each direction from the outset this would not be possible due to the shortage of funds and phasing will therefore be required.

19.1 PHASING OF THE PROJECT

The construction of a single carriageway can be done according to two options.

- a) Option A would be to construct the single carriageway with the minimum earthworks necessary for the single carriageway road only.
- b) Option B would be to construct the single carriageway only and also to complete the earthworks for the eventual dual carriageway road from the outset.

These two phasing options are discussed below:

a) **Option A: Single carriageway with minimum earthworks**

This is not the preferred option for the following reasons:

- Major earthworks will have to be carried out in the future in proximity to heavy traffic utilising the initial carriageway. Deep cut areas which will include blasting will be problematic and temporary road closures will be required.
- Costly benching will have to be carried out to mate the new fill into the existing fill. A difference in settlement between the fills is also likely to occur in areas of high fill.
- Rate prices for earthworks for the second carriageway will be substantially higher in the future because of working in proximity to a major road and due to escalating prices.
- A significant amount of work carried out under Stage 1 would have to be abandoned such as grassing of embankments and verges, temporary stormwater drainage pipes and catchpits and generally destroying certain restoration work which was carried out on completion of Stage 1.
- Access to the site will have to take into account the traffic on the already constructed carriageway.
- Heavy earthmoving construction vehicles will have to make use of the constructed first carriageway at Redhouse Chelsea Arterial to haul fill material resulting in abnormal loading of initial heavy axel vehicles utilising the road.
- The design of the dual carriageway road has been optimised to obtain a balanced cut and fill situation. With a single carriageway, material will have to be stockpiled for future use and double handled, increasing the cost of the future earthworks.

- An environmental approval for a stockpile site will have to be obtained. The stockpile material will probably have to be vegetated and maintained to prevent dust nuisance.
- If material has to be spoiled the situation becomes more un-economical due to extra cost to spoiling material and future additional cost to obtain fill material.
- There are practical construction complications with regard to the Baakens River crossing structure, N2 overpass structure and the cyclopa structure if the full earthworks adjacent to these structures is not completed from the outset.
- From SANRAL's perspective it would be an advantage to complete both N2 overpass bridges (i.e. one for each carriageway) from the outset. If this is done then the bridge embankment fills should also be completed for both carriageways for this section of roadway.

b) Option B: Single carriageway with dual carriageway earthworks

This option is the most practical option when keeping the future aim of a dual carriageway in sight. In terms of the traffic impact report it is estimated that the second carriageway will probably be required by 2018-2020 but the planning transportation and traffic studies will be reviewed and only then will its necessity be determined.

- This option will allow the balancing of the cut and fill material to be utilised for the outset.
- The danger of blasting and carrying out large earth moving operations in close proximity of traffic is avoided.
- No additional environmental approval will be needed for long term stockpiling of fill material.
- Services and stormwater drainage system can be positioned correctly in the road reserve from the outset and major modifications will not be required.
- There will be no aborted work.
- The upfront cost to implement the additional earthworks is estimated to be R21,9 million including VAT. The construction of the additional earthworks for the second carriageway is the responsibility of the NMBM and this cost will therefore have to be borne by the municipality.

c) Recommendation

Option B (Single carriageway with dual carriageway earthworks) is the recommended and preferred option for the reasons as set out above. The western carriageway will be constructed under the implementing stage with the eastern carriageway earthworks completed to subgrade level. This option will cost NMBM an estimated additional amount of R21,9 million but will result in a more economic and easily implemented scheme in the long run. This agreed option is to be known as Phase 1A.

At the NMBM/SANRAL/BWC meeting of 18 May 2012 it was reaffirmed that this was the preferred option and that NMBM would therefore endeavour to find the necessary additional funds for the project.

19.2 ADAPTING INTERSECTION DESIGNS FOR: CONSTRUCTION OF ONE CARRIAGEWAY

Due to the fact that only one carriageway is to be initially constructed, the intersections have been designed to accommodate both initial and final road configurations. These are described below:

19.2.1 Redhouse Chelsea Arterial / Walker Drive Extension Intersection

The Redhouse Chelsea/Walker Drive intersection has been designed as a traffic circle with a 30m diameter central island and a 10m wide circulatory road painted for two 5m circulatory lanes. This traffic circle is required to enable buses to turn around after the bus station which in future will be constructed in the median of the dual carriageway Redhouse Chelsea arterial, opposite the Bay West Mall eastern access. This intersection will therefore be designed for the dual carriageway situation from the outset, with tapers to the single carriageway construction as follows:

- Walker Drive north carriageway widens to dual carriageway before entering the circle.
- Walker Drive westwards extension around mall tapers from dual carriageway to single north carriageway (C towards D).
- Redhouse Chelsea Arterial from constructed as dual carriageway from C to E.

Redhouse Chelsea Arterial southern extension will be bell mouthed for future dual carriageway and provided with appropriate barriers at end of bellmouth. Appropriate tapers will be provided if and when the Redhouse Chelsea is extended through to Kragga Kamma Road and to Montmedy Road / Fairview Arterial Road.

19.3 POSSIBLE DELAYS TO THE IMPLEMENTATION OF THE PROJECT

The re-alignment of section C – E can result in a delay to the project because of all the items mentioned in section 10 above.

The decision from DEDEA with regards to the structure required at the Baakens River will delay the detail design of this structure until confirmation have been received whether it will be a culvert or a bridge.

20. ACCESS TO THE SITE, HAUL ROADS AND TRAFFIC ACCOMODATION

At present the only access to the section of the site south of the N2 is westwards along the existing Walker Drive from its intersection with Kabega Road. Walker Drive also serves as the main access to all of the existing developments situated on both sides of it and is a heavily trafficked road with severe congestion during peak hours.

In addition the commercial development at Bay West City (BWC) will be simultaneously under construction resulting in numerous heavy vehicles using the road, aggravating the present traffic congestion along the existing Walker Drive and result in an abnormal reduction in the life of the existing pavement layerworks. Considerable delays in construction vehicle traffic movements can be expected.

A proposal was made that Walker Drive be constructed as a separate contract to the Redhouse Chelsea Arterial road contract. This was originally done in order to speed up the access to the Bay West City development which is an important investment for the municipal area. It was also anticipated that Walker Drive extension would be ready to be implemented ahead of the Redhouse Chelsea Arterial contract. In the event these two projects are now running simultaneously and if the construction of Walker Drive system is included in the Redhouse Chelsea Arterial contract, a further access to this site could be obtained directly from the N2, National Road. This is now the current preferred option.

SANRAL have approved the concept that access for construction vehicles to and from the Redhouse Chelsea Arterial will be allowed from the N2 making use of the proposed interchange south-off and north -on ramps.

The construction of the south off-ramp to subgrade standards would allow construction vehicles to directly access both the southern section of the Redhouse Chelsea Arterial and interchange as well as the Walker Drive making use of the section C – E of Redhouse Chelsea Arterial. If Redhouse Chelsea Arterial is constructed under a separate contract to Walker Drive then access would require crossing another contractor's site which could create logistical and programming problems with possible resultant claims for delays. If the contracts are combined then the single contractor could plan and programme his access activities accordingly. Such an arrangement would provide access to Walker Drive and vehicles leaving the site could utilise existing Walker Drive. At the NMBM/SANRAL/BAY

WEST CITY meeting of 15 June 2012 it was agreed therefore that Walker Drive would be constructed as part of the Redhouse Chelsea Arterial contract.

Vehicles leaving the site could however also access the N2 by utilising the N2 north carriageway on-ramp provided the contractor effectively programmes his operations. The section of the Redhouse Chelsea Arterial south of the N2 requires large volumes of fill to be obtained from the northern section of the road. In order to move this material from the northern to the southern side of the N2 it will be necessary to construct a haul road along the alignment of North CD road from Redhouse Chelsea Arterial to the existing N2 overpass bridge, across the existing N2 bridge and then utilising the road reserve of the South CD road which forms part of the Bay West City (BWC) Development. This road will be constructed by the Bay West City Development contractor and permission to use the South CD road will have to be negotiated. In terms of current planning the South CD road will only be constructed towards the end of the BWC contract and a temporary haul road will therefore be required along this section. SANRAL have approved the use of the existing bridge for construction traffic.

Access for the northern sections of the project can be obtained from Cape Road, however a temporary bridge crossing of the Baakens River will be required to gain access to the area south of the river. An existing low level crossing over the Baakens river along gravel tracks in the area consist of pipe culverts which will have to be upgraded to accommodate the load of the construction vehicles if the crossing is used.

It has been agreed with SANRAL that temporary alternate closures of one of the carriageways of the N2 will be permissible to facilitate the overpass bridge construction. This is dealt with in more detail in the overpass bridge report. Refer to **Annexure L**.

21. PRELIMINARY IMPLEMENTATION PROGRAMME

The tentative implementation programme for Phase 1A is attached as **Annexure F**. The programme indicates the following aspect salient:

- Completion date: August 2014. This date has been fixed as the Redhouse Chelsea Arterial is required for the opening of the Bay West City Mall. The developers of the Mall are to contribute to the cost of the road and therefore have an interest in the project.
- Commencement of construction: January 2013. This date is dependent on the following requirements being satisfied:
 - Funding Agreements concluded and funds available.
 - The approval of all engineering reports, designs and documentation.
 - The approval of all environmental aspects and the Environmental Management Plan (EMP).
 - Agreements concluded between NMBM, SANRAL and Bay West City Developers.
 - Approval of NMBM Council and SANRAL Board to accept the construction tender.

The above shows that the construction period will be approximately 18 months, which will require a spend rate of approximately **R 11,2 million** per month. This high requirement will mean that only major contractors will be eligible for this project or suitable consortiums of smaller contractors. It also shows that any delays in non-engineering, approvals could delay the completion date.

22. CONTRACTURAL MATTERS

There are three parties involved in the funding of the proposed Redhouse Chelsea Arterial and the N2 interchange ramps and bridges. These parties are the NMBM, Bay West City Developers, SANRAL and possibly the Eastern Cape Department of Roads and Public Works (ECDRPW). An agreement has been reached between SANRAL and Bay West City in respect to the funding of the interchange. The services level agreement between SANRAL, NMBM and Bay West City is presently being negotiated. These negotiations are outside the scope of this report; however the necessary cost estimates have been prepared together with the tentative allocation of funding responsibilities. Refer to **Annexure B**.

On completion of the project, the ownership and maintenance responsibilities for the facilities will be as follows:

Table 15: Ownership of facilities after completion

| Item No. | Description | Owner |
|----------|---|--------|
| 1. | Redhouse Chelsea Arterial Sections C – E and F – G | NMBM |
| 2. | The N2 Interchange: Comprising Redhouse Chelsea E – F and north and south on and off ramps and loop ramps | SANRAL |

Under normal circumstances the NMBM would be responsible for constructing their sections of the Redhouse Chelsea Arterial, namely Sections C – E and F – G, to NMBM specifications and under their control and according to their tender and contractual procedures. Likewise SANRAL would construct the interchange E – F including the N2 overpass bridges and cyclopa culvert and the associated ramps in terms of their specifications and under their control.

To subdivide the construction of the road into a number of separate contracts will be impractical as all sections are inter-related. If separate contracts are awarded then contractual conflicts are bound to arise. Some of these problems would be the following:

- Fill is required for the N2 overpass bridge and cyclopa bridge embankments which will form part of the SANRAL interchange E - F. This fill has to be obtained mainly from the cut sections within municipal section F – G north of the N2. This cut material will therefore have to be stockpiled under one contract and taken over by another contractor. Late supply of fill could result in significant financial claims for delays etc.
- Access to the N2 overpass bridge site north of N2 will be along section F – G road reserve or the on and off ramps to the N2 which would be under the control of a different contractor. Any hindrance of access from one side to the other could also lead to substantial claims.
- The same situation applies to the splitting of contracts south of the N2.
- Numerous other contractual disputes could arise between the various contractors.

In order to avoid these complications and the impracticality of splitting of contracts, a meeting was held in the offices of SANRAL on 13 December 2010, at which senior officials of both SANRAL and NMBM were present. It was agreed in principle at that meeting to implement the project on the following basis:

- a) The NMBM would be responsible for carrying out design work up to a certain stage to be agreed to, thereafter SANRAL would take over the appointment.
- b) The design would be to the approval of NMBM, SANRAL and ECDOPW, if the latter contributes funds to the scheme.
- c) Contract documentation would be prepared as follows:
 - Roadworks : COLTO
 - Services : SANS 1200
 - Bridges : COLTO
 - Contractual requirements : General conditions of Contract 2010 edition.
- d) All documentation to be reviewed and approved by NMBM & SANRAL before tender advertisement
- e) SANRAL tendering procedures would be adhered to and tender recommendation reviewed by SANRAL and NMBM.
- f) NMBM and SANRAL would enter into the applicable agreements for the execution of the project and the provision of funds.
- g) The construction of Walker Drive Extension would be included in the Redhouse Arterial contract.

In addition to the above certain municipal services will have to be installed across and along sections of the Redhouse Chelsea to serve the future Bay West City development. In order to avoid the Bay West City services contractor having to install these services it is suggested that they be added into the Redhouse Chelsea Arterial road contract as a separate section to be installed by the Redhouse Chelsea Arterial contractor.

This work would be carried out to municipal specifications and the cost borne by the Bay West City developer. This is considered a more practical arrangement to preferable to handing over portions of the Redhouse Chelsea site to other contractors to carry out work simultaneously on the same site. As Bay West City makes a contribution to the cost of the Redhouse Chelsea Arterial, the cost of these services can be added to and included for in the funding agreements. It is therefore recommended that the road contractor be awarded to carry out all of the civil works to be carried out within the Redhouse Chelsea Arterial road reserve.

23. PRELIMINARY COST ESTIMATES

Details of the preliminary cost estimates for the arterial road are given in **Annexure B**.

The summarised values are given below:

Cost Estimates for the Dual Carriageway assuming the use of culverts instead of bridges over the Baakens River and Cyclopa watercourse is as follows:

Table 16: Cost Estimate Phase 1 Dual carriageway

| Item | Description | Estimate Cost |
|------|--|----------------------|
| 1. | Redhouse Chelsea Arterial (C – E) | R 14 145 181 |
| 2. | Interchange: E – F | R 23 256 452 |
| 3. | Redhouse Chelsea Arterial F – G | R 46 409 043 |
| 4. | Cyclopa Culvert (E – F) | R 5 199 352 |
| 5. | N2 Overpass Bridge (E – F) | R 43 848 996 |
| 6. | Retaining Structures (E – F) | R 0 |
| 7. | South Off-Ramp (Including Wetland Culvert) | R 17 770 996 |
| 8. | South On Loop Ramp | R 13 474 074 |
| 9. | North On-Ramp | R 7 161 801 |
| 10. | North Loop Off-Ramp | R 9 541 351 |
| 11. | Baakens River Culvert | R 12 717 534 |
| 12. | Street Lighting | R 9 523 344 |
| | Total | R 200 786 172 |

Note:

- If a bridge is required over the Baakens River in place of assumed culvert crossing the cost will increase by R10,9 million.
- If a bridge is required for the cyclopa crossing the cost will increase by R4,4 million.
- If cyclopa bridge is required the cost will increase by R3,8 million for the retaining structure.

Detailed cost estimates are included as **Annexure B** in this report.

These estimates only include 12% for Preliminary and General Items, 5% Contingencies and 14% VAT.

24. CONCLUSIONS AND RECOMMENDATIONS

- a) The implementation of the Redhouse Chelsea Arterial Road connecting Walker Drive, the N2 and Cape Road is a vital cross link in the transportation plan for the city. The existing traffic congestion along Walker Drive and Kabega Road is severe during the peak hours and the direct connection at Walker Drive to the two main transportation arteries in the western areas of the city will require access to the N2 and Cape Road in order for it to be developable.
- b) The cross city nature of the link will also avoid traffic having to travel further into town and then double back to reach the outlying western areas of the city. The construction of the above road will therefore result in major savings in lost traveling time, carbon emissions, and fuel savings, in addition to allowing the natural westward expansion of the city.
- c) The Traffic Impact Report indicates that a single carriageway of the Redhouse Chelsea Arterial Road together with the full interchange Phase 1A will provide an adequate level of services (LOS) until approximately year 2020 at which time the second carriageway may be required Phase 1. This requirement being determined by a new traffic impact assessment being carried out at this time.
- d) Due to funding difficulties the initial implementation Phase 1A of the project will therefore comprise the construction of one carriageway from Walker Drive to Cape Road, the complete interchange including two bridge structures over the N2. For economic and practical reasons the earthworks for the second carriageway will be constructed as part of Phase 1A.
- e) It has been agreed that the project will be funded by the three interested parties, NMBM, SANRAL and Bay West City as follows:

Phase 1A (Initial Construction):

This phase comprises the construction of one carriageway from Walker Drive Extension to Cape Road, one carriageway and two overpass bridge structures as well as the on and off ramps of the interchange together with the earthworks for the second carriageway. The Baakens River crossing will be a culvert (pending environmental approvals) and constructed to full width of two carriageways.

The financial responsibilities for this phase are as follows:

NMBM: *Earthworks for the second carriageway from C – E – F – G.*

SANRAL: *One half the cost of the interchange E – F with one carriageway and one overpass bridge structure. SANRAL has opted to construct the second bridge structure at their cos.*

B W C: *One half of the interchange cost with one carriageway and one bridge only. One carriageway C – E and F – G. Has the option of constructing second carriageway layerworks C – E at an additional cost of R 4,4 million.*

Phase 1 (As per TIA):

This phase comprise the construction of the second carriageway from Walker Drive Extension to Cape Road to complete the construction of Phase 1A to comply with Phase 1 as indicated in the TIA.

NMBM: *Construct pavement layerworks and surfacing of second carriageway C – E – F – G when traffic conditions demand such. Construct stormwater inlets along new carriageway and connect to existing system.*

Phase 2 (As per TIA):

This phase comprise the alteration of the then existing dual carriageway to accommodate the Bus Rapid Transit system or traffic lane.

NMBM: *Amend the lane configuration of both carriageways by line painting to accommodate the Bus Rapid Transit system.*

Phase 3 (Future):

This phase comprise the future extension of Redhouse Chelsea Arterial as indicated in the TIA.

NMBM: *Extend Redhouse Chelsea Arterial from Walker Drive to Kragga Kamma Road if future transportation planning indicates such a need.*

25. REFERENCES

- a) Engineering Advice and Services. March 2009. *Transportation Study for the Western Suburbs Local Spatial Development Framework*. Port Elizabeth: Engineering Advice and Services.
- b) Aurecon. September 2009. *Network Demand Modelling in Support of Western Suburbs LSDF: Bay West City Modelling*. Port Elizabeth: Aurecon.
- c) SSI. October 2009. *Revised Traffic Impact Assessment for Proposed Mixed Use Development on Erf 426 Hunters Retreat and Portion 131 from Little Chelsea No. 10*. Port Elizabeth: SSI.
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