PROPOSED IMPROVEMENTS TO THE R44 BETWEEN SOMERSET WEST AND STELLENBOSCH

REVISED FINAL BASIC ASSESSMENT REPORT VOLUME 1

Main Report and Appendices A – E4

Prepared for:
Department of Environmental Affairs and Development Planning

On behalf of:
Kantey & Templer Consulting Engineers for
Western Cape Government: Department of Transport and Public Works

Prepared by:
CCA Environmental (Pty) Ltd

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Prepared for:
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Western Cape Government:
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PROJECT INFORMATION

TITLE	Proposed Improvements to the R44 between Somerset West and Stellenbosch: Revised Final Basic Assessment Report
APPLICANT	Western Cape Government: Department of Transport and Public Works
ENVIRONMENTAL CONSULTANTS	CCA Environmental (Pty) Ltd
ENGINEERING CONSULTANT	Kantey & Templer Consulting Engineers
REPORT REFERENCE	K&T12R44/REVISED FBAR/1
DEA&DP REFERENCE NO.	16/3/1/1/B4/45/1005/13
REPORT DATE	21 November 2017

REPORT COMPILED BY: Ena de Villiers

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Ena de Villiers
Environmental Consultant

REPORT REVIEWED BY: Jonathan Crowther

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Jonathan Crowther (Pr.Sci.Nat.; CEAPSA)
Managing Director

EXPERTISE OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

NAME	Jonathan Crowther
RESPONSIBILITY ON PROJECT	Project management and quality control.
DEGREE	B.Sc. Hons (Geol.), M.Sc. (Env. Sci.)
PROFESSIONAL REGISTRATION	Pr.Sci.Nat., CEAPSA
EXPERIENCE IN YEARS	29
EXPERIENCE	Jonathan Crowther has been involved in environmental consulting since 1988. He has expertise in a wide range of environmental disciplines, including Environmental Impact Assessments (EIA), Environmental Management Plans / Programmes, Environmental Planning & Review, Environmental Auditing & Monitoring, Environmental Control Officer, Public Consultation & Facilitation. He has project managed a number of offshore oil and gas EIAs for various exploration and production activities in South Africa and Namibia. He also has extensive experience in projects related to roads, property developments and waste landfill sites.

NAME	Ena de Villiers
RESPONSIBILITY ON PROJECT	Project consultant and report writing.
DEGREE	B.A. Hons (Philosophy), B.A. Hons (Demography), M.Phil (Environmental Ethics)
PROFESSIONAL REGISTRATION	-
EXPERIENCE IN YEARS	9
EXPERIENCE	Ena de Villiers has worked as an environmental assessment practitioner since 2008 and has been involved in a number of projects covering a range of environmental disciplines, including Basic Assessments (BA), Environmental Impact Assessments and Environmental Management Plans/Programmes and Environmental Control Officer. She has been exposed to a range of projects relating to mining (e.g. mineral prospecting and borrow pit development), property development and infrastructure (e.g. bridges, roads, waste water treatment works).

EXECUTIVE SUMMARY

1. INTRODUCTION

The Western Cape Government (WCG): Department of Transport and Public Works (DTPW) is proposing safety and Level of Service (LOS) improvements along Main Road 27 (R44) between Somerset West and Stellenbosch. The project study area extends from Steynsrust Road (km 20.15) in Somerset West to Van Rheede Street (km 33.00) in Stellenbosch, a total distance of 12.85 km (see Figure 1).

The Basic Assessment (BA) process undertaken for the proposed project commenced in 2012 (see Table 1 (overleaf) for a summary of documents released for public comment during the course of the process). The Draft Basic Assessment Report (BAR) was available for a public review and comment period from 2 April 2014 to 30 May 2014. In response to the public reaction to the findings of the Draft BAR, additional proposals for alternative project designs were developed and detailed traffic operational analysis and further economic specialist studies were undertaken to test the viability of these additional proposals. This formed the basis of a revised scope for the proposed project and alternatives. Specialist studies were subsequently updated in order to consider the implications of the changes to the proposed project scope. The updated proposed project, specialist studies and impact assessment were included into the Revised Draft BAR.

The Revised Draft BAR was made available for a 40-day public and authority review and comment period from 1 March to 13 April 2016. In response to the Interim Comment submitted by Heritage Western Cape (HWC), the Heritage Impact Assessment (HIA) was reviewed and updated in order to comply with Section 38(8) of the National Heritage Resources Act (NHRA) (No. 25 of 1999). The Revised Draft BAR was subsequently updated into a Final BAR, which included the findings of the additional HIA.

The Final BAR was made available for public review and comment from 12 December 2016 to 30 January 2017. All comments received on the Final BAR were collated and responded to in two Comments and Responses Reports, which together with the Final BAR were submitted to the Department of Environmental Affairs and Development Planning (DEA&DP) on 31 May 2017 for consideration. On 14 July 2017, DEA&DP informed DTPW that the Final BAR had been rejected and would have to include certain additional information to be accepted, namely adequate response to the concerns HWC raised in its final comment; proof of submission of an application for Water Use Authorisation in terms of the National Water Act, 1998; and an MMP for future maintenance work within watercourses. The specific requests made by DEA&DP have subsequently been addressed and the Final BAR has been updated into this Revised Final BAR to include the required additional information (see Section 2.2.2 and Table 3 below for detail).

This Executive Summary incorporates the main findings of the Revised Final BAR. It should be noted that all significant changes to the Final BAR are underlined and in a different font (Times New Roman) in this Revised Final BAR.

The Revised Final BAR has been distributed for a 21-day review and comment period from **23 November to 14 December 2017**. Copies of the report are available for viewing at the following locations:

- Stellenbosch Public Library, Plein Street, Stellenbosch;
- Somerset West Public Library, c/o Victoria Street and Andries Pretorius Street, Somerset West;
- CCA Environmental (Pty) Ltd (CCA) offices (Cape Town); and
- On the CCA/SLR website (http://www.ccaenvironmental.co.za/docs-for-comment).

All comments on the Revised Final BAR should be submitted to CCA at the contact particulars shown below, by no later than **Thursday 14 December 2017**.

CCA Environmental (Pty) Ltd
Contact person: Ena de Villiers
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The Revised Final BAR, together with all comments received by the conclusion of the comment period, will be submitted to DEA&DP as part of the application procedure. Once DEA&DP has reached a decision, all Interested and Affected Parties (I&APs) registered on the project database will be notified of the outcome of the application and the reasons for the decision. A statutory Appeal Period will follow the issuing of the decision.

Table 1: Summary of documents released for public comment during the course of Basic Assessment process

No.	Document	Comment period	U-turn alternatives proposed / assessed	Information regarding further investigations included in the report
1	Background Information Document	1 February to 22 March 2013	Steynsrust Road Intersection: • Improvements to road network. Winery and Annandale Road Intersections: • Grade-seprated roundabouts.	
2	Draft Basic Assessment Report (BAR)	2 April 2014 to 30 May 2014	Steynsrust Road Intersection: • Same as above. Winery and Annandale Road Intersections: • Traffic signals; • At-grade two-lane roundabouts; and • Grade-separated roundabouts	Specialist assessment of at-grade and grade-separated U-turn alternatives.
3	Revised Draft BAR.	1 March to 13 April 2016	Steynsrust Road Intersection: • Dedicated U-turn bridge. Winery and Annandale Road Intersections: • Grade-separated roundabouts – above-ground; and • Diamond interchange – below-ground. In the Jamestown vicinity: • Grade-separated U-turn bridge; • At-grade teardrop; and • Webersvallei Road signalised intersection	Traffic operational anaylsis of viability of various combintaitons of at-grade and grade-separated U-turn alternatives. Specialist assessment of above- and below-ground grade-separated alternatives.
4	Final BAR	12 December 2016 to 30 January 2017	Same as above.	Second Heritage Impact Assessment.
5	Revised Final BAR	23 November to 14 December 2017	Same as above.	Additional information requested by DEA&DP

2. BA PROCESS AND METHODOLOGY

2.1 APPLICABILITY OF THE NEMA EIA REGULATIONS

A Basic Assessment is required in terms of the Environmental Impact Assessment (EIA) Regulations of 2010 (Government Notice (GN) R543), promulgated under Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA], as the proposed project triggers a number of listed activities in terms of GN R544 and GN R546 (see Table 1).

It should be noted that the NEMA EIA Regulations 2014, which came into effect on 8 December 2014, have subsequently replaced the EIA Regulations 2010. However, applications submitted in terms of the previous regulations and which were pending when the EIA Regulations 2014 took effect, must be dispensed with in terms of the EIA Regulations 2010, on condition that all impacts associated with the newly identified activities in terms of the EIA Regulations 2014[1] have also been considered and adequately assessed. This approach has been followed (see Table 2).

Table 2: List of applicable activities in terms of the EIA Regulations 2010 and 2014 (as amended)

Activity No.	Activity Description
In terms of GN R544 of the EIA Regulations 2010 – Listing Notice 1	
11	*The construction of: (iii) bridges, (xi) infrastructure or structures covering 50 m² or more, where such construction occurs within a watercourse or within 32 m of a watercourse ...*

[1] Listed activities in terms of the EIA Regulations 2014 applicable to this proposed project were presented in the Final BAR. The EIA Regulations 2014 were subsequently amended on 7 April 2017. The relevant listed activities as amended have thus been included in the Revised Final BAR.

Activity No.	Activity Description
18	*The infilling or depositing of any material of more than 5 m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell girt, pebbles or rock more than 5 m^3 from (i) a watercourse.*
39	*The expansion of (iii) bridges within a watercourse or within 32 m of a watercourse …*
47	*The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km (i) where the existing reserve is wider than 13.5 m ...*
In terms of GN R546 of the EIA Regulations 2010 – Listing Notice 3	
19	*The widening of a road by more than 4 m or the lengthening of a road by more than 1 km. (d) In Western Cape: (ii) All areas outside urban areas.*
24	*The expansion of: (d) Infrastructure where the infrastructure will be expanded by 10 m^2 or more, where such construction occurs within a watercourse, measured from the edge of watercourse ... (d) In Western Cape: (ii) Outside urban areas, in (gg) Areas within 10 km from national parks or world heritage sites or 5 km from any other protected areas identified in terms of NEMPAA or from the core area of a biosphere reserve …*
In terms of GN R327 of the EIA Regulations 2014 (as amended) – Listing Notice 1	
12	*The development of … (ii) infrastructure or structures with a physical footprint of 100 m^2 or more; where such construction occurs – (a) within a watercourse ...*
19	*The infilling or depositing of any material of more than 10 m^3 into, or the dredging, excavation, removal or moving of soil, sand, pebbles … or rock of more than 10 m^3 from a watercourse …*
48	*The expansion of – (i) infrastructure or structures where the physical footprint is expanded by 100 m^2 or more; … where such expansion occurs – (a within a watercourse; …. excluding – … (ee) where such expansion occurs within existing roads or road reserves.*
56	*The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km – (i) where the existing reserve is wider than 13.5 m; or (ii) where no reserve exists, where the existing road is wider than 8 m; excluding widening or lengthening occurring inside urban areas.*
In terms of GN R325 of the EIA Regulations 2014 (as amended) – Listing Notice 3	
18	*The widening of a road by more than 4 m, or the lengthening of a road by more than 1 km. (i) In Western Cape: All areas outside urban areas: (aa) Areas containing indigenous vegetation …*

2.2 BA PROCESS

The BA process has consisted of two phases, namely an initial I&AP interaction phase and the BA phase, comprising specialist studies and integration and assessment.

2.2.1 Initial I&AP interaction phase

The initial public participation process undertaken to identify the key issues and concerns relating to the proposed project entailed the following key steps:

- The DTPW issued a press release on 18 September 2012 announcing the project and inviting comments;
- A preliminary project database was compiled, including directly affected and adjacent landowners, authorities (key departments), councillors, local community forums and other key stakeholders.
- Interaction with directly affected landowners occurred between October and December 2012, and official notification letters were sent via registered post to the directly affected landowners as part of the formal landowner notification process;
- A Background Information Document (BID) was compiled and distributed as part of the initial notification and registration period between 1 February and 22 March 2013;
- Six site notices were erected on 30 January 2013 at various intersections along the R44;
- An advertisement publicising the project and the availability of the BID was placed in two local newspapers on 31 January and 1 February 2013, respectively.
- An Open Day and Information Sharing Meeting were held on 27 February 2013;
- All comments received (128 in total) were collated into a BID Comments and Responses Report.

2.2.2 BA Phase

The key steps in the BA Phase to date include the following:

- The initial six specialist studies were commissioned and completed;

- The Draft BAR was compiled and distributed for review and comment;
- An Open Day and Information Sharing Meeting were held on 5 May 2014;
- During the course of the BA process the list of I&APs has continuously been supplemented and updated. There are currently 286 I&APs on the database;
- Comments received on the Draft BAR (65 in total) were collated and responded to in two Comments and Responses Reports, presenting submissions from commenting authorities and I&APs, respectively;
- In response to public reaction to the Draft BAR, further project alternatives were developed. The viability of various alternatives was investigated by means of detailed traffic modelling and further economic specialist input. Specialist studies were undertaken and/or updated to assess the potential impacts; and
- The Draft BAR has been updated to the Revised Draft BAR and distributed for review and comment.
- Representatives of six commenting authorities and 38 other I&APs submitted comments in response to the Revised Draft BAR;
- In response to interim comment provided by HWC, the HIA was reviewed. This additional specialist study was included in the Final BAR;
- Comments received on the Revised Draft BAR were collated and responded to in two Comments and Responses Reports representing comments from commenting authorities and I&APs;
- The Revised Draft BAR was updated to the Final BAR;
- The Final BAR was released for a 30-day review and comment period;
- A total of 47 submissions were received in response to the Final BAR, four of which were from representatives of commenting authorities and 43 from other I&APs. These comments were collated and responded to in two Comments and Responses Reports, one each for commenting authorities and I&APs;
- In response to DEA&DP's feedback on the Final BAR, the necessary steps were taken to address the specific requests;
- The Final BAR was updated to this Revised Final BAR, and detail regarding the additional information has been appended to the report (see Table 3 for detail in this regard);
- The Revised Final BAR has been released for a 21-day review and comment period.

Table 3: Amendments incorporated into the Revised Final BAR in response to DEA&DP's requests

Item no.	DEA&DP's request	Actions taken in response	Inclusion in Revised Final BAR.
3.1	Addressing concerns raised by HWC	In order to further investigate HWC's concerns, a meeting was held on 17 October 2017 at which HCW, DTPW, its project team and DEA&DP were present. It was concluded that DTPW would provide a response to these concerns in a letter addressed to HWC, for further consideration by the Impact Assessment Committee. This letter has been submitted to HWC for consideration and decision-making.	Sections 1.1 and 2.1.2; and Appendix H3.
3.2	Application for Water Use Authorisation	It should be noted that a Water Use Licence is not required for this proposed project as General Authorisation for the specific water uses would be applicable. An application for the registration of water uses in terms of the General Authorisation for Section 21(c) and (i) water uses in terms of the National Water Act, 1998 has been submitted to the Department of Water and Sanitation.	Sections 1.1 and 2.1.3; and Appendices E2.3 and H4.
3.3	Maintenance Management Plan (MMP)	An MMP was compiled and is included as a component (Part 2) of the Environmental Management Programme. This MMP pertains only to the works at the proposed intersections where watercourses would be affected by the safety improvements. The balance of the route under investigation would not be changed by the proposed improvements and is already subject to an ongoing routine road maintenance programme undertaken by DTPW.	Section 1.1; and Appendix G.
4	Process to finalise the Revised Final BAR	The Revised Final BAR has been made available for a 21-day comment period. Proof of notification of registered I&APs of the opportunity to comment as well as copies of any comments received will be submitted together with the Revised Final BAR to DEA&DP. The due date for the submission of this documentation is 15 January 2018.	Sections 1.1, 1.7, and 2.2.3.2; and Appendix F17.

3. PROJECT RATIONALE AND CONSIDERATION OF ALTERNATIVES

3.1 PROJECT RATIONALE

The proposed project identified the need to find a holistic solution to the safety and LOS issues along the R44 between Somerset West and Stellenbosch. The overarching safety issue is due to the large number of median openings and the traffic turning movements associated with these openings. Additionally, with the substantial increase in traffic volumes over the last few years, the LOS has also reduced and the route is no longer effectively catering for the substantial volumes of traffic that use the R44 on a daily basis. At the same time the strategic mobility function of the R44 necessitates that such safety improvements would have to be effected without sacrificing capacity and mobility along the route.

In order to address these issues, an overarching improvement project was initially proposed by DTPW which included the closure of all median openings along the R44 and the provision of grade-separated roundabouts at two key intersections in order to provide safe turnaround (U-turn) facilities.

3.2 INITIAL PROJECT SCHEME PROPOSALS AND PUBLIC RESPONSE

The BA process commenced with the distribution of a Background Information Document (BID) as part of an initial notification and registration period from 1 February to 22 March 2013. The BID described the project scope which at that stage included the following:

- Consolidation of minor roadways and closure of median openings along the R44;
- Improvements of sections of road along the R44 including intersections of the R44 with Steynsrust Road, Bredell Road, and Technopark Road; and
- Introduction of U-turn opportunities which would be facilitated by the introduction of grade-separated roundabouts – one located at the Winery Road / R44 intersection and the other at the Annandale Road / R44 intersection.

During the BID public consultation process it became apparent that many I&APs did not, for various reasons, consider the proposed grade-separated roundabouts a suitable solution. This was largely based on concern over the visual impact that they would have in a largely rural environment and associated negative impacts on cultural heritage and tourism. Directly affected neighbours were also concerned about the impact it could have on issues such as access, business and agriculture. Regarding the median closures, a number of landowners and businesses located between the proposed interchanges were concerned about additional travel distance associated with closed medians.

Various other options were suggested as a solution to the safety and LOS problems along this stretch of road. These included suggestions such as a Stellenbosch bypass, additional access to Techno Park, secondary service roads running parallel to the R44, an additional new road closer to the mountain foothills, improved public transport, dedicated bus lanes and a reduction in the speed limit. These alternatives were then considered by the technical team but none of these alternatives were deemed as suitable to resolve the safety and LOS deficiencies that precipitated this project.

3.3 PROJECT SCHEME PROPOSALS AND ALTERNATIVES INCLUDED IN THE DRAFT BAR

In order to address concerns regarding the proposed concept of grade-separated roundabouts, the project engineers identified alternative means of facilitating U-turn movements in addition to the grade-separated roundabouts. These included signalised intersections and at-grade two-lane roundabouts / traffic circles. Three alternatives were subsequently assessed and compared for both the Winery Road and Annandale Road Intersections, i.e. grade-separated roundabouts; at-grade roundabouts and signalised intersections. The BA study process and its conclusions and recommendations were presented in the Draft BAR, which was released for public review and comment in April 2014. The Draft BAR concluded that, based on the economic specialist input, grade-separated roundabouts should be implemented.

The public reaction following the release of the Draft BAR showed continued support to urgently address the existing safety issues on the R44 and that the median openings should be closed. However, many concerns and objections were again raised in relation to the findings of the Draft BAR.

The main objections were the same as those raised during comment on the initial BID. These included the visual impact and effect on the rural landscape character, effects on tourism and direct effects on adjacent landowners. Other key concerns included the cost implications of the grade-separated roundabouts and that the grade-separated roundabouts were investigated in isolation from the system-wide traffic flows as the impact on the local traffic system at each end of the R44 corridor had not been fully analysed. This highlighted the statement in the Draft BAR that time gained due to improved traffic flow along the R44 could be reduced or nullified as the traffic builds up at the signalised intersections entering Stellenbosch as well as on the urban road network in Somerset West.

3.4 INVESTIGATION OF AT-GRADE ROUNDABOUT OPTIONS AND RELATED INFRASTRUCTURE

In taking cognisance of the strong opposition to the proposed grade-separated roundabouts and submissions received from I&APs, the project engineers were tasked to look at other possible solutions to address the project needs. This led to the identification of further conceptual design alternatives, which included *inter alia* a dedicated U-turn bridge at the existing Steynsrust Road Interchange to avoid increased traffic loading of the street network in this area, and the provision of three at-grade roundabouts along the route, namely at Bredell, Winery and Annandale Roads as well as a dedicated at-grade U-turn facility near the Jamestown Cemetery.

In order to test the viability of these additional conceptual alternatives (in terms of overall performance in relation to system-wide traffic flows) an independent traffic specialist firm (ITS Engineers) was commissioned to provide a detailed traffic operational analysis of the interim revised scheme and alternatives. The scope of work was also to include a comparison of any revised solution with the originally proposed grade-separated roundabout solution. The purpose of the ITS study was to quantify and evaluate in detail the different upgrade alternatives along the R44 within the context of the current capacity constraints on either side of the study section, i.e. Stellenbosch and Somerset West. The specialist report tested 10 different combinations of the quantity, positions, number of lanes of at-grade roundabouts and / or grade-separated interchanges along the R44 as well as other intersection upgrades within Stellenbosch.

A micro-simulation model of the R44 corridor was created to test the traffic-related impacts associated with various alternatives and combinations. The modelling process included the evaluation of the R44 travel times, overall average network speed and trip times between major destinations as well as the future capacity constraints of the network.

The traffic volume scenarios were investigated by using historical counting data to plot likely growth estimates, concluding that the growth rate of the traffic along the R44 is likely to vary from 2% to 4% per annum. However, as this growth continues the R44 will reach a vehicle capacity limit, at which point the LOS would be deemed to have failed.

The traffic analysis determined that the capacity limit of the R44 road network was calculated at a traffic demand increase of 15% over the 2014 traffic volumes. This means that after this point, the network would become overwhelmingly congested and the flow rates throughout the network would begin to decline. Traffic congestion is characterised by slower speeds, longer trip times, delays and vehicular queuing. On this basis, the modelling results of all the upgrade alternatives were compared to two demand scenarios, namely (1) the current demand, defined as the existing demand volumes in 2014; and (2) at a 15% increase in the current demand, which is representative of the projected situation on the road within a period of five years.

Whilst road user costs can be divided into four categories, i.e. time related costs; safety costs; vehicle operating costs; and environmental costs, the simulation modelling focussed primarily on time-related

costs in terms of vehicle delays. These delays result from capacity constraints in the road network and would be impacted by possible upgrade alternatives.

Overall system performance measures were extracted from the simulation model in order to determine the network-wide impacts of the range of upgrade alternatives. These system performance measures included total network travel time; network travel time per vehicle trip, or average trip time; and network capacity constraints at intersections.

The key findings and conclusions of the traffic operational analysis are summarised as follows:

- In relation to the R44 capacity:
  - The capacity limit of the R44 road network was calculated at a traffic demand increase of 15%.
  - The R44 is operating close to capacity, thus most intersections within Stellenbosch would operate above capacity with a 15% increase in traffic demand, which translates to five years' growth.
  - The signalised intersections within Stellenbosch would therefore require upgrading in the near future regardless of upgrades implemented elsewhere along the R44 corridor. This issue would become even more apparent if a grade-separated interchange were to be introduced at Annandale Road Intersection as vehicles would arrive sooner at the first of the signalised intersections at the Stellenbosch end of the R44.

- In relation to at-grade intersections:
  - The existing signalised intersection at Annandale Road would not be able to accommodate the addition of a dedicated U-turn phase at current traffic levels. This would be further exacerbated with additional traffic growth.
  - Double-lane at-grade roundabouts would not be viable to provide U-turn facilities in addition to accommodating all through traffic and turning movements associated with secondary roads, as they would add network travel time in every scenario. This applies especially at the existing Annandale Intersection, where its capacity limit would be reached as soon as it is built. While double-lane roundabouts at Winery Road and Bredell Road would be able to accommodate a higher entering flow due to less conflicting flow, capacity would be reached within five years.
  - Three-lane at-grade roundabouts were also investigated and analysed to determine whether better operational capacity and LOS could be achieved along the R44. While the theoretical design life of triple-lane roundabouts would be in the order of 8 to 10 years, this is not considered viable in practise. This is because the operational efficiency, safety and driver behaviour at high capacity (triple-lane) roundabouts along a mobility corridor in a semi-rural environment are considered problematic in the current South African road user context. There are no similar examples anywhere in South Africa from which to determine the actual operations. Thus the design life is considered to be purely theoretical and based on ideal driver behaviour. Hence, the traffic operational analysis does not recommend the use of triple-lane roundabouts for the R44.

- In relation to grade-separated interchanges:
  - Grade-separated roundabout interchanges would provide the best LOS and most efficient network travel times as a result of facilitating free-flow conditions for both directions of travel along the R44 while the side road traffic would experience minimal delays. This effect would apply to most forms of interchange, which would serve to separate the R44 traffic from the cross road traffic. Removing the at-grade control constraints (in the form of either at-grade roundabouts or traffic signals) would thus result in traffic moving more freely towards Stellenbosch and/or Somerset West with a concomitant increase in congestion at the end points of the study section of the R44. This means that the design life of any solution incorporating grade-separated interchanges in the middle section of the R44 is dependent on the bottlenecks or constraints on either side, i.e. at the Stellenbosch and/or the Somerset West end. As the current spare capacity of the R44 entering/exiting Stellenbosch is less than 10%, there is very little design life left if measured against the capacity of the overall system.
  - The capacity constraints of the R44 at the Stellenbosch end could be improved by adding more through lanes at the signalised intersections from Webersvallei Road to Van Rheede Street.

This could add another 30% to 40% capacity, i.e. a design life of 10 to 15 years. Beyond that timeframe, the traffic operational analysis recommends that a bypass should be considered.[2]

3.5 REVISED PROJECT SCHEME AND ALTERNATIVES

3.5.1 Further investigation of alternative considerations for grade-separated interchanges

The findings of the traffic analysis thus determined that an at-grade scheme with either traffic lights or at-grade roundabouts was not viable. It further confirmed that grade-separated interchanges would be the most effective alternative to provide U-turn movement facilities, especially if capacity constraints were improved by including upgrading of signalised intersections within Stellenbosch into the project scheme.

These findings led to further investigation of alternative considerations for grade-separated interchanges. Firstly, various other options for grade-separated above ground interchanges were compared to reconsider the potential visual effect to that of the grade-separated roundabouts. This exercise focussed on various configurations of diamond interchanges. However, it was found that the bridge deck surface area as well as the footprint areas of the structures would be comparable to that of the above-ground roundabouts. Also, the visual effect of an above-ground structure from a distance perspective is caused in the first instance by its elevated position in relation to its surrounds rather than by the deck surface. Thus a smaller deck surface would not have any significant mitigation with regards to the visual effect of one above-ground structure compared to another. In addition, from a technical perspective traffic flow on a diamond interchange would be less efficient than that of a grade-separated roundabout.

Secondly, the technical and engineering implications of below-ground grade-separated interchange options were further investigated. Below-ground construction takes longer, has higher construction costs than above ground construction and results in far greater traffic disruption during the construction phase Costs would furthermore be significantly increased by any rock being encountered, a highly likely scenario in this region.

The question the project team then posed was whether the higher monetary cost of a below-ground option could be offset against the largely unquantified benefits to society, such as mitigation of potential visual and sense of place impacts. This then led to the further investigations discussed in the next section.

3.5.2 Investigation into economic efficiency of project scheme alternatives/ Cost benefit analysis

An investigation into the economic efficiency of a project scheme with above-ground versus below-ground structures was then undertaken to determine which alternatives could be considered viable for further consideration. The economic analysis focused on those alternatives that were considered viable in the traffic analysis model. The following four alternatives were thus considered further in the economic study:

- *Alternative 1*: Two above-ground, grade-separated roundabouts at the Annandale and Winery Road Intersections. These are similar to the only efficient alternative from the previous analysis, but with the addition of a grade-separated U-turn bridge at the existing Steynsrust Road Interchange.
- *Alternative 2*: As per above, but with additional through lanes at five key signalised intersections leading into Stellenbosch from Webersvallei Road. There would also be changes to the timing and phases of these signals. A grade-separated U-turn bridge would also be included near the Jamestown Cemetery.
- *Alternative 3*: Two below-ground, grade-separated roundabouts at the Annandale and Winery Road Intersections, grade-separated U-turn bridges at Steynsrust and Jamestown Cemetery, with lane and signal improvements into Stellenbosch. This addresses the visual concerns related to above-ground roundabouts. This alternative assumes a cost with 30% underground rock.

[2] It should be noted that the recommendation regarding a Stellenbosch bypass does not fall within the scope of this proposed project. The analysis states that the alignment of a by-pass and the various options should be studied and planned as soon as possible to ensure the long term sustainability of Stellenbosch.

- *Alternative 4*: Two below-ground diamond interchanges at the Annandale and Winery Road Intersections, grade-separated U-turn bridges at Steynsrust and Jamestown Cemetery and again with the through lanes and signal improvements into Stellenbosch. These below-ground diamond interchanges would be less expensive to construct than the below-ground roundabouts. This assumes a cost with 30% underground rock. However, they would result in a lower LOS due to reduced sight and stopping distances. A diamond interchange would also have more conflicting movements than a roundabout interchange (which has a left-turn only approach and departure and hence has fewer conflicting movements). Roundabout interchanges are thus more efficient in processing U-turn manoeuvres for which the project caters.

The results of the cost benefit analysis were as follows:

- *Alternative 1:* This alternative is considered to be economically efficient as it has a benefit-cost ratio (BCR) above 1. However, without the proposed improvements for the Stellenbosch portion of the project, the BCR of 1.62 and internal rate of return (IRR) of 15% are much lower than that of Alternative 2. Without the improvements at the Stellenbosch section, overall travel time saved along the R44 would simply be lost due to continued delays at the Stellenbosch end of the project. This option was therefore dropped as it was not found to be a viable alternative for further consideration.
- *Alternative 2:* This alternative addresses the shortcomings of Alternative 1 and is economically robust with a BCR of 2.02 and an IRR of 18%.
- *Alternative 3:* This alternative is economically efficient although the results are marginal, i.e. a BCR of 1.39 and an IRR of 12%. This is the least efficient of the four alternatives investigated and is the most sensitive to changes in assumptions and variables. Due to the high capital cost of this option and the low BCR, this alternative was dropped from consideration as a future solution.
- *Alternative 4:* Alternative 4 has a BCR of 1.66 and IRR of 14%. This alternative is economically efficient, though not as economically efficient as Alternative 2. However, it does address the issue of visual impact which has not been considered in the economic assessment.

Thus it was concluded to include Alternative 2, which is the most economically efficient solution, and Alternative 4, which addresses the visual and associated aspects, for detailed further assessment.

3.2.5.3 Implications of the additional cultural heritage specialist study for the proposed project scheme

The additional HIA report assessed the potential cultural heritage impact of closing the R44 median openings as well as the various alternatives proposed at the Annandale and Winery Road Intersections. The findings in this regard are presented in Section 6 of this Executive Summary.

As the additional HIA was required to review all details relating to the cultural landscape contained in the initial HIA, it also assessed the at-grade alternatives originally proposed and assessed in the Draft BAR. The findings are as follows:

- *At-grade roundabouts:* The cultural heritage impact of the at-grade roundabouts at both Winery and Annandale Roads was assessed as being of high significance due to the imposition of an urban morphology into a rural cultural landscape which is considered a valuable heritage resource. Similar to the grade-separated roundabout, the at-grade roundabout option would result in a physical and visual separation of the wider landscape.
- *Signalised intersections:* The cultural heritage impact of signalised intersections was assessed as being of medium significance as the provision of traffic lights would not impose on the landscape in the same way as the grade-separated alternatives. However, the study argues that they are capable of being as detrimental to the overall sense of a rural cultural landscape and the character of the gateway nodes

The findings that these proposed alternatives, like the grade-separated options, would have a medium to high significance impact on cultural heritage would add further support to the findings of the traffic operational study and economic cost benefit analysis that at-grade solutions do not present feasible project alternatives.

3.5.3 Consideration of alternatives to provide viable U-turn facilities at the Somerset West and Stellenbosch ends of the upgrade section

The problem of congestion at both urban ends of the upgrade road section is an issue that received considerable attention from I&APs in response to the Draft BAR. Both the traffic operational analysis and the economic analysis clearly demonstrated that, at the Stellenbosch end, congestion would be alleviated by increasing capacity at the existing signalised intersections from Webersvallei Road to Van Rheede Street. These improvements are thus included in the proposal presented in this Revised Draft BAR.

At the Somerset West end, the solution proposed is to provide a dedicated U-turn bridge at the existing Steynsrust Interchange which would serve to separate U-turning traffic from the urban road network, thus avoiding placing U-turn traffic on the existing road network. This solution in itself addresses almost all of the issues raised by I&APs regarding the Somerset West end of the project and is thus included in the proposal presented in this Revised Draft BAR.

At the Stellenbosch end three alternatives where investigated to facilitate the U-turn movements which would need to be accommodated as a result of the closure of the existing median openings between Annandale and Webersvallei Roads. These are:

- A grade-separated option in the form of a dedicated U-turn bridge near Jamestown Cemetery;
- An at-grade option in the form of a dedicated U-turn teardrop facility at the same location; or
- Accommodating U-turn movements at the Webersvallei Road Intersection.

3.5.4 Revised project scheme and alternatives

The above findings led to the project proposal and alternatives that have been assessed in the Revised Draft BAR. The revised project scheme, which is described in detail in Section 4, consists of the following:

- Closing all median openings along the R44;
- Providing a grade-separated U-turn facility at Steynsrust Bridge;
- Providing a left in/left out access to Bredell Road;
- Providing grade-separated turning facilities at Winery Road and Annandale Road. Two alternative are being considered for each of these intersection, namely:
  - Grade-separated roundabout interchange, above ground; and
  - Grade-separated diamond interchange, below ground.
- Providing a turning facility in the vicinity of Jamestown. Three alternatives are being considered for this purpose, namely:
  - Grade-separated U-turn bridge near Jamestown Cemetery;
  - At-grade teardrop turning facility near Jamestown Cemetery; and
  - Accommodating U-turn movements at the Webersvallei Road signalised intersection.
- Improving at-grade signalised intersections within the Stellenbosch Municipal area between Webersvallei Road and the end of the project at Van Rheede Street, at the following five intersections:
  - Webersvallei Road (km 29.6);
  - Techno Park (km 30.3);
  - Blaauwklippen Road (km 31.2);
  - Trumali Road (km 32.0); and
  - Van Rheede Road (km 32.9).
- Additional safety measures:
  - Implementing average speed over distance (ASOD) control; and
  - Accommodating pedestrian and cycling facilities in the interchange design.

4. PROPOSED PROJECT DESCRIPTION

4.1 CLOSURE OF MEDIAN CROSSINGS

It is proposed to close all 22 median openings between Steynsrust Road and Webersvallei Road. The result would be that all public and private roads as well as private accesses along this section of the R44 would have only left in/left out access from and to the R44. U-turn facilities would be provided at both ends of the road section as well as at Winery and Annandale Roads in order to limit the addition travel distance to access properties along the R44.

4.2 STEYNSRUST ROAD U-TURN FACILITY

A grade-separated U-turn bridge in the form of a horseshoe is proposed adjacent to the existing Steynsrust Road Interchange bridge structure. The purpose of this facility would be to provide southbound traffic wishing to go north with the opportunity to make a U-turn without accessing the local road network. Thus traffic generated by the median closures along the R44 would not affect the surrounding municipal road network.

The proposed upgrade would entail the following:

- Development of a dedicated U-turn bridge, adjacent to and just north of the existing Steynsrust Bridge, with on- and off-ramps within the existing road reserve;
- Providing deceleration turning lanes facilitating access to Old Stellenbosch Road and Zandberg Road.

4.3 BREDELL ROAD / KLEIN HELDERBERG ROAD

It is proposed to close the existing median openings to Bredell Road and the Klein Helderberg Road and to provide left / left out access to both roads. Improvements at the Bredell Road Intersection would entail the provision of a deceleration turning lane and an acceleration entry lane as well as a triangular splitter island at the exit / entry point.

4.4 WINERY ROAD INTERCHANGE

4.4.1 Grade-separated roundabout – above ground

The grade-separated roundabout would be located at the existing intersection and alignment of Winery Road with the R44. The Winery Road vertical alignment would be steepened to tie in with the grade-separated roundabout which would, in turn, be linked to the R44 via on-and off-ramps. Pedestrian walkways and cycling lanes would be included in the ramps and the roundabout. Provision would also be made on all four of the ramps for taxi drop off / pick up embayments.

Access to the Ken Forrester Wine Estate would be directly opposite the access road to the smallholdings located to the north of Winery Road. The eastern edge of the roundabout would extend onto the Avontuur Estate property. The Avontuur Estate's existing access would be relocated so as to provide direct access from the roundabout itself.

It is proposed that the grade-separated roundabout would have 1:2 slope embankments in order to mitigate the potential visual impact. The slopes would be vegetated with appropriate vegetation in order to blend in with the surrounding landscape. Approximately 2.0 ha of land outside the road reserve would have to be obtained from the adjacent landowners.

As an alternative to the embankments and to minimise land-take, it would be possible to construct the embankments with a combination of vertical retaining walls and sloped embankments. This option could reduce the total land required for the interchange from private landowners to approximately 1.3 ha. The drawback of vertical retaining walls is that the visual impact of such structures would be higher initially, but could be reduced by vegetation screening that would become more effective with time.

As part of the temporary traffic accommodation measures that would be required during the construction phase, it is proposed to upgrade a secondary road which would link Winery Road to a point on the R44 north of Winery Road.

Street lighting would be required in terms of the standard guideline for a grade-separated interchange. This would include lighting on the approach ramps to the roundabout as well as lighting within the roundabout itself – the latter of which would be kept to as low a level as possible whilst complying with the minimum specified standards.

4.4.2 Grade-separated diamond interchange – below ground

A grade-separated diamond interchange is proposed as a below-ground alternative to a grade-separated roundabout located above ground. This would entail placing Winery Road approximately 7 to 8 m below the existing ground level, i.e. the R44 grade line. Access to the Ken Forrester Wine Estate and the Avontuur Estate property would be similarly aligned as described above for the grade-separated roundabout. The R44 dual carriageway would retain its existing grade line, but would be located on bridge decks passing over the below-ground structure.

Approximately 2.5 ha of land outside the road reserve would have to be obtained from adjacent landowners. Street lighting would be limited to the on- and off-ramps and within the interchange area, which would not be above ground. The extent of rock is unknown at this stage and would have a bearing on cost and duration of construction.

The below-ground interchange would have to make provision for an underground stormwater system (a gravity system) to remove stormwater from the lowest point of the interchange. Water may accumulate from groundwater seepage and/or from stormwater. Due to the topography falling to the west, a stormwater drain would be placed in the Winery Road ramps and would emerge (daylight) at the western limit of construction. The stormwater would then continue westwards in a lined side drain of Winery Road.

Vertical retaining walls could also be used as an alternative to ramp embankments. This option could reduce the total land required from private landowners to a similar area as for the above-ground roundabout, i.e. 1.3 ha. The footprint of the interchange using vertical retaining walls would be similar to that for the above ground roundabout alternative.

4.5 ANNANDALE ROAD INTERCHANGE

4.5.1 Grade-separated roundabout – above ground

The R44 and Annandale Road Intersection is a key intersection on the route providing regional connectivity between the R44 and the R310 into Stellenbosch. Similarly to the Winery Road Intersection, it is proposed to construct a grade-separated roundabout at this location. The roundabout would be off-set to the south of the existing intersection requiring the realignment of Annandale Road from both sides as it approaches the interchange. This alignment has been derived so as to minimise the potential impact on property in all four quadrants of the intersection whilst simultaneously taking the temporary construction period traffic accommodation practicalities into account. The approximate land acquisition requirement would be 3.3 ha.

The interchange would require the realignment of a number of existing access points to surrounding properties. These include:

- A relocation of the existing entrance onto Farm 540 (Zetler's packing plants and the Zetler residence) from Annandale Road;
- A new entrance to the existing servitude access linking the Remaining Extent of Farm 537 (Root 44 Market) to Annandale Road via a relocated access 250 m along Annandale Road taking road access safety considerations into account. This would result in land acquisition and incorporation into the road reserve of a portion of Portion 18 of Farm 537 (Klein Akkerdraai Lodge);

- A relocated access similar to that described above to access Portion 20 of Farm 537 (Mooiberge Padstal) – this access road would be located on Portion 20 of Farm 537;
- A new point of access from the southbound R44 on-ramp onto Portion 20 of Farm 537. This point would also provide for Mooiberge Farmstall traffic to exit directly onto the R44; and
- A new point of access from the southbound R44 off-ramp to the Remaining Extent of Farm 537. This point would also provide for Root 44 Market traffic to exit directly onto the R44. This would reduce the traffic volume using access to Root 44 from Annandale Road (this is a new access not provided in the Draft BAR).

Vertical retaining walls could be used as an alternative to ramp embankments. This would reduce the expected interchange land requirement to approximately 2.8 ha. Vertical retaining walls would have a lower impact on the heritage resources at the intersection.

4.5.2 Grade-separated diamond interchange – below ground

As for Winery Road, a below-ground grade-separated diamond interchange is proposed as an alternative with Annandale Road passing below the R44. Access roads to surrounding properties would be similarly aligned as described above for the grade-separated roundabout. The R44 dual carriageway would retain its existing grade line, but would be located on bridge decks passing over the below-ground structure.

Approximately 3.8 ha of land outside the road reserve would have to be obtained from the adjacent landowners. As for Winery Road, street lighting would be limited to below ground. The extent of rock is unknown at this stage and would have a bearing on cost and duration of construction.

As for Winery Road, an underground stormwater system (a gravity system) would be required to remove stormwater from the lowest point of the below-ground interchange. The stormwater drainage system would be aligned along the R44 to the north as the topography falls in this direction to a low point at a small stream (a tributary of the Bonte River) approximately 220 m north of the interchange.

It would also be possible to construct the embankments with a combination of vertical retaining walls and sloped embankment, which could reduce the total land required from private landowners to approximately 2.5 ha. The footprint of the interchange using vertical retaining walls would be similar to that for the above ground roundabout alternative**.**

4.6 U-TURN FACILITY NEAR JAMESTOWN CEMETERY OR WEBERSVALLEI ROAD

A U-turn facility would be required to allow vehicles travelling from the south to make a U-turn in order to (i) access properties located along the eastern side of the R44 between Jamestown Cemetery and Annandale Road, and (ii) enable vehicles departing from properties located along the western side of the R44 north of Annandale Road to undertake U-turns in order to proceed in a southerly direction.

Three alternatives are assessed and compared in the Revised Draft BAR, namely:
- A grade-separated U-turn bridge near Jamestown Cemetery;
- An at-grade teardrop facility near Jamestown Cemetery; and
- An at-grade U-turn movement at the Webersvallei Road signalised intersection.

4.6.1 Jamestown Cemetery grade-separated U-turn bridge

This alternative is similar to the Steynsrust Road U-turn facility, namely a dedicated U-turn bridge over the R44 in the form of a horseshoe, with an on- and off-ramp to the R44, which would allow turns in only one direction. It would be located in the vicinity of Jamestown Cemetery. This facility would provide for U-turn movements without conflicting with the movement of traffic on the R44.

This proposal would require widening of the road reserve by approximately 5 m on each side of the R44 and thus approximately 0.2 ha of land would have to be acquired from an adjacent landowner and the Jamestown Cemetery.

4.6.2 Jamestown Cemetery at-grade teardrop

This is an at-grade dedicated U-turn teardrop facility alternative which would also be located adjacent to Jamestown Cemetery. It would entail the provision of a turning lane located between the two carriageways. In order to accommodate the U-turn facility the northbound carriageway of the R44 would have to be relocated over a distance of approximately 500 m, resulting in an extension of the road reserve boundary approximately 12 m to the north-west. Approximately 0.5 ha of land would have to be acquired for this purpose.

The key disadvantage of this facility is that U-turning traffic would have to slow down to enter the facility while travelling in the fast lane of the northbound carriageway, and exit the teardrop into oncoming traffic using the fast lane of the southbound carriageway. From a technical perspective the option of traffic slowing down and accelerating from / into the fast lane is not supported by DTPW.

4.6.3 Webersvallei Road Intersection

The third alternative proposed for the purpose of accommodating U-turning traffic between Annandale Road the Webersvallei Road, is to accommodate such movements at the existing Webersvallei Road Intersection. The upgrading of this signalised intersection forms part of the proposed improvements to ease congestion at the Stellenbosch end of the R44. This would entail widening the road to add turning lanes to both the west and east and providing three through lanes in each direction. These improvements would provide sufficient space to accommodate U-turns of heavy vehicles at the traffic lights.

It should be noted that this alternative is based on existing traffic generated between Annandale and Webersvallei Roads. It does not take into consideration any traffic implications that could potentially occur as a result of changes in land use along the R44 between these roads.

4.7 IMPROVEMENTS TO EXISTING SIGNALISED INTERSECTIONS AT THE APPROACH TO STELLENBOSCH

Existing at-grade signalised intersections within the Stellenbosch Municipality from Webersvallei Road to Van Rheede Street would be improved in order to ease congestion and support the R44 corridor mobility function. The five intersections included in the project scope are Webersvallei Road; Techno Road; Blaauwklippen Road; Trumali Street; and Van Rheede Street. The proposed improvements would entail road widening to provide turning lanes to the west and east as well as three through lanes in each direction to accommodate traffic at each intersection.

In addition, traffic signal timing would be improved. The traffic signals along the route are currently poorly coordinated. Thus it is planned to improve traffic signal timing at the above signalised intersections in conjunction with the Stellenbosch Municipality by coordinating the signals on an area traffic control system along with the rest of the signals in Stellenbosch. This would form part of the Stellenbosch Roads Master Plan which is currently being developed. Such signal timing improvements would assist to reduce congestion and time delays experienced during peak hour traffic.

4.8 ADDITIONAL SAFETY MEASURES

4.8.1 Implementing average speed over distance (ASOD) control

The closure of median openings and provision of grade-separated U-turn facilities would remove at-grade conflicts between vehicles travelling along the R44 at higher speed and vehicle movements through the median openings. The grade-separated interchanges at Winery and Annandale Roads would allow for free flow of traffic between Somerset West and Webersvallei Road. This would allow for the effective use of average speed over distance (ASOD) control to further improve safety conditions along the route by maintaining a constant speed limit of 100 km/h.

4.8.2 Accommodating pedestrian and cycling facilities in the interchange design

Many farmworkers, school children and other pedestrians cross the R44 daily on a somewhat random dispersed pattern along the length of the route with localised concentrations at the Winery Road and Annandale Road Intersections and lesser concentrations at Eikendal Road. Currently, the only moderately safe crossing point between Somerset West and Webersvallei Road is at the Annandale Road Intersection. Large numbers of pedestrians at Winery Road and at Klein Helderberg / Bredell Road have no safe crossing facilities.

In the case of the proposed grade-separated interchanges (whether above or below ground), provision would be made to facilitate the movement of pedestrians and cyclists to either side of the R44 as well as to provide specific public transport stops at appropriate positions. Pedestrian bridges could be considered in future should numbers warrant bridges and as specific pedestrian desire lines become apparent.

4.9 PROJECT COSTS

The costs for the overall project scheme for different combinations of alternatives are provided in Table 4. These costs include initial construction and annual maintenance and rehabilitation costs for 30 years based on 2015 prices. Those project components for which there are no alternatives are included in all the combinations, namely closure of median openings; upgrade to the Steynsrust Road Interchange, including the U-turn facility; upgrade to Bredell Road / Klein Helderberg; signal and lane improvements entering Stellenbosch; and speed over distance monitoring.

Table 4: Project scheme costs for different combinations of alternatives

U-turn facility at northern end of route section	Interchanges at Winery and Annandale Roads	
	Grade-separated roundabouts	Below-ground interchanges
Webersvallei Road signalised intersection	R 256.7 million	R 354.0 million
At-grade teardrop at Jamestown Cemetery	R 278.6 million	R 375.9 million
U-turn bridge at Jamestown Cemetery	R 292.7 million	R 390.0 million

4.5 NO-GO ALTERNATIVE

The No-Go alternative relates to the option of maintaining the status quo by not improving the R44 between Somerset West and Stellenbosch. Section 3.1 clearly shows the need for improving the safety and mobility of the R44 route. However, should the project not go ahead (No-Go alternative), the following specific implications would arise (both negative and positive):

- No change to historic features at Winery Road and Annandale Road Intersections;
- No negative visual and heritage impact on the landscape;
- No change to the quality of the R44 as a scenic route or to the surrounding cultural landscape;
- Adjacent landowners and tourists would have continued direct access to/from the R44 to their homes and businesses;
- Unsafe traffic conditions would remain and furthermore become worse in the future as traffic volumes along the R44 continue to grow;
- Traffic congestion would increase over time and pressure on the local road network would become more problematic than is currently the case;
- Tourism potential may become compromised due to the negative effect of unsafe road conditions for motorised vehicle users, pedestrians and cyclists; and
- Road safety for pedestrians and cyclists would not improve at affected intersections.

It must be noted that should the proposed improvements not go ahead, the DTPW is still within its rights to close the median crossings to improve road safety. However, that would leave the route without the necessary safe U-turn facilities which would likely result in illegal U-turns at unsafe locations and a subsequent increase in accidents.

5. THE AFFECTED ENVIRONMENT

5.1 THE BIOPHYSICAL ENVIRONMENT

The climate is classified as a Mediterranean climate, with dry hot summers and cold wet winters. The natural topography of the study area is relatively flat, with moderate to low undulating hills interspersed by tributaries of the Eerste River. The general slope is towards the south and east.

The geology can be described as quaternary alluvium derived mostly from Table Mountain sandstones and the Malmesbury Group clays (with some Cape Granite). Along the R44 route, the sections to the north of the Blaauwklippen River are largely underlain by Malmesbury Group shales, while to the south of the river, the Cape Granites of the Stellenbosch-Kuilsriver and Helderberg Plutons occur.

The historical vegetation type that would have covered the study area and surrounds is Swartland Granite Renosterveld. However, high levels of transformation have occurred in the study area due to the arable land being converted for agricultural purposes. Natural vegetation now only occurs as remnant patches.

No Critical Biodiversity Areas (CBA) have been identified for the portion of the study area that falls within the City of Cape Town municipal boundary. The portion falling with in the Stellenbosch Municipality is included in the Stellenbosch – Drakenstein Municipality's CBA plan. In terms of the area plan several patches of land at the Annandale Road and Winery Road Intersections are designated as critically important. However, after ground-truthing by the vegetation specialist of these areas, this designation is considered erroneous since no conservation worthy patches of vegetation, nor any species of conservation concern, were found.

The area of interest is located in the Berg Water Management Area and in quaternary catchment G22H. The freshwater features of the study area consist of a number of tributaries of the Eerste River of which the Blaauwklippen (Blouklip), Bonte and Moddergat Rivers are the largest. Five watercourses at the Steynsrust, Annandale and Techno Road Intersections may be affected by the proposed intersection improvements, as well as wetland areas north of the proposed U-turn facility near Jamestown Cemetery. There are no watercourses present at the other intersections included in the proposed project scope.

The aquifers between Somerset West and Stellenbosch are secondary in character and as a result are classed as intergranular and fractured aquifers. Granitic aquifers are heterogeneous, with hydraulic properties varying significantly over short distances. The granitic aquifer between Somerset West and Stellenbosch is considered to be moderately vulnerable to anthropogenic impacts.

The hydrocensus confirmed that all landowners adjacent to the Winery and Annandale Road Intersections use groundwater for domestic purposes. Groundwater is also used in wineries, watering of horses and irrigation of strawberries and gardens. The area is not supplied with water by the Stellenbosch Municipality. Consequently, groundwater is of high value to property owners.

5.2 HERITAGE

The general area is one dominated by agriculture with vineyards and some strawberry fields notable in the vicinity of the R44. Horses are also reared on one farm. The area is highly scenic and has a rich layering of history with many farms going back to the late 1600s. Historical houses, whether farm manor houses or workers' cottages, abound in the landscape. At Winery Road Intersection there are three historic buildings of heritage value. At the Annandale Road Intersection there are four structures with little heritage value and one structure, a labourer's cottage in the north-eastern quadrant, with some heritage value.

Archaeological resources were found in a few places in very limited density. None carry high significance and are thus referred to as 'ungradeable' resources in this particular study.

The specialist identified that the section of the R44 from Bredell Road to just south of Jamestown is considered to be a significant rural cultural landscape. The cultural landscape is described as follows:

- *The Eerste River Valley rural cultural landscape:* This section of the R44 is located in the wider rural cultural landscape of the Eerste River Valley. The landscape consists of a collection of formally declared Provincial Heritage Sites, protected biosphere areas, sites that are possibly worthy of Grade I and II heritage status, as well as sites of high local significance. The landscape is of considerable heritage value in terms of patterns of historical settlement and cultivation dating to the late 17th century, with scenic route conditions and collections of very significant settlements and significant farmsteads.

- *R44 Scenic Route:* Early maps and survey diagrams indicate that a road along the route of the R44 existed by the 19th century. The route which became the R44 was part of a network of intersecting paths, tracks and routes. From a heritage perspective, the R44 is described as a historic route, with significant gateway conditions into the rural farming areas of the foothills and basin and into Stellenbosch itself. However, the upgrade into a dual carriageway in the 1970s, with related urban road geometric design, has turned it into a highly trafficked mobility route whose rural quality is often compromised along its route. The urban-scaled signalized infrastructure of the Annandale Road Intersection, over-scaled tourist uses and related intrusive signage all contribute to a detraction of the qualities of the rural landscape. The R44 has been identified as a Scenic Route in the Provincial Spatial Development Framework and has been included as an Rural Scenic Drive in the Overlay Zone of the draft Revised Zoning Scheme of the Stellenbosch Municipality. The specialist study thus proposes a grading of Grade III Scenic Drive Heritage Resource.

- *Median openings:* The cultural heritage specialist study identified strong heritage resource indicators in respect of traditional movement routes within the rural cultural landscape. Certain median openings are regarded as an integral historic component of the R44 and wider highly significant cultural landscape, with heritage significance in their own right. The proposed grading for the median openings is IIIC.[3]

5.3 VISUAL

The study area is a predominantly rural area. Farmsteads and agricultural buildings are scattered across the rural landscapes, with numerous conversions to tourist orientated businesses such as farmstalls, restaurants and tourist accommodation.

Situated in the north-western suburbs of Somerset West, the Steynsrust Road Interchange lies within an area that is transitional from a suburban to rural landscape. Residential development is within 100 m of the intersection in the south. Large exotic trees and low grass provide an open parkland adjacent to the intersection through which the road traverses.

The Winery Road Intersection is situated in the rolling, rural landscape on the slopes of the lower foothills of the Helderberg Mountain. The scenic resources of the Winery Road Intersection area can be described as rural, with vineyards, pastures, paddocks, windbreaks, shaded homesteads and tree lined streams on the gently rolling hills backed by the massive mountains providing a scenic and visual resource that is highly sought after.

The R44 / Annandale Road Intersection is also set on the Helderberg foothill slopes surrounded by a busy rural node of tourist facilities. Large trees line the watercourse and provide shade for homesteads, with a plantation of Stone Pine trees covering the slopes of the hills to the north. Strawberry fields dominate the immediate surrounds of the intersection with these being seasonally covered by rows of white plastic, a stark sight and source of glare at certain hours of the day. Large scarecrow like caricatures are scattered through a strawberry field and along the fence leading to the Mooiberge Farmstall, which while colourful and reminiscent of ‘Playground Fairs’ could be construed as visual clutter. Nonetheless, these and the farmstall, provide a remarkable landmark at this intersection.

[3] Grade IIIC indicates the lowest level of local significance in terms of the HWC grading system. The National Heritage Resources Act provides for a three tier grading system of national (Grade 1), provincial (Grade II) and local (Grade III) significance, while the HWC system provides a guideline on dividing Grade III resources according to their level of local significance (Grades IIIA, IIIB and IIIC), with resources of very low significance considered ‘ungradeable’.

5.4 SOCIO-ECONOMIC ENVIRONMENT

This section provides a description of the Somerset West and the Stellenbosch Local Municipality area, inclusive of the smaller settlements of Jamestown and Raithby which are situated roughly along the relevant section of the R44. For comparative purposes as well as due to a lack of data at the town level, data is also provided for the wider sub-region consisting of the City of Cape Town (CoCT) Municipality, which includes Somerset West, and the Cape Winelands District Municipality (CWDM), which includes Stellenbosch.

The 2011 Census estimated the population of the CoCT at 3.74 million in 2011, having grown robustly at an average annual rate of 2.57% since 2001. The population of Somerset West was estimated at 55 166. The population in the Stellenbosch Local Municipality stood at approximately 155 732 with a relatively high annual population growth rate of 2.71 % since 2001 (StatsSA, 2013).

Unemployment in the study area remains a major challenge, as in the rest of the country. Nevertheless, unemployment rates as well as youth unemployment rates are below the provincial and national averages and have fallen since the last Census in 2001. The unemployment rate for Somerset West in 2011 was 9.2 %, significantly lower than that of CoCT at 31.4 %. At 24.4 % in 2011, the unemployment rate of the Stellenbosch Local Municipality was marginally higher than that of the Cape Winelands District (21 %) as well as the provincial (21.6 %), but lower than the national average (29.8 %).

5.5 PLANNING CONTEXT

The following planning documents were considered during the Basic Assessment Process:

- Provincial Spatial Development Framework (2014);
- Western Cape Infrastructure Framework (2013);
- Western Cape Government: Department of Transport and Public Works Strategic Plan (2015/16 – 2019/20);
- City Of Cape Town Scenic Drive Network Management Plan (2003);
- City of Cape Town Integrated Development Plan (2012 – 2017);
- City of Cape Town Spatial Development Framework (2012);
- City of Cape Town Integrated Transport Plan (2013-2018);
- City of Cape Town Environmental Management Framework (2012);
- Cape Winelands District Municipality Integrated Development Plan (2015/16) and Spatial Development Framework (2009/2010);
- Cape Winelands District Municipality Environmental Management Framework (2011);
- Stellenbosch Municipality Integrated Development Plan (2015/16);
- Stellenbosch Municipality Spatial Development Framework (2013);
- Stellenbosch Municipality Comprehensive Integrated Transport Plan (2011); and
- Draft Stellenbosch Municipality Environmental Management Framework (2014); and
- Draft Stellenbosch Revised Zoning Scheme (2012).

6. SUMMARY FINDINGS OF FINAL BAR

The environmental impacts of the proposed project are summarised under the two sections below. First the main findings regarding overall project impacts are discussed. Thereafter the findings regarding the proposed intersection improvements and a comparative assessment of the proposed alternatives for the Winery and Annandale Road Intersections and the U-turn facility in the vicinity of Jamestown are summarized. Summary impact significance tables are presented for each.

6.1 PROJECT SCALE IMPACTS

6.1.1 Economic efficiency of upgrade / cost benefit analysis

The overall economic efficiency of the project was determined by means of conducting a cost benefit analysis (CBA). The result of the cost benefit analysis (which included a grade-separated U-turn facility near Jamestown) was that both the grade-separated roundabouts (Alternative 2) and the below-ground Interchanges (Alternative 4) would be economically efficient. The results for each are as follows:

- Alternative 2: The net present value (NPV) is R 381 m, the BCR is 2.02 and the IRR 18%. This is considered to be economically robust and is the most efficient alternative; and
- Alternative 4: A NPV of R 300 m, a BCR of 1.66 and an IRR of 14%. This alternative is economically efficient but less so than for Alternative 2.

The economic analysis of the three solutions considered for the Jamestown / Webersvallei U-turn movement, concluded that the use of the Webersvallei Road Intersection is the most efficient of the options considered. This conclusion is based on the understanding that the service levels at the Webersvallei traffic lights are acceptable and that no phasing of lights is required to accommodate U-turn movements.

The efficiency of Alternatives 2 and 4 is further improved if the Webersvallei Road U-turn option is included in the overall cost benefit. For Alternative 2, the NPV increases to R 407 m (from R 381 m), the BCR from 2.02 to 2.17, and the IRR from 18% to 20%. For Alternative 4, the NPV increases to R 326 m (from R 300 m), the BCR from 1.66 to 1.76, and the IRR from 14% to 15%.

A sensitivity analysis was performed on a number of assumptions. In most of the ranges tested the sensitivity analysis shows that Alternative 2 is the most efficient. However, when considering the proportion of underground rock, in the highly unlikely case where there is no rock, the BCR for Alternative 4 is slightly higher than for Alternative 2 – thus in this case this would be the most efficient option. I

6.1.2 Economic feasibility of the project alternatives

As indicated above, the economic study determined the BCR of each alternative. A BCR greater than 1 indicates that the completed project would constitute an economic asset; a BCR of less than 1 implies that the project would be an economic liability. Alternative 2 with a BCR of 2.17 is economically efficient and is assessed to have an impact of ***HIGH (Positive)*** significance with and without mitigation. Alternative 4 is also economically efficient with a BCR of 1.76. The impact significance is assessed to be ***MEDIUM to HIGH (Positive)*** with and without mitigation. The summary of anticipated economic feasibility impacts for each alternative is provided in Table 5.

Table 5: Summary of economic feasibility impacts of the project alternatives

	ALTERNATIVE 2		ALTERNATIVE 4	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Economic feasibility of the project alternatives	***High (positive)***	***HIGH (positive)***	***Medium to High (positive)***	***MEDIUM to HIGH (positive)***

6.1.3 Heritage impact: Closing of the R44 median openings

Certain of the median openings along the R44 are considered to be a heritage resource in their own right and to contribute significantly to the R44 as a scenic route.

The potential impact of the closing of the R44 median openings on the quality of the R44 as an identified scenic route and on the surrounding rural cultural landscape is assessed to be of **HIGH** significance with and without mitigation (see Table 6).

Table 6: Summary of the potential impact of closing the R44 median openings on the cultural landscape

IMPACT	WITHOUT MITIGATION	WITH MITIGATION
Closing of the R44 median openings	**High**	**HIGH**

6.2 IMPACTS OF PROPOSED INTERSECTION IMPROVEMENTS

6.2.1 Biophysical and social impacts

The impacts of the proposed intersections alternatives on the affected environment in terms of vegetation, freshwater, groundwater, heritage and visual are described below and summarised in Tables 7 to 10.

At the existing Steynsrust Road Interchange the natural environment is severely modified and only a small area outside the existing road reserve would be affected by the proposed U-turn bridge and ramps. After mitigation the impact on vegetation and freshwater is anticipated to be of **LOW** and **VERY LOW** significance, respectively. The visual impact is considered to be of **LOW** significance after mitigation due to the existing transformed nature of the current Steynsrust Bridge. It is not anticipated that any impacts would be experienced on groundwater and heritage as a result of this project component (see Table 7).

At the Bredell Road Intersection the proposed safety improvements would not extend outside the existing road reserve. It is therefore not anticipated that any impacts would be experienced on vegetation, freshwater, groundwater, heritage or visual features (see Table 7).

Table 7: Comparative summary of potential impacts associated with proposed intersection improvements and alternatives at Steynsrust and Bredell Roads

	STEYNSRUST ROAD	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**
Freshwater	**Low**	**VERY LOW**
Visual	**Low to Medium**	**LOW**
Groundwater	None	
Heritage		
	BREDELL ROAD	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	None	
Freshwater		
Groundwater		
Heritage		
Visual		

At the Winery Road Intersection vegetation, groundwater, heritage and the visual impacts would occur (see Table 8):

- *Grade-separated roundabout alternative*:
  - For the grade-separated roundabout alternative the anticipated impacts on vegetation and groundwater range between **INSIGNIFICANT** and **LOW** with mitigation.
  - Heritage impacts are assessed to be of **VERY LOW** significance after mitigation in terms of archaeological and historical artefacts and as a result of the intrusion of the grade-separated roundabout of **HIGH** significance, with no mitigation considered possible, in terms of changes to the cultural landscape and the R44 scenic drive. The potential cultural heritage impact of the above-ground grade-separated alternative would be greater in visual terms compared to the below-ground alternative. This is due to the visibility of the structures imposed on the landscape, as well as in material terms, in that the concrete structures and the considerable amount of cut and fill would not be in line with the recommendations for a scenic drive.

  Visual impacts are anticipated to range between **LOW to MEDIUM** and **MEDIUM** after mitigation with the most significant impacts that of light pollution, a change in the landscape character and impacts on sensitive receptors in the area.

- *Below-ground interchange alternative :*
  - The below-ground interchange would have an impact on vegetation of **LOW** significance with mitigation.
  - The groundwater impact, which in this case would also include lowering of the water table, would be **INSIGNIFICANT** after mitigation.
  - The heritage impacts in terms of archaeological and historical artefacts are assessed to be of **VERY LOW** significance after mitigation. In terms of changes to the cultural landscape and the R44 scenic drive the impact is assessed to be of **HIGH** significance, with no mitigation considered possible. The cultural heritage specialist study recognised that the below-ground alternative represents a potentially less intrusive option than the above-ground alternative in that it would visually maintain a degree of continuity with the surrounding cultural landscape. Nevertheless, the study sees the below-ground alternative as still representing a fundamental intrusion onto the established historic pattern which underpins the heritage significance of the wider rural cultural landscape.
  - The visual impacts range from **VERY LOW to LOW** with mitigation due to Winery Road being located below the R44 for this alternative.

Table 8: Comparative summary of potential impacts associated with proposed grade-separated alternatives at Winery Road

WINERY ROAD				
ALTERNATIVES	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**	**Low**	**LOW**
Freshwater	None		None	
Groundwater				
Damage to or loss of existing boreholes	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Blasting	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Lowering of water table	**N/A**	**N/A**	**Insignificant**	**INSIGNIFICANT**
Heritage				
Archaeological and historical artefacts	**Very low**	**VERY LOW**	**Very low**	**VERY LOW**
Cultural landscape	**High**	**HIGH**	**High**	**HIGH**
Visual				
Change in landscape character	**High**	**MEDIUM**	**Low**	**LOW**
Light Pollution	**Medium - High**	**MEDIUM**	**Low**	**VERY LOW**
Visibility from sensitive receptors	**High**	**MEDIUM**	**Low**	**LOW**
Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route	**Medium**	**LOW - MEDIUM**	**Low - Medium**	**LOW**

At the **Annandale Road Intersection** impacts are anticipated on vegetation, freshwater, groundwater, heritage and the visual environment (see Table 9):

- *Grade-separated roundabout alternative:*
  - Anticipated impacts on vegetation, freshwater and groundwater for the *grade-separated roundabout alternative* range between **INSIGNIFICANT** and **VERY LOW to LOW** with mitigation.
  - Heritage impacts in terms of archaeological and historical artefacts are assessed to be **VERY LOW** after mitigation; **MEDIUM to HIGH** after mitigation in terms of the built environment as a result of the loss of the labourer's cottage in the north-eastern quadrant; and as a result of intrusion of the grade-separated roundabout of **HIGH** significance, with no mitigation considered possible, in terms of changes to the cultural landscape and the R44 scenic drive. As is the case

for Winery Road, the potential cultural heritage impact of the above-ground grade-separated alternative would be greater in visual terms compared to the below-ground alternative.

- Visual impacts are anticipated to range between **LOW** and **MEDIUM** after mitigation with the most significant impacts relating to the loss of a visual resource (the labourer's cottage) and the loss of views due to the presence of the structure in close proximity to a residence.

- *Below-ground interchange alternative :*
  - The anticipated impacts of the *below-ground interchange* on vegetation, freshwater and groundwater all range from **INSIGNIFICANT** to **LOW** with mitigation.
  - Heritage impacts have been assessed to have the same impact significance as for the grade-separated roundabout, namely **VERY LOW** after mitigation for archaeological and historical artefacts; **MEDIUM** to **HIGH** after mitigation for the built environment as a result of the loss of the labourer's cottage in the north-eastern quadrant; and **HIGH** significance, with no mitigation considered possible, for the cultural landscape and the R44 scenic drive as a result of the intrusion of the below-ground interchange onto the established historic pattern. The below-ground interchange alternative does represent a potentially less intrusive option to that of the grade-separated roundabout alternative.
  - The visual impacts are mostly of **LOW** significance, with the exception of the loss of visual resources which is assessed to have the same impact as for the *grade-separated roundabout*, namely **LOW to MEDIUM** with mitigation.

Table 9: Comparative summary of potential impacts associated with proposed grade-separated alternatives at Annandale Road

ANNANDALE ROAD				
ALTERNATIVES	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**	**Low**	**LOW**
Freshwater	**Low**	**VERY LOW – LOW**	**Low**	**VERY LOW - LOW**
Groundwater				
Damage to or loss of existing boreholes	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Blasting	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Lowering of water table	**N/A**	**N/A**	**Insignificant**	**INSIGNIFICANT**
Heritage				
Archaeological and historical artefacts	**Medium**	**VERY LOW**	**Medium**	**VERY LOW**
Built environment	**High**	**MEDIUM – HIGH**	**High**	**MEDIUM – HIGH**
Cultural landscape	**High**	**HIGH**	**High**	**HIGH**
Visual				
Change in landscape character	**Medium**	**LOW - MEDIUM**	**Low**	**LOW**
Light Pollution	No change	No change	No change	No change
Loss of visual resource	**Medium**	**MEDIUM**	**Low - Medium**	**LOW - MEDIUM**
Loss of view	**Medium**	**MEDIUM**	N/A	N/A
Visibility from sensitive receptors	**Medium**	**LOW – MEDIUM**	**Low**	**LOW**
Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route	**Low - Medium**	**LOW**	**Low - Medium**	**LOW**

At the Jamestown Cemetery/Webersvallei Road U-turn options impacts are anticipated on vegetation, freshwater, heritage and the visual environment (see Table 10).

- For the *U-turn bridge alternative* the impacts on vegetation and freshwater were assessed to be **LOW** and **VERY LOW** after mitigation, respectively. The impact on archaeology was also assessed as being **VERY LOW**. Due to the semi urban nature and visual nature of the bridge, the impact on

cultural heritage and visual change in character were assessed to be of **MEDIUM** significance with mitigation. The impact on visible receptors was assessed to be **LOW.**

- The *at-grade teardrop facility* would result in an impact of **MEDIUM** significance on freshwater due to the impact on the nearby wetland. The impact on vegetation, heritage and the visual environment would with mitigation range from **VERY LOW** to **LOW to MEDIUM.**
- At the *Webersvallei Road Intersection* the only impact would be on freshwater with a significance of **VERY LOW**. All other issues would remain the same.

Table 10: Comparative summary of potential impacts associated with proposed U-turn facilities near Jamestown Cemetery and Webersvallei Road.

JAMESTOWN CEMETERY / WEBERSVALLEI ROAD INTERSECTION						
ALTERNATIVES	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP FACILITY**		**SIGNALISED INTERSECTION**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**	**Low**	**LOW**	N/A	
Freshwater	**Very Low**	**VERY LOW**	**Medium**	**MEDIUM**	**Very Low**	**VERY LOW**
Heritage						
Archaeological impacts	**Very Low**	**VERY LOW**	**Very Low**	**VERY LOW**	N/A	N/A
Cultural heritage impacts	**Medium-High**	**MEDIUM**	**Low-Medium**	**LOW - MEDIUM**	N/A	N/A
Visual						
Change in landscape character	**Medium - High**	**MEDIUM**	**Low - Medium**	**LOW**	N/A	N/A
Visibility from sensitive receptors	**Medium**	**LOW**	**Low - Medium**	**LOW**	N/A	N/A

In the case of improvements to the existing signalised intersections, they would remain largely within the existing road reserve, thus there would be no impact of any significance on vegetation, groundwater, heritage or visual aspects. At the Techno Road Intersection the potential freshwater impact on a local tributary is assessed to be **INSIGNIFICANT**.

6.2.2 Local economic impacts

Impacts assessed by the economic specialist include negative localised impacts associated with land loss, impacts on commercial operations associated with access and visual changes and impacts on local property values, which are summarised below and presented in Tables 11 and 12.

Land loss associated with the *below-ground interchanges* would in both cases be higher than for the *grade-separated roundabouts* at Winery and Annandale Road Intersections. The economic specialist report indicated that despite the relatively slight differences between the two, the impacts associated with land loss would be of **LOW TO MEDIUM** significance with mitigation for both alternatives.

At the Jamestown Cemetery location, the impact on land loss for both the raised *U-turn bridge and at-grade U-turn teardrop facility* is assessed to be of **VERY LOW to LOW** significance with mitigation. There would be no impact on private landowners at Webersvallei Road Intersection.

Impacts on commercial operations associated with access changes are divided into impacts on commercial operations at the intersections and commercial operations along the R44 without direct access to the intersections since these operations would be affected differently by the proposed access changes and travel distances. Commercial operations at the intersections would experience a **LOW to MEDIUM** significance impact after mitigation due to the implementation of either the *grade-separated roundabouts* or *below-ground interchanges.* For operations along the R44 with no direct access to the intersections, it is anticipated that the *grade-separated roundabouts* and below-ground interchanges would have a **LOW** significance impact after mitigation.

Either *U-turn facility near Jamestown* would provide an additional more convenient U-turn option. Using the *Webersvallei Road Intersection* would result in somewhat longer trips for those between Annandale Road and Jamestown Cemetery.

Impacts on commercial operations associated with visual changes are anticipated to be the same for those operations at the intersections and those along the R44 without direct access to the intersections. *Grade-separated roundabouts* are anticipated to have a **MEDIUM** significance impact on these operations after mitigation while the impact of the *below-ground interchanges* is anticipated to be of **VERY LOW to LOW** significance after mitigation.

As no businesses that rely on specific customer experience were identified at the proposed Steynsrust and Jamestown bridges no significant impacts in relation to these structures are anticipated.

Key aspects affecting impacts on overall tourism potential with the greatest relevance when considering potential to result in changed tourist behaviour with respect to the wider area include:

- Changes in the character of the areas near the intersections; and
- Impacts on the views of users of the R44 as a result of the proposed interchanges.

For the *grade-separated roundabouts alternative* it is anticipated that the overall impact on tourism potential would be **LOW to MEDIUM** with mitigation. This is due to the nature of the structures involved and also the visual sensitivity at these intersections which was rated as moderate in both cases due to lower lying topography and other factors. Given their low visual impacts, the *below-ground interchanges* would have limited impacts when viewed from a wider tourism impact perspective. The economic specialist study thus concluded that the impacts of these alternatives on tourism are likely to be **VERY LOW**.

For the *U-turn bridge near Jamestown Cemetery* the impacts on overall tourism potential is assessed to be of **LOW TO MEDIUM** significance after mitigation. The *at-grade and Webersvallei Road options* are not expected to result in any impact on tourism.

Table 11: Summary of potential economic impacts associated with the proposed project: Comparison of grade-separated roundabout and below-ground interchange alternatives

ALTERNATIVE	GRADE-SEPARATED ROUNDABOUT		BELOW-GROUND INTERCHANGE	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Impacts associated with land loss	**Medium**	**LOW - MEDIUM**	**Medium**	**LOW - MEDIUM**
Impacts on commercial operations associated with access change				
Impacts on commercial operations at the intersections	**Low - medium**	**LOW - MEDIUM**	**Low - medium**	**LOW - MEDIUM**
Impacts on commercial operations along the R44 without direct access to the intersections	**Low**	**LOW**	**Low**	**LOW**
Impacts on commercial operations associated with visual changes	**Medium**	**MEDIUM**	**Low**	**VERY LOW - LOW**
Impacts on overall tourism potential	**Medium**	**LOW - MEDIUM**	**Low**	**VERY LOW**
Impacts on local property values				
Impacts on property values at the intersections	**Medium**	**LOW - MEDIUM**	**Low - medium**	**LOW**
Impacts on property values along the R44 without direct access to the intersections	**Low**	**LOW**	**Low**	**LOW**

Impacts on local property values have also been divided into those properties at the intersections and those properties along the R44. For the properties at the intersections it is anticipated that the *grade-separated roundabouts* would have a **LOW to MEDIUM** significance impact after mitigation while the *below-ground interchange*s would have a **LOW** significance impact with mitigation. For properties along the R44, both grade-separated alternatives would have a **LOW** significance impact after mitigation.

For the *U-turn bridge near Jamestown Cemetery* the impact on property values is assessed to be of **LOW TO MEDIUM** significance after mitigation. The *at-grade and Webersvallei Road options* are not expected to result in any impact on property values.

Table 12: Summary of potential economic impacts associated with the proposed project: Comparison of proposed U-turn facilities near Jamestown Cemetery and Webersvallei Road

JAMESTOWN CEMETERY / WEBERSVALLEI ROAD INTERSECTION						
ALTERNATIVES	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP FACILITY**		**SIGNALISED INTERSECTION**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Impacts associated with land loss	**Low**	**VERY LOW - LOW**	**Low**	**VERY LOW - LOW**	N/A	
Impacts on overall tourism potential	**Medium**	**LOW - MEDIUM**	N/A		N/A	
Impacts on local property values						
Impacts on property values at the intersections	**Medium**	**LOW - MEDIUM**	N/A		N/A	
Impacts on property values along the R44 especially between Annandale Road and the Jamestown Cemetery	**Low**	**VERY LOW - LOW**	N/A		N/A	

6.3 SHORT-TERM CONSTRUCTION-PHASE IMPACTS

Impacts anticipated to occur during the construction phase relate to short-term job creation and procurement which is considered to have an overall ***LOW (POSITIVE)*** impact with mitigation and construction disturbances such as dust, noise, visual and travel inconvenience or travel delays are considered to have an overall **VERY LOW** significance after mitigation (see Table 13).

Table 13: Summary of potential short term construction related impacts associated with the proposed project

IMPACT	WITHOUT MITIGATION	WITH MITIGATION
Jobs and procurement	***Very Low (positive)***	***LOW (POSITIVE)***
Dust, noise, visual, travel inconvenience / travel delays	**Low**	**VERY LOW**

7. CONCLUSIONS

Key conclusions of the assessment findings are provided below:

7.1 Perhaps the major dilemma/conflict that confronts this proposed project is what can be considered as the dual function of the R44. The DTPW (and most likely many users) see the R44 as a strategic mobility route that provides both a commuter link between Somerset West and Stellenbosch and a major regional provincial road link between the N1 and N2. Another group which consists of people that live along the R44 and various Stellenbosch interest groups see the R44 in the context as a local road with local functions servicing the agricultural and tourism sectors. Thus the needs of both user functions have to be considered in moving forward with the proposed safety and LOS improvements along the R44.

7.2 The R44 has formed an integral part of the provincial road network for many decades. Thus the function of the R44 as a strategic mobility route must be acknowledged within this context. The original R44, a single lane undivided rural road, was replaced with the road in its current form in the 1970s to provide a regional link between Somerset West and Stellenbosch and as part of the larger provincial route between Kleinmond and Malmesbury (via Wellington). Thus the status of the R44 as a strategic mobility route within the broader context of the provincial road network is a fact that preceded the initiation of this proposed project.

Many of the approximately 30 000 vehicles travelling daily along the R44 between Somerset West and Stellenbosch include daily commuters between the two towns for purposes of work or study, including staff and students from the University of Stellenbosch. They need to move from one point to another as efficiently as possible. With further economic development that is supported in all future planning documents for Somerset West and Stellenbosch, it is expected that traffic volumes on the R44 would increase (regardless of what level of growth is assumed). Even with a range of measures that could be put in place to initiate a reduction in traffic volumes on the R44, empirical evidence from South African cities and most big cities around the world would suggest that even if traffic growth is slowed by implementing such measures, actual traffic volumes are most likely to continue growing. This underlines the requirement to retain the mobility function of the R44.

7.3 The R44 fulfills a range of local functions such as providing access to farms, other businesses and tourism related activities. Agriculture is a key activity on either side of the R44 itself generating slower moving farm traffic along the route. Numerous farms have also converted to or added tourist-orientated businesses to their core agricultural activities, such as farm stalls, restaurants and tourist accommodation. Cyclists and pedestrians also use sections of the route on a regular basis for commuting and sport.

The R44 is regarded as a historic cultural heritage route with significant gateway conditions into the rural farming areas of the mountain foothills and the Eerste River basin and into Stellenbosch itself. The heritage study regards the R44 as a Grade III Scenic Drive Heritage Resource in the light of its designation as a Scenic Route in the Provincial Spatial Development Framework and its inclusion as an Rural Scenic Drive in the Overlay Zone of the draft Revised Zoning Scheme of the Stellenbosch Municipality. The heritage study argues that the proposed solution is not appropriate from a cultural heritage perspective and should not be considered further.

7.4 The closure of the median openings would result in a significant improvement to safety for all road users (including the local community, commuters and tourists). However, such closure would result in dis-benefits to landowners / commercial operations located between the intersections in terms of additional travel distance and possible effect on businesses. The closure of the median openings would also have a negative impact on the cultural landscape. Seen from a longer-term perspective the proposed closure of the median openings would be less of a dis-benefit in relation to the implications of vastly deteriorating safety if the median openings were to remain open as traffic volumes increase.

7.5 The traffic analysis undertaken to evaluate *various at-grade U-turn solutions* showed that none of the solutions would be viable as they would reach operating capacity limits immediately or very shortly thereafter. Thus DTPW would not be able to justify providing a solution that would immediately be at capacity or could in fact reduce the existing LOS. In the context of the at-grade options, it should be pointed out that the cultural heritage study assessed the impact significance of at-grade roundabouts and a new signalised intersection as being of **HIGH** and **MEDIUM** significance, respectively.

7.6 The economic cost benefit analysis which considered a *grade-separated solution for the U-turn movement* has shown that both Alternative 2 (above-ground grade-separated roundabouts) and Alternative 4 (below-ground diamond interchanges) would be economically efficient. Assuming the use of the existing Webersvallei Road Intersection for U-turn movements at the northern end of the project, Alternative 2 is economically robust with an NPV of R 407 m and BCR of 2.17.

Alternative 4 is less efficient with a NPV of R 326 m and BCR of 1.76. The difference in costs (NPV at 2013 prices) between the two alternatives is R 81 million (Alternative 2 having the higher NPV). Thus both alternatives are considered to be economically feasible with Alternative 2 being assessed as high positive significance and Alternative 4 as medium to high positive significance. However, the risk associated with Alternative 4 is the unknown below-ground conditions and extent of rock that may exist.

7.7 It should be noted that the operational efficiency of the below-ground diamond interchange would be lower than that of the above-ground grade-separated roundabout, meaning that the U-turn movements would take longer. A diamond interchange would also have more conflicting movements than a roundabout interchange (which has a left-turn only approach and departure and hence has fewer conflicting movements). Roundabout interchanges are thus more efficient in processing U-turn manoeuvres for which the project caters. However, both are considered to be technically suitable.

7.8 In addition to the economic analysis findings, consideration is also given to the impacts of the grade-separated roundabouts and below-ground interchanges on the *biophysical and socio-economic environments* at Winery and Annandale Road Intersections. The biophysical impacts of both alternatives are assessed to be of insignificant to low significance for both intersections and are not considered to be factors that should affect decision-making of the proposed project.

The assessment of the *visual impact*, a key issue raised strongly by the local community, shows that the below-ground interchanges would substantially reduce the impact significance at these intersections compared to the above-ground grade-separated roundabouts. The below-ground interchange alternative would also address many of the concerns related to the impacts on tourism along the R44. The *local economic impacts* for the below-ground interchanges would be the same or lower in comparison to the grade-separated roundabouts. *Effects on landowners* would include land loss, impacts on commercial operations due to access and visual changes and property values. The impact on these operations is considered to be of low to medium significance. However, the size of these farming operations is such that the land loss associated with either alternative would not result in any substantial effect on the overall farming operations.

The *cultural heritage impact* is another key issue raised by I&APs which has been assessed to be of high significance for both the above- and below-ground alternatives at both locations. While it is recognised that a degree of visual continuity would be achieved with the below-ground option, this alternative is still considered to represent a fundamental intrusion onto the underlying historic pattern of both the R44 as a scenic route and the broader rural cultural landscape.

7.9 The HIA has assessed all alternatives that have been considered in this assessment including the closure of the median openings, as having a highly significant impact on the cultural heritage of the area through which the R44 passes. From a cultural heritage perspective the heritage specialist study concludes that the project in its current form and all alternatives that have been considered should not be developed.

This, however, has to be put in context – the R44 as a dual carriageway has existed since the 1970s. When the four-lane dual carriageway replaced the existing single lane road, this could be regarded as when the major change to the cultural landscape actually occurred. The safety and LOS improvements that are now being proposed would largely take place within the confines of the existing road reserve (except at the two interchanges) and should be considered in this context.

The proposed project scheme is based on the premise that the safety issue can only be addressed by closing the median openings as DTPW has proposed. Thus, although recognising the cultural heritage value of these openings, their closure is the key component of the project rationale. Should the medians openings not be closed, the safety concerns associated with vehicles using the openings would continue – with the safety risk expected to increase in the future in line with anticipated traffic growth.

7.10. With regards to which grade-separated alternative to implement at Winery and Annandale Road intersections, a decision would have to weigh up the substantially more economically and operationally efficient above-ground grade-separated roundabout with its associated visual, cultural heritage and tourism impacts versus a more costly, higher risk and less efficient below-ground interchange that would mostly address the strong visual concerns raised by the local community.

7.11 The economic analysis of the three solutions considered for the Jamestown Cemetery / Webersvallei U-turn movement, concluded that the Webersvallei Road Intersection would be the most efficient. The assessment of the biophysical and socio-economic impacts resulting from the three alternatives similarly shows that the Webersvallei Road Intersection would have significantly lower impacts than the Jamestown Cemetery options, specifically much lower than the grade-separated U-turn bridge. Thus the Webersvallei Road Intersection is recommended for implementation.

7.12 The No-go option of leaving the R44 as it is currently is not considered as an option. The high accident rate and LOS issues need to be addressed as has been motivated by this project and requested by the community. In the No-go scenario the accident rate will further increase as the level of service further deteriorates. The interventions needed for these improvements would clearly result in changes to the local environment, businesses and travel patterns. However, the benefits to society as a whole are considered to outweigh the negative implications of the proposed project that would occur in the short term.

The positive implications of not going ahead with the project are that the status quo in terms of historic features at the Winery and Annandale Road intersections, local road use and access, would remain unchanged. No negative visual impact on the landscape or change to the quality of the R44 as a scenic route or to the surrounding cultural landscape would occur.

7.13 It should be noted that DTPW's preferred alternative is the proposed project scheme that includes the above-ground grade-separated roundabouts at Winery and Annandale Roads and accommodating U-turn movements at the Webersvallei Road Intersection.

8. RECOMMENDATIONS FOR MITIGATION

The recommended mitigation measures that should be undertaken, if a positive Environmental Authorisation is issued by DEA&DP, are summarised below:

Natural vegetation:

- Rehabilitate the road reserve and road islands using endemic shrub species (rather than replacing vegetation with hard-wood species);
- Replace vegetation removed from the hedge and tree line at the Winery Road and Annandale Road Intersections with similar sized indigenous vegetation / trees, to retain the screening function currently provided; and
- Where possible, relocate, transplant or replace the wild olive trees.

Freshwater:

- New structures should not constrict the flow in the watercourse channels but should aim to improve storm water management as far as possible;
- Control invasive alien vegetation within the road reserve;
- Rehabilitate disturbed areas within the freshwater features after construction;
- For the proposed U-turn facility near Jamestown Cemetery: The structure should avoid or minimise any impact on freshwater features and avoid affecting the flow of watercourse channels; and
- Overflow from the upstream dam flows along the Techno Road and into the stormwater drains which results in erosion of the road edges. It is recommended that this informal stream be accommodated within the upgrade activities.

Groundwater:

- Prior to construction, replace the boreholes that would be destroyed so as to provide a continuous supply of the same volume of water to the affected groundwater users;
- Monitor the high risk boreholes so that any impacts to borehole performance due to any blasting can be quantified; and
- Use a retaining wall rather than a fill slope to reduce the risk of loss of any boreholes where possible or feasible (potentially boreholes DW1 and MB1 at the Annandale Road Intersection).

Heritage:

- Ensure that the project footprint is kept to a minimum;
- Undertake archaeological test excavations to look for historical dumps and/or earlier foundations near the labourer's cottage at the Annandale Road Intersection;
- Undertake plaster sampling and a detailed recording of the above-ground characteristics and features of the labourer's cottage; and
- For the proposed U-turn bridge near Jamestown Cemetery:
  - Plant appropriate trees around the retaining walls to screen the structure;
  - Use columns were feasible to reduce the length of walling; and
  - Use surface textures and colours on the concrete that are sympathetic to the landscape.

Visual:

- For the proposed U-turn facility at Steynsrust Road:
  - Limit the extent of disturbance;
  - Appoint a Landscape Architect to develop the landscape philosophy, provide detail drawings and specifications for the tender documentation and to monitor implementation;
  - Consult with the City of Cape Town's Spatial Planning and Urban Design Department to obtain input into the proposed landscape plans prior to construction; and
  - Rehabilitate and revegetate disturbed areas with appropriate vegetation after construction;
- Use 'low spill' light which directs light downward;
- Cover associated infrastructure such as electrical kiosks with rural type coverings or where feasible, bury them;
- Reduce the extent of the cut/fill slopes by the use of retaining walls, especially in the north-western quadrant of the Annandale Road Intersection;
- Provide a planted berm adjacent to the new access road on the Klein Akkerdraai property to serve as a visual and noise screen;
- Plant vegetation on the fill slopes / embankments or in front of the vertical retaining walls to screen the interchange from sensitive receptors;
- Landscape cut embankments and disturbed areas in appropriate ways to blend with the rural nature of the surrounds;
- For the below-ground interchange alternative: Use exposed aggregate finish to provide a more natural aesthetic;
- Screen the lights at the intersections from the surrounding landscape through tree planting of a rural nature, where possible; and
- For the proposed U-turn bridge near Jamestown Cemetery:
  - Use exposed aggregate finish on ramp retaining walls to provide a more natural aesthetic;
  - Appoint an arborist to manage root and crown pruning of trees;
  - Replant trees and plant new trees to screen the elevated structure from the surrounding landscape.

Economic:

- Put measures in place to minimise traffic disruption during construction;
- Ensure that land loss is kept to minimum;
- Ensure market-related compensation for land and any improvements / structures that need to be removed and rebuilt by means of following the prescribed statutory process for acquisition of land;
- Include compensation for any movement or re-orientation of operations;
- Ensure construction activities take the needs of landowners into account;

- Establish a landowner liaison committee including all affected landowners and senior representatives of the applicant, engineers and contractor all with appropriate decision-making power. This committee should meet regularly to discuss and deal with any challenges that arise during construction;
- Ensure that a complaints register is available and that landowners are aware of it and can make inputs if needed;
- Ensure that adequate alternative temporary access is provided during construction and that the timing of construction takes into account the needs of landowners to the greatest degree possible (e.g. avoid busy times of year); and
- Provide clear and adequate signage to indicate changes in access.

Construction:

- Tender documents should include a detailed Construction EMP which covers all relevant biophysical concerns and recommended mitigation measures to ensure that sufficient project budget is allocated for its implementation; and
- Appropriate targets for local labour, including training, and local affirmative business enterprises should be included in the tender documentation in line with standard public sector procurement policy.

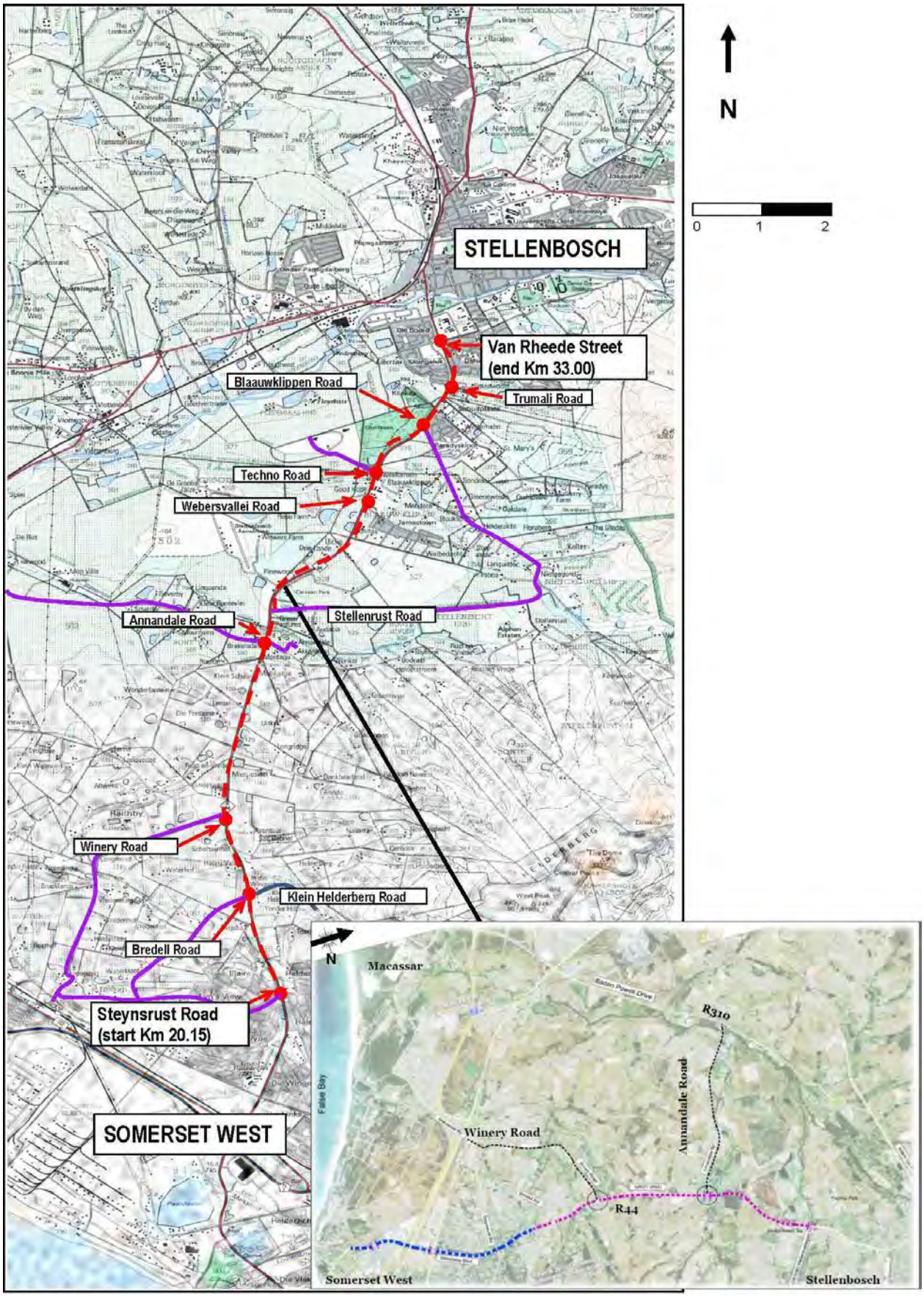

Figure 1: Map showing the position and extent of the proposed road improvements

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BID:	Background Information Document
CCA:	CCA Environmental (Pty) Ltd
BAR:	Basic Assessment Report
CBA:	Critical Biodiversity Area
DEA&DP:	Department of Environmental Affairs and Development Planning
DTPW:	Department of Transport and Public Works (Western Cape Government)
DWS:	Department of Water and Sanitation
EAP:	Environmental Assessment Practitioner
EIA:	Environmental Impact Assessment
EMP:	Environmental Management Programme
FEPA:	Freshwater Ecosystem Priority Areas
GN:	Government Notice
HWC:	Heritage Western Cape
I&APs:	Interested and Affected Parties
MMP	Maintenance Management Plan
NEMA:	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NHRA:	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA:	National Water Act, 1998 (Act No. 36 of 1998)
NID:	Notice of Intent to Develop

1. INTRODUCTION

This chapter provides background and a brief history to the proposed project, describes the purpose of this report, describes the need and desirability for the proposed project, presents the Terms of Reference for this study, identifies the assumptions and limitations, explains the report structure and describes the opportunity for comment.

The Final BAR was made available for public review and comment from 12 December 2016 to 30 January 2017. All comments received on the Final BAR were collated and responded to in two Comments and Responses Reports, which together with the Final BAR were submitted to the Department of Environmental Affairs and Development Planning (DEA&DP) on 31 May 2017 for consideration.

On 14 July 2017, the DEA&DP informed the applicant, the Department of Transport and Public Works (DTPW), that the Final BAR had been rejected and would have to be amended in order to be accepted (a copy of the letter is provided in Appendix H1). The specific requests made by DEA&DP have subsequently been addressed and the Final BAR has been updated into this Revised Final BAR to include the required additional information (see Sections 1.1; 2.1.2; and 2.1.3 for detail regarding the additional information).

It should be noted that all significant changes to the Final BAR are underlined and in a different font (Times New Roman) in this Revised Final BAR.

This Revised Final BAR has been made available for a 21-day public and authority review and comment period from **23 November to 14 December 2017** (see Section 1.7). The Revised Final BAR, together with all comments received by the conclusion of the comment period, will be submitted to DEA&DP as part of the application procedure. Once DEA&DP has reached a decision, all Interested and Affected Parties (I&APs) registered on the project database will be notified of the outcome of the application and the reasons for the decision. A statutory Appeal Period will follow the issuing of the decision.

1.1 BACKGROUND AND BRIEF PROJECT HISTORY

DTPW has identified the need to address safety issues and Level of Service (LOS) improvements along the R44 (Main Road 27) between Somerset West and Stellenbosch. The overarching safety issue is due to the large number of median openings and the traffic movements associated with these openings. Additionally, with the substantial increase in traffic volumes over the last few years, the LOS has also reduced and is no longer effectively catering for the substantial volumes of traffic that use the R44 daily.

In 2011, DTPW appointed Kantey and Templer Consulting Engineers (Pty) Ltd (K&T) to investigate the safety and LOS issues on the R44 and to undertake design of an overarching R44 improvement project. K&T presented a conceptual planning report to DTPW in mid-2012, which served as a basis for introducing the project into the public domain. CCA Environmental (Pty) Ltd (CCA) was appointed as the independent environmental assessment practitioner to undertake a Basic Assessment (BA) process in order to ensure compliance with the Environmental Impact Assessment (EIA) Regulations, 2010, promulgated in terms of Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA].[1]

[1] The NEMA EIA Regulations 2014, which came into effect on 8 December 2014, have subsequently replaced the EIA Regulations 2010. However, applications submitted in terms of the previous regulations and which were ending when the EIA Regulations 2014 took effect, must be dispensed with in terms of the EIA Regulations 2010. Refer to Section 2.1.1 for more details regarding the transitional arrangements stipulated in the EIA Regulations 2014.

The project study area extends from Steynsrust Road (km 20.15) in Somerset West to Van Rheede Street (km 33.00) in Stellenbosch, a total distance of 12.85 km (see Figures 1.1 and 1.2).

The public participation phase of this project commenced in September 2012 when DTPW issued a press release announcing the proposed improvements to the R44 between Somerset West and Stellenbosch.

The BA process commenced with the distribution of a Background Information Document (BID) as part of an initial notification and registration period from 1 February to 22 March 2013. The BID described the project scope which at that stage included the following:

- Consolidation of minor roadways and closure of median openings along the R44;
- Improvements of sections of road along the R44 including intersections of the R44 with Steynsrust Road, Bredell Road, and Techno Road; and
- Introduction of U-turn opportunities which would be facilitated by the introduction of grade-separated roundabouts – one located at the Winery Road / R44 intersection and the other at the Annandale Road / R44 intersection.

Substantial public response was subsequently received strongly opposing the proposed concept of grade-separated roundabouts. Thus to address these concerns the project engineers also identified alternative means of facilitating U-turn movements in addition to the grade-separated roundabouts. These included signalised intersections and at-grade two-lane roundabouts / traffic circles. Three alternatives were subsequently assessed and compared for both the Winery Road and Annandale Road Intersections, i.e. grade-separated roundabouts, at-grade roundabouts and signalised intersections. The BA study process and its conclusions and recommendations were presented in the Draft Basic Assessment Report (BAR), which was released for public review and comment in April 2014.

The public reaction following the release of the Draft BAR showed continued support to urgently address the existing safety issues on the R44 and that the median openings should be closed. However, many concerns and objections were again raised in relation to the findings of the Draft BAR which, based on the economic specialist input, concluded that grade-separated roundabouts were recommended.

The potential visual impact of the roundabouts remained one of the main reasons for the public opposition. The cost implications of this alternative compared to the other alternatives were also questioned as it is perceived to be an unnecessary expense. A further concern raised was that the roundabouts were investigated in isolation from the system-wide traffic flows as the impact on the local traffic system on each end of the R44 corridor had not been fully analysed. This highlighted the statement in the Draft BAR that time gained due to improved traffic flow along the R44 could be reduced or nullified as the traffic builds up at the signalised intersections entering Stellenbosch as well as on the urban road network in Somerset West.

In taking cognisance of the strong opposition to the proposed grade-separated roundabouts and submissions received from I&APs, the project engineers were tasked to look at other possible solutions to address the project needs. This led to the identification of further conceptual design alternatives, which included *inter alia* a dedicated U-turn bridge at the existing Steynsrust Road Interchange to avoid increased loading of the street network in this area, and the provision of three at-grade roundabouts along the route, namely at Bredell, Winery and Annandale Roads as well as a dedicated at-grade U-turn facility near the Jamestown Cemetery. In order to test the viability of these additional conceptual alternatives (in terms of overall performance in relation to system-wide traffic flows) a detailed traffic

operational analysis was commissioned[2]. This served as a basis to develop and assess a revised project scheme and alternatives. These additional alternatives and the findings of the additional traffic analysis are described in detail in Chapter 3.

The findings of the traffic analysis determined that an at-grade scheme would not be viable as signalized intersections and at-grade roundabouts would reach capacity limits very shortly after their implementation. Other design options therefore had to be considered to address the visual, heritage and tourism concerns raised regarding the above-ground grade-separated roundabouts. Thus, the option of placing Winery and Annandale Roads below the R44 in the form of below-ground interchanges is now also being considered.

The revised scope of the proposed project and alternatives thus includes the following:

- Closing all median openings along the R44;
- Providing a grade-separated U-turn facility at Steynsrust Bridge;
- Providing a left in/left out access to Bredell Road;
- Providing grade-separated turning facilities at Winery Road and Annandale Road. Two alternatives are being considered for each of these intersections, namely:
  - Grade-separated roundabout interchange above ground; and
  - Grade-separated diamond interchange, below ground;
- Providing a turning facility in the vicinity of Jamestown. Three alternatives are being considered for this purpose, namely:
  - Grade-separated U-turn bridge at Jamestown Cemetery;
  - At-grade teardrop turning facility at Jamestown Cemetery; and
  - Accommodating U-turn movements at the Webersvallei Road signalised intersection;
- Improving at-grade signalised intersections within the Stellenbosch Municipal area between Webersvallei Road and the end of the project at Van Rheede Street. This would entail road widening to provide turning lanes and three through lanes in each direction at the following five intersections:
  - Webersvallei Road (km 29.6);
  - Techno Road (km 30.3);
  - Blaauwklippen Road (km 31.2);
  - Trumali Street (km 32.0); and
  - Van Rheede Street (km 32.9).
- Additional safety measures:
  - Implementing average speed over distance (ASOD) control; and
  - Accommodating pedestrian and cycling crossing facilities in the interchange design.

Specialist studies were subsequently updated in order to consider the implications of the additional below-ground alternatives and other changes to the proposed project scope. The updated proposed project, specialist studies and impact assessment were included into the Revised Draft BAR, which was released for public review and comment in March 2016.

A review of the Heritage Impact Assessment and compilation of an additional report was undertaken following the closure of the comment period. The Revised Draft BAR was subsequently updated into the Final BAR, which was released for a further public review and comment period in December 2016. All comments received on the Final BAR were collated and responded to in two Comments and Responses Reports, which together with the Final BAR were submitted to DEA&DP on 31 May 2017 for consideration.

[2] ITS Operational analysis of the upgrade alternatives proposed for the R44 between Somerset West and Stellenbosch, 2015. A copy of the study is appended to this report in Appendix E8.

On 14 July 2017, DEA&DP informed DTPW that the Final BAR had been rejected and would have to include certain additional information to be accepted (see Appendix H1). Detail regarding the required amendments, the approach followed in response, and the inclusion of relevant information in the Revised Final BAR is provided in Table 1.1 below.

Table 1.1: Amendments incorporated into the Revised Final BAR in response to DEA&DP's requests

Item no.	DEA&DP's request	Actions taken in response	Inclusion in Revised Final BAR.
3.1	Addressing concerns raised by HWC: DEA&DP noted that " … the final comment from HWC dated 17 February 2017 has not been adequately addressed. As such, concerns raised by HWC must be addressed prior to the submission of the Revised Final BAR".	In order to further investigate HWC's concerns, a meeting was held on 17 October 2017 at which HWC, DTPW, its project team and DEA&DP were present. It was concluded that DTPW would provide a response to these concerns in a letter addressed to HWC, for further consideration by the Impact Assessment Committee. This letter has been submitted to HWC for consideration and decision-making.	Sections 1.1 and 2.1.2; and Appendix H3.
3.2	Water Use Authorisation: DEA&DP noted that " …a Water Use Licence Application ("WULA") is required in terms of the National Water Act, 1998 (Act No. 36 of 1998). Please be advised that proof of submission of such an application to the DWS along with the WULA assessment information must be provided to this Department for decision-making".	It should be noted that a Water Use Licence is not required for this proposed project as General Authorisation for the specific water uses would be applicable. An application for the registration of water uses in terms of the General Authorisation for Section 21(c) and (i) water uses in terms of the National Water Act, 1998 has been submitted to the Department of Water and Sanitation.	Sections 1.1 and 2.1.3; and Appendices E2.3 and H4.
3.3	Maintenance Management Plan (MMP): DEA&DP stated that, as Activity 19 of GN No. 327 is triggered and future maintenance work may be required within watercourses, "… a MMP for future maintenance work within a watercourse must be compiled and submitted with the Revised Final BAR …".	An MMP was compiled and is included as a component (Part 2) of the Environmental Management Programme. This MMP pertains only to the works at the proposed intersections where watercourses would be affected by the safety improvements. The balance of the route under investigation would not be changed by the proposed improvements and is already subject to an ongoing routine road maintenance programme undertaken by DTPW.	Section 1.1; and Appendix G.
4	Process to finalise the Revised Final BAR: DEA&DP requested that "… the amended final BAR must be made available for a 21-day commenting period. Only once the commenting period has closed can the amended Final BAR be submitted to the Department with proof that registered I&APs have been provided with an opportunity to comment. Any comments received from I&APs on the amended BAR must also be submitted to the Department together with the amended report".	The Revised Final BAR has been made available for a 21-day comment period. Proof of notification of registered I&APs of the opportunity to comment as well as copies of any comments received will be submitted together with the Revised Final BAR to DEA&DP. The due date for the submission of this documentation is 15 January 2018.	Sections 1.1; 1.7; and 2.2.3.2; and Appendix F17.

1.2 PURPOSE OF THIS REPORT

The BAR has been compiled as part of the BA process undertaken for the proposed project. The Draft BAR, which was available for an extended public review and comment period from 2 April 2014 to 30 May 2014, was updated into the Revised Draft BAR for reasons discussed in Section 1.1 above.

This Revised Final BAR summarises the process followed to date, provides a description of the proposed project, describes the affected environment, presents the findings of the specialist studies and provides an environmental assessment of the potential impacts of the proposed project. The report also presents responses to previous comment on project proposals, indicating how the feedback from I&APs informed the further conceptualisation of project alternatives. Lastly, the report provides the opportunity for comment on the proposals contained therein.

The format of this Revised Final BAR has not followed that prescribed by DEA&DP for a Basic Assessment. The format has rather been aligned to that of an environmental impact report which facilitates a more suitable means of presenting the findings of a project of this nature. For completeness sake the standard DEA&DP BAR form is included in Appendix A.

1.3 NEED AND DESIRABILITY

Safety concerns have dominated the media at various times in the past as a result of serious accidents that have occurred along the R44. Solutions to such safety problems then focused on secondary roads intersecting with the R44 rather than the overarching safety implications for the R44 mobility corridor between Somerset West and Stellenbosch.

Thus this R44 improvement project was initiated as a result of DTPW identifying the need to introduce an overall holistic approach to improve the safety along the R44. The strategic mobility function of the R44 necessitates that such safety improvements would have to be effected without sacrificing capacity and mobility along the route. The aim of the conceptual planning and design of the proposed project is thus to improve the safety of the R44 while maintaining its capacity and mobility along the route.

The R44 is predominantly a mobility corridor that forms a strategic link between Somerset West and Stellenbosch at a regional transport planning level. It provides a daily commuter route for people travelling between these towns for work, school and university. The R44 also has an important local function, serving agriculture, business and the local tourism industry.

The road is a dual carriageway that has a number of intersections where side roads join via unsignalised or signalised intersections – the latter being mainly where the R44 falls within the Stellenbosch municipal area. Many private properties abutting the R44 have direct access onto the R44. There are also many median openings which provide access between the two carriageways of the R44.

Over the past 20 years, significant traffic volume growth has been experienced on the R44 from approximately 2 000 vehicles per day in 1980 to nearly 30 000 vehicles per day presently, roughly a 5 % annual traffic growth rate. As a result of the high traffic volume and growth, congestion along the route has increased with resulting increases in delays, queuing and a decrease in LOS. A significant number of accidents have taken place on the route and road safety is a key concern to commuters, the adjacent community and DTPW. This is attested to by the significant coverage that the accidents and safety has received in the local press and is one of the main reasons for the project. It is also becoming increasingly difficult and dangerous to negotiate the numerous median openings and accesses, as well as right turns and the frequently observed U-turns across heavy opposing traffic volumes.

Development pressure along the R44 and in the adjacent areas has increased over the years and many new developments and land uses have been approved and developed. Many of the farms and businesses still have direct access to the R44 with median breaks at most of these locations along the road. The access spacing of most of the driveways and corresponding median openings are deemed to be substandard in terms of the Provincial Road Access Guidelines. These median openings are known

to be highly dangerous from a traffic safety point of view as the slower moving right turning vehicles need to negotiate both carriageways with vehicles travelling at relatively high speed.

The initial analysis of the problem determined that the primary safety issue relates to various conflicting traffic movements required due to the numerous median openings and property accesses within the context of the R44 as a high speed mobility route. High speed differentials between the turning movements compound the problem, with vehicles having to decelerate and accelerate to and from stationary in the midst of through traffic travelling in both directions along the R44 dual carriageways at higher speeds of 100 km/h and over. These safety risks all contribute to the high accident rates recorded for the route.

Thus the overall solution that is being proposed to improve safety along the route is the closure of the median openings between Steynsrust and Webersvallei Roads. With the medians closed access to properties would only be via left-in and left-out movements which are far safer. Thus local users would have to travel to the nearest intersection in order to be able to turn and travel in the opposite direction, which results in the need for appropriate infrastructure to facilitate U-turn movements at regular intervals.

1.4 TERMS OF REFERENCE

The Terms of Reference for the study are as follows:

- Include a formal public participation process which involves participation with landowners, Interested and Affected Parties (I&APs) and relevant authorities. Specific tasks included the compilation and distribution of a Background Information Document (BID), holding of open days and public information meetings and collecting, collating and responding to comments received during the participation process;
- Undertake the necessary specialist studies to assess the key issues associated with the proposed project;
- Compile a Draft BAR, a Revised Draft BAR and a Final BAR and make these available for I&AP comment;
- Ensure the study complies with the relevant requirements of NEMA and the EIA Regulations 2010 and transitional arrangements of the EIA Regulations 2014; and
- Ensure that the decision-maker is provided with all the necessary information.

1.5 ASSUMPTIONS AND LIMITATIONS

The assumptions and limitations for the study are listed below:

- The BA process assumes that CCA has been provided with all relevant project description information by the applicant's project team and that it was correct and valid at the time it was provided;
- There will be no significant changes to the project description or surrounding environment between the completion of the report and implementation of the proposed project that could substantially influence findings, recommendations with respect to mitigation and management, etc.;
- The BA process assumes that all recommended mitigation measures would be implemented as proposed; and
- Specialists have all the relevant information in order to produce accurate and unbiased assessments.

1.6 STRUCTURE OF THIS REPORT

This report consists of seven chapters, the contents of which are outlined below.

Table 1.2: Report Structure

Section	Contents
Executive Summary	Provides an overview of the content and main findings of the BAR.
Chapter 1	**Introduction** Provides background and a brief history to the proposed project, describes the purpose of this report, describes the need and desirability for the proposed project, presents the Terms of Reference for this study, identifies the assumptions and limitations, explains the report structure and describes the opportunity for comment.
Chapter 2	**BA approach and methodology** Covers the legislative requirements of the BA process, describes the objectives of the study, presents the BA process undertaken and presents the way forward.
Chapter 3	**Project rationale and alternatives** Describes the rationale and motivation for the proposed improvements of the R44 between Somerset West and Stellenbosch. This is followed by a discussion on the process of conceptualising various alternative project schemes during the course of the project development.
Chapter 4	**Project description** Provides a detailed description of the proposed project scheme and of the alternatives that are assessed and compared in this Final BAR.
Chapter 5	**Description of the affected environment** Provides a description of the biophysical and socio-economic environment likely to be affected by the proposed project.
Chapter 6	**Impact description and assessment** Describes and assesses the significance of potential impacts of the proposed project alternatives on the socio-economic and biophysical environment. It also presents mitigation or optimisation measures that could be used to reduce the significance of any negative impacts or enhance any benefits, respectively.
Chapter 7	**Conclusions and recommendations** Provides a summary of the impact assessment findings, makes conclusions to the BA study and recommends key mitigation measures for the proposed project.
Chapter 8	**References** Provides a list of the references used in compiling this report.
Appendices	Appendix A: DEA&DP Basic Assessment Report Form Appendix B: Maps & Figures Appendix C: Design Drawings Appendix D: Photographs Appendix E: Specialist Studies Appendix E1: Botanical Assessment • Appendix E1.1: Original assessment (August 2013) • Appendix E1.2: Addendum report (August 2015) Appendix E2: Freshwater Assessment • Appendix E2.1: Original assessment (December 2013) • Appendix E2.2: Addendum report (August 2015) • Appendix E2.3: Addendum report 2 (October 2017) Appendix E3: Groundwater Assessment • Appendix E3.1: Original assessment (February 2014) • Appendix E3.2: Addendum report (August 2015) Appendix E4: Heritage Impact Assessment • Appendix E4.1: Original assessment (February 2014) • Appendix E4.2: Addendum report (August 2015) • Appendix E4.3: Review and second additional report (October 2016) Appendix E5: Visual Impact Assessment

Section	Contents
	• Appendix E5.1: Original assessment (March 2014) • Appendix E5.2: Addendum report (November 2015) Appendix E6: Economic Assessment • Appendix E6.1: Original assessment (March 2014) • Appendix E6.2: Addendum to localised impacts section of the economic specialist study (December 2015) • Appendix E6.3: Addendums 1 and 2 to economic analysis section of the economic specialist study (December 2015) Appendix E7: Conceptual design report and traffic data Appendix E8: Traffic operational analysis report • Appendix E8.1: Original assessment (August 2015) • Appendix E8.2: Addendum memorandum (December 2015) Appendix F: Public Participation Appendix F1: I&AP Database Appendix F2: Landowner notification Appendix F3: I&AP notification and Background Information Document Appendix F4: Advertisements and site notices Appendix F5: Notes on first information sharing meeting (27 February 2013) Appendix F6: Comments and Responses on the Background Information Document Appendix F7: Notification of availability of Draft BAR Appendix F8: Notes on second information sharing meeting (5 May 2014) Appendix F9: Draft BAR Comments and Responses Report 1: Commenting authorities Appendix F10: Draft BAR Comments and Responses Report 2: I&APs Appendix F11: Notification of availability of Revised Draft BAR Appendix F12: Revised Draft BAR Comments and Responses Report 1: Commenting authorities Appendix F13: Revised Draft BAR Comments and Responses Report 2: I&APs Appendix F14: Notification of availability of Final BAR Appendix F15: Final BAR Comments and Responses Report 1: Commenting authorities Appendix F16: Final BAR Comments and Responses Report 2: I&APs Appendix F17: Notification of availability of Revised Final BAR Appendix G: Environmental Management Programme Appendix H: Other Appendix H1: DEA&DP correspondence Appendix H2: Convention for assigning significance ratings of impacts Appendix H3 Interaction with HWC • Appendix H3.1: HWC's final comment (17 February 2017) • Appendix H3.2: Meeting with HWC (17 October 2017) • Appendix H3.3: Response to HWC final comment (14 November 2017 Appendix H4: Documentation regarding water use authorisation

1.7 COMMENT ON THE REVISED FINAL BAR

This Revised Final BAR has been distributed for a 21-day review and comment period from **23 November to 14 December 2017** in order to provide I&APs and authorities with an opportunity to review the final document.

An I&AP notification letter, including an Executive Summary of the Final EIR, has been forwarded to all I&APs registered on the project database.

Copies of the report have been made available for viewing at the following locations:

- Stellenbosch Public Library, Plein Street, Stellenbosch;
- Somerset West Public Library, c/o Victoria Street and Andries Pretorius Street, Somerset West;
- CCA Environmental (Pty) Ltd (CCA) offices (Cape Town); and

On the CCA/SLR website (http://www.ccaenvironmental.co.za/docs-for-comment).

All comments on the Revised Final BAR should be submitted to CCA at the contact particulars shown below, by no later than **Thursday 14 December 2017**.

CCA Environmental (Pty) Ltd
Contact person: Ena de Villiers
Unit 39 Roeland Square, 30 Drury Lane, Cape Town, 8001
PO Box 10145, Caledon Square, 7905
Tel: (021) 461 1118 / 9; Fax: (021) 461 1120
E-mail: ena@ccaenvironmental.co.za

After the conclusion of the comment period, the Revised Final BAR, together with all comments received, will be submitted to DEA&DP for consideration and decision-making.

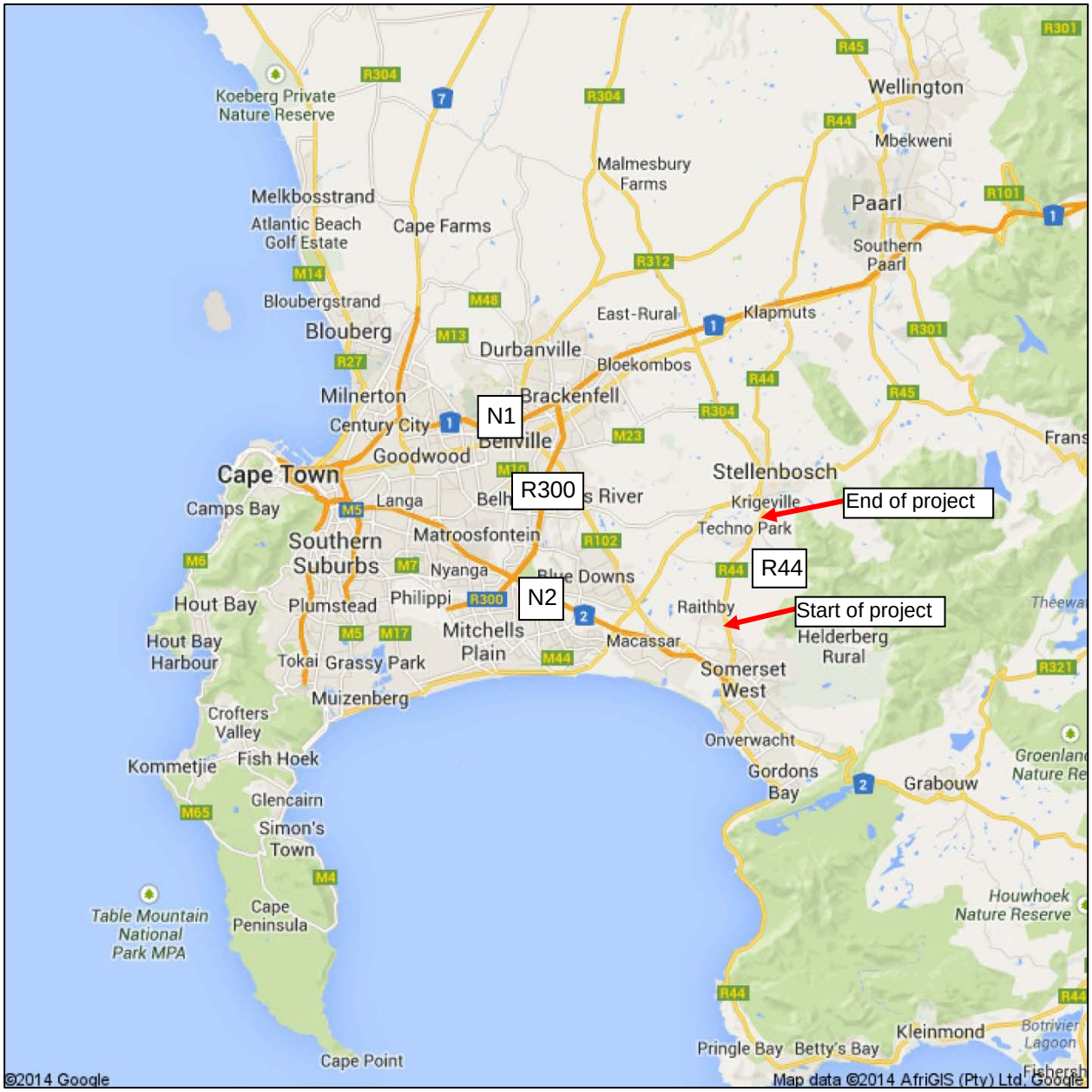


Figure 1.1: Map of the Western Cape Peninsula showing the major roads (Google Maps, 2014)

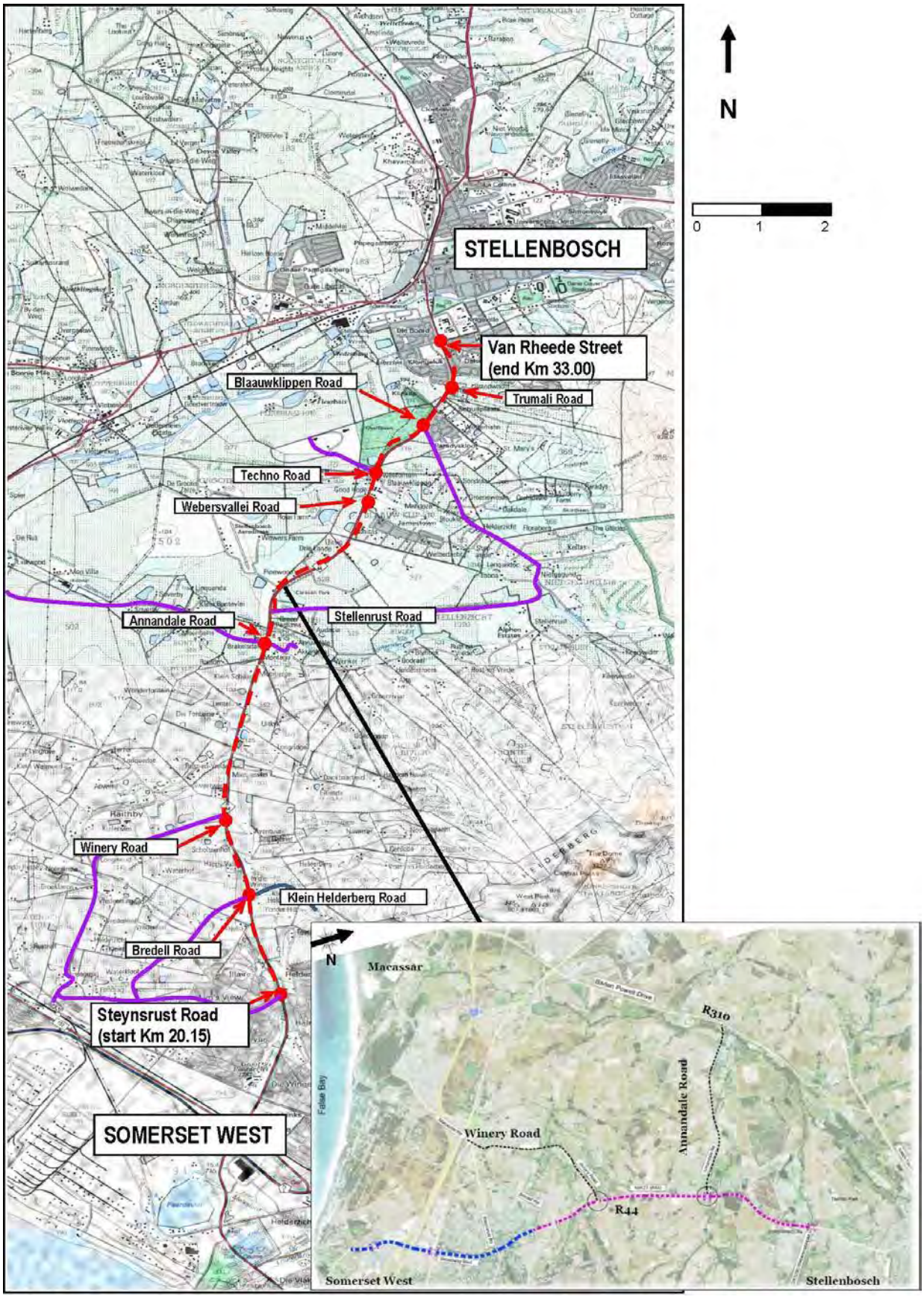


Figure 1.2: Map showing the position and extent of the proposed road improvements

2. BASIC ASSESSMENT APPROACH AND METHODOLOGY

This chapter covers the legislative requirements of the BA process, describes the objectives of the study, presents the BA process undertaken and presents the way forward.

2.1 LEGISLATIVE REQUIREMENTS

2.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NO. 107 OF 1998) AND NEMA EIA REGULATIONS 2010

Section 2 of NEMA, as amended, sets out a range of environmental principles that are to be applied by all organs of state when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. NEMA also provides for the participation of I&APs and stipulates that decisions must take into account the interests, needs and values of all I&APs.

Chapter 5 of NEMA, as amended, outlines the general objectives and implementation of Integrated Environmental Management, which provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment and communication of the potential impact of activities.

The EIA Regulations 2010 promulgated in terms of Chapter 5 of NEMA provide for the control of certain activities that are listed in Government Notices (GNs) R544, R545 and R546 of 18 June 2010. Activities listed in these notices must comply with the regulatory requirements listed in GN R543, which prohibits such activities until written authorisation is obtained from the competent authority. Such environmental authorisation, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations 2010. GN R543 also sets out the procedures and documentation that need to be complied with in undertaking a Basic Assessment (BA). The proposed project includes activities contained in Listing Notices 1 (GN R544) and 3 (GN R546) (see Table 2.1), thus a BA process must be undertaken in order for DEA&DP to consider the application in terms of NEMA.

Subsequent to the commencement of the BA process in terms of the EIA Regulations 2010, the regulations have been replaced by the EIA Regulations 2014, which were published on 4 December 2014 and came into effect on 8 December 2014. Despite the promulgation of the EIA Regulations 2014, transitional arrangements in the new regulations make provision to accommodate applications submitted in terms of the previous regulations and which were pending when the EIA Regulations 2014 took effect, despite the repeal of the previous regulations. Such applications must in terms of Regulation 53(1), be dispensed with in terms of the EIA Regulations 2010, as if these regulations had not been repealed. In addition, in terms of Regulation 53(3) where an application is pending and new activities are now applicable under the EIA Regulations 2014, these must be dispensed with in terms of the previous regulations on condition that all impacts associated with activities identified in terms of the new regulations have also been considered and adequately assessed.

Listed activities in terms of the EIA Regulations 2014 applicable to this proposed project were presented in the Final BAR. The EIA Regulations 2014 were subsequently amended on 7 April 2017, after the completion of the Final BAR. The relevant listed activities as amended have thus been included in the Revised Final BAR (see

Table 2.2). All the potential impacts associated with the newly listed activities have been considered and adequately assessed in this BAR.

Table 2.1: List of applicable activities in terms of GN R544 and R546, EIA Regulations 2010

GN No.	Activity No.	Activity Description	Corresponding Project Component
GN R544	11	*The construction of: (iii) bridges, (xi) infrastructure or structures covering 50 m² or more, where such construction occurs within a watercourse or within 32 m of a watercourse, measured at the edge of the watercourse, excluding where such construction will occur behind the development setback line.*	Culverts would need to be upgraded and constructed where new roadways (associated with the intersection improvements) would be constructed. Various rivers and their tributaries are located near some intersections with the R44. Construction activities would take place as part of the intersection improvements.
GN R544	18	*The infilling or depositing of any material of more than 5 m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell girt, pebbles or rock more than 5 m³ from (i) a watercourse ....*	Watercourses are situated near some intersections with the R44. Improvements of the intersections could lead to work being undertaken in the watercourses which would most likely result in the excavation, removal or moving of soil, sand, etc.
GN R544	39	*The expansion of (iii) bridges within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse ...*	Certain intersections with the R44 are located near watercourses. Any bridge type infrastructure at these intersections would fall within 32 m of a watercourse.
GN R544	47	*The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km (i) where the existing reserve is wider than 13.5 m; or (ii) where no reserve exists, where the existing road is wider than 8 m, excluding widening or lengthening occurring inside urban areas.*	The road would be widened by more than 6 m in some areas where interchange improvements would need to be undertaken.
GN R546	19	*The widening of a road by more than 4 m or the lengthening of a road by more than 1 km.* *(d) In Western Cape* *(ii) All areas outside urban areas.*	The road would be widened by more than 4 m in some areas where interchange improvements would need to be undertaken. This would mainly occur outside the urban area.
GN R546	24	*The expansion of:* *(d) Infrastructure where the infrastructure will be expanded by 10 m^2 or more,* *where such construction occurs within a watercourse or within 32 m from a watercourse, measured from the edge of watercourse, excluding where such construction will occur behind the development setback line.* *(d) In Western Cape* *(ii) Outside urban areas, in:* *(gg) Areas within 10 km from national parks or world heritage sites or 5 km from any other protected areas identified in terms of NEMPAA or from the core area of a biosphere reserve …*	The proposed project is located within 5 km from the Hottentots-Holland Mountain Catchment Area, the Helderberg Nature Reserve and the Jonkershoek Nature Reserve.

Table 2.2: List of applicable activities in terms of GN R327 and R325, EIA Regulations 2014, as amended

GN No.	Activity No.	Activity Description	Corresponding Project Component
R327	12	*The development of … (ii) infrastructure or structures with a physical footprint of 100 m² or more; where such construction occurs – (a) within a watercourse ...*	This activity is similar to Activity 11 in GN No. R544 (see Table 2.1).
R327	19	*The infilling or depositing of any material of more than 10 m^3 into, or the dredging, excavation, removal or moving of soil, sand, pebbles … or rock of more than 10 m^3 from a watercourse …*	This activity is similar to Activity 18 in GN No. R544 (see Table 2.1).
R327	48	*The expansion of – (i) infrastructure or structures where the physical footprint is expanded by 100 m² or more; … where such expansion occurs – (a) within a watercourse; …. excluding – … (ee) where such expansion occurs within existing roads or road reserves.*	This activity is similar to Activity 39 in GN R544 (see Table 2.1).
R327	56	*The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km – (i) where the existing reserve is wider than 13.5 m; or (ii) where no reserve exists, where the existing road is wider than 8 m; excluding widening or lengthening occurring inside urban areas.*	This activity is similar to Activity 47 in GN R544 (see Table 2.1).
R325	18	*The widening of a road by more than 4 m, or the lengthening of a road by more than 1 km. (i) In Western Cape: (i) All areas outside urban areas: (aa) Areas containing indigenous vegetation …*	This activity is similar to Activity 19 in GN R546 (see Table 2.1).

In undertaking this project, the following DEA&DP guideline documents have been taken into consideration:

- Guideline on Generic Terms of Reference for EAPs and Project Schedules (March 2013);
- Guideline on Public Participation (March 2013);
- Guideline on Alternatives (March 2013);
- Guidelines on Specialist Studies (June 2005); and
- Guideline on Need and Desirability (March 2013).

Section 22 (GN R543) of the EIA Regulations 2010 lists the necessary content of a BAR. Table 2.3 lists these content requirements and indicates if and where such information has been included within this report.

Table 2.3: Requirements of a BAR, in terms of the EIA Regulations 2010

Section 22	Content of Basic Assessment Report	Completed (Y/N or N/A)	Section
(2)(a)	(i & ii) Details and expertise of EAP who prepared the report.	Y	Page ii
(2)(b)	Detailed description of the proposed activity.	Y	Chapter 4
(2)(c)	A description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is:	N/A	Chapter 4
		Y	

Section 22	Content of Basic Assessment Report	Completed (Y/N or N/A)	Section
	(i) a linear activity, a description of the route of the activity; or (ii) An ocean-based activity, the co-ordinates where the activity is to be undertaken.	N/A	
(2)(d)	A description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.	Y	Chapter 5
(2)(e); (3)(a) & (b)	An identification of all legislation, relevant guidelines and any departmental policies, environmental management instruments and other decision making instruments that have been developed or adopted by the competent authority in respect of the kind of activity which is the subject of the application, that have been considered in the preparation of the BAR.	Y	Section 2.1
(2)(f)	Details of the public participation process conducted in terms of regulation 21(2)(a) in connection with the application, including:	Y	See below
	(i) The steps that were taken to notify potentially interested and affected parties of the proposed application;	Y	Section 2.2.2
	(ii) Proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given;	Y	Appendix F2
	(iii) A list of all persons, organisations and commenting authorities that were registered in terms of regulation 55 as interested and affected parties in relation to the application; and	Y	Appendix F1
	(iv) A summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues.	Y	Appendices F6, F9, F10, F12, F13, F15 and F16
(2)(g)	A description of the need and desirability of the proposed activity.	Y	Section 1.3 and Chapter 3
(2)(h)	A description of any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity.	Y	Chapters 3 and 4
(2)(i)	A description and assessment of the significance of any environmental impacts, including: (i) Cumulative impacts, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the activity; (ii) The nature of the impact; (iii) The extent and duration of the impact; (iv) The probability of the impact occurring; (v) The degree to which the impact can be reversed; (vi) The degree to which the impact may cause irreplaceable loss of resources; and (vii) The degree to which the impact can be mitigated.	Y	Chapter 6 & Appendix H2
(2)(j)	Any environmental management and mitigation measures proposed by the EAP.	Y	Chapter 6
(2)(k)	Any inputs and recommendations made by specialists to the extent that may be necessary.	Y	Chapters 6 and 7
(2)(l)	A draft environmental management programme containing the aspects contemplated in Regulation 33.	Y	Appendix G
(2)(m)	A description of any assumptions, uncertainties and gaps in knowledge.	Y	Section 1.5

Section 22	Content of Basic Assessment Report	Completed (Y/N or N/A)	Section
(2)(n)	A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Y	Chapter 7
(2)(o)	Any representations and comments received in connection with the application or the BAR.	Y	Appendices F6, F9, F10, F12, F13, F15 and F16
(2)(p)	The minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants.	Y	Appendices F2, F5 & F8
(2)(q)	Any responses by the EAP to those representations, comments and views.	Y	Appendices F6, F9, F10, F12, F13, F15 and F16
(2)(r)	Any specific information required by the competent authority. • Adequately address concerns raised by Heritage Western Cape (HWC); • Application for Water Use Authorisation; and • Include MMP in Environmental Management Plan	Y	Refer to Appendix H1. Also see Sections 1.1, 1.7, 2.1.2, 2.1.3 and 2.2.3.2; and Appendices E2.3; H3; H4 and G.
(2)(s)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act. (This refers to Environmental Authorisations and procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment that the authority needs to consider when reviewing an Application).	Y	Revised Final BAR and EMP (see Appendix G)
(4)	The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 22(2)(h), exist.	Y	Chapter 3

2.1.2 NATIONAL HERITAGE RESOURCES ACT (NO. 25 OF 1999)

Section 38(1) of the National Heritage Resources Act (NHRA) (No. 25 of 1999) lists development activities that would require authorisation by the responsible heritage resources authority. Activities considered applicable to the proposed project include the following:

"(a) The construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;

(b) The construction of a bridge or similar structure exceeding 50 m in length;

(c) Any development or other activity which will change the character of a site –

(i) exceeding 5 000 m² in extent"; and

(ii) involving three or more existing erven or divisions thereof.

(d) Rezoning of a site exceeding 10 000 m^2 in extent.

The NHRA requires that a person who intends to undertake a listed activity notify the relevant provincial heritage authority at the very earliest stages of initiating such a development. The relevant provincial heritage authority would then in turn, notify the person whether a Heritage Impact Assessment (HIA) Report should be submitted. However, according to Section 38(8) of the NHRA, a separate report would not be necessary if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act (now replaced by NEMA) or any other applicable legislation. The decision-making authority should, however, ensure that the heritage evaluation fulfils the

requirements of the NHRA and take into account in its decision-making any comments and recommendations made by the relevant heritage resources authority.

A Notice of Intent to Develop (NID) Form was submitted to HWC to notify them of proposed project. In response HWC indicated that an HIA would be required. An HIA was subsequently undertaken and the findings were presented in the Revised Draft BAR (refer to Section 5.1.7, Chapter 6 and Appendix E4). The HIA was also submitted to HWC for consideration. HWC formally responded that its Impact Assessment Committee (IACom) had resolved that *"[t]he submission does not fulfil the requirements of Section 38(3) in that the public participation process is not complete. However, the Committee is of the view that the submission is flawed in a number of serious respects".* It was further recommended that a complete review of the HIA and the process which it is assessing should be undertaken (see Revised Draft BAR Comments and Responses Report 1 in Appendix F12 for detail in this regard). Thus a heritage practitioner experienced in cultural landscape assessments was appointed to review and update the HIA as required by HWC. The findings of this additional specialist study were presented in the Final BAR (refer to Section 5.1.7, Chapter 6 and Appendix E4).

The HIA was also submitted to HWC for consideration. In its final comment dated 17 February 2017 HWC stated that the matter was discussed at the Impact Assessment Committee (IACom) meeting of 8 February 2017 (see Appendix H3.1). More detail regarding the contents of HWC's final comments is provided in Box 2.1. DTPW's project manager provided a response which was included in the Final BAR Comments and Responses Report 1 (see Appendix F15 for detail in this regard).

BOX 2.1: FINAL COMMENT FROM HERITAGE WESTERN CAPE

It was noted *inter alia* that *"The Committee acknowledged the high traffic volumes experienced on the R44 and the DTPW's mandate to explore improvements and enhance safety. HWC however confines itself to the protection of heritage resources and this comment is purely based on heritage considerations"*. It was confirmed that the Addendum HIA report, to be read in conjunction with the archaeology and built environment findings of the previous HIA reports, complied with the provisions of Section 38(3) of the NHRA. HWC's final comment further stated that *"The Committee supports the recommendations of the second addendum report, being:*

- *That a complete review of the nature of the proposed upgrade to the entire route, but in particular the section that falls within the identified scenic drive, be undertaken.*
- *That such review of the upgrade and proposals are undertaken with substantial input from a heritage practitioner, landscape architect and urban designer in the first instance in order to provide for an integrated and holistic solution.*
- *That in respect to the above bullet, the DTPW engages with DEA&DP, Heritage Western Cape and the affected local Municipality, taking into account relevant policy in respect of scenic drives and the provisions of relevant Spatial Development Frameworks and NHRA. Decisions in respect of the future of the R44 should be holistic and taken up at departmental level.*
- *That given the evident significance of the wider area that will be impacted on by the proposed upgrades in their current form, Heritage Western Cape gives consideration to the provisional protection of the R44 Scenic route in terms of the provisions of Section 29(1)(a)(ii) of the National Heritage Resources Act …"*

As mentioned previously, DEA&DP indicated that HWC's Final Comment had not been adequately addressed and requested that the concerns raised by HWC must be addressed prior to submitting the Revised Final BAR. DTPW and its professional team thus met with representatives of HWC and DEA&DP on 17 October 2017 for an in-depth discussion of the above-mentioned concerns with a view to exploring a mutually acceptable solution going forward. It was agreed at the meeting that the most appropriate approach to the matter would be for DTPW to provide a formal written response to HWC's final comment (see Appendix H3.2 for notes on the meeting). DTPW addressed a letter to HWC on 14 November 2017 with the request to table the attached response for discussion at a meeting of the HWC IACom for their further consideration together with the Revised Final BAR. A copy of this correspondence is attached as Appendix H3.3 to the Revised Final BAR.

2.1.3 NATIONAL WATER ACT (NO. 36 OF 1998)

The National Water Act (No. 36 of 1998) [NWA] provides for Constitutional demands including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State and the EIA process is used as a fundamental management tool.

A water resource includes a watercourse, surface water, estuary or aquifer, and, where relevant, its bed and banks. A watercourse means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland lake or dam, into which or from which water flows; and any collection of water that the Minister may declare to be a watercourse. Relevant water uses for the proposed improvements of the R44 at various intersections in terms of Section 21 of the NWA include the following:

Section 21(c): Impeding or diverting the flow of water in a watercourse; and
Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

Government Notice 509 published in Government Gazette 40229 dated 26 August 2016 grants general authorisation for the above water uses where the Risk Class is Low as determined by the Risk Matrix[1]. A risk assessment undertaken by the freshwater specialist as an addendum to the Freshwater Assessment Report indicated that the bridge maintenance work would have a LOW risk class, which confirms General Authorisation (GA) in terms of Section 6(1)(iii) of GN R509 of 2016 (see Appendix E2.3)

The GA includes certain conditions for impeding or diverting the flow of water or altering the bed, banks, course or characteristics of a watercourse, which would be considered in the designs for the proposed improvements. Those conditions relating to the construction phase of the proposed project have also been incorporated into the Construction Environmental Management Programme (EMP) prepared for the proposed project (see Appendix G1). The GA further stipulates requirements regarding rehabilitation; monitoring and reporting; budgetary provisions; and registration in relation to the water uses.

Pollution of river water (silt-laden run-off, oil from machines, etc.) is a contravention of the NWA. Chapter 3, Part 4 of the Act deals with pollution prevention and in particular the situation where pollution of a water resource occurs or might occur as a result of activities on land. The person who owns, controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources. Chapter 3, Part 5 of the Act deals with pollution of water resources following an emergency incident, such as an accident involving the spilling of a harmful substance that finds or may find its way into a water resource. The responsibility for remedying the situation rests with the person responsible for the incident or the substance involved.

The Draft BAR and Revised Draft BAR were both submitted to the Department of Water and Sanitation (DWS) for their consideration. Their comments confirmed that the above-mentioned water uses would apply (see Draft BAR Comments and Responses Report 1 in Appendix F9 as well as Revised Draft BAR Comments and Responses Report 1 in Appendix F12 for detail in this regard).

As mentioned previously, in response to DEA&DP's request regarding an application for Water Use Authorisation, an application for the registration of water uses in terms of the GA for Section 21(c) and (i) water uses in terms of the National Water Act, 1998 was submitted to DWS on 9 November 2017 (see Appendix H4).

[1] The Risk Matrix is appended to the Notice as Appendix A, and must be completed by a suitably qualified professional member of the South African Council for Natural Scientific Professions (SACNASP).

2.1.4 OTHER RELEVANT LEGISLATION

In addition to the foregoing, the proponent must also comply with the provisions of other relevant national legislation, conventions and regulations, which include the following:

- Roads Ordinance (No. 19 of 1976);
- National Environmental Management Act: Biodiversity Act (No. 10 of 2004);
- Noise Control Regulations: Environmental Conservation Act, 1989 (No. 73 of 1989); and
- Land Use Planning Ordinance (15 of 1985) [LUPO].

2.2 BASIC ASSESSMENT PROCESS

2.2.1 OBJECTIVES OF THE STUDY

The BA process has the following specific objectives:

- To provide a reasonable opportunity for I&APs to be involved in the study;
- To identify any potential environmental issues and impacts related to the proposed project requiring further investigation in the BA;
- To identify feasible and reasonable alternatives related to the project proposal;
- To undertake the necessary specialist studies to assess the key issues associated with the proposed project;
- To compile and update reports which present all relevant information regarding the study, and make these available for I&AP comment; and
- Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.

The BA process has consisted of two phases, namely:

(1) Initial I&AP interaction phase ; and
(2) BA phase, comprising specialist studies and integration and assessment.

Each phase is described in more detail below.

2.2.2 INITIAL I&AP INTERACTION PHASE

2.2.2.1 I&AP registration and public participation

Public participation was an important focus throughout the BA process. The initial participation process undertaken to identify issues and concerns is described in detail in Box 2.2 below. Supporting documents, including the Background Information Document, adverts, site notices, meeting notes and written submissions and responses, compiled in a BID Comments and Responses Report, are provided in Appendix F. A flowchart indicating the process is presented in Figure 2.1.

BOX 2.2: ACTIVITIES UNDERTAKEN AS PART OF THE PUBLIC CONSULTATION PROCESS DURING THE INITIAL I&AP INTERACTION PHASE OF THE BA PROCESS

1. Press Release

The DTPW issued a press release on 18 September 2012 in which the project was announced and CCA contact details were provided. Subsequent comments from I&APs were captured and acknowledged.

2. Compilation of I&AP database

All I&APs who responded to the press release were registered on the project database. Contacts from previous EIA studies in the area were also used to expand the project database. The database included directly affected and

adjacent landowners, authorities (key departments), councillors, local community forums and other key stakeholders. During the course of the BA process the list of I&APs was continuously supplemented and updated. At the beginning of the Draft BAR review and comments period there were 209 I&APs on the database, which was updated to 261 I&APs at the beginning of the Revised Draft BAR comment period. There were 275 I&APs on the database at the beginning of the Final BAR comment period and it was updated to 286 I&APs at the beginning of the Revised Final BAR comment period (see Appendix F1).

3. Notification of directly affected landowners

Interaction with directly affected landowners occurred between October and December 2012. Minutes of meetings were compiled and official notification letters were sent via registered post to the directly affected landowners as part of the formal landowner notification process (see Appendix F2). Meetings took place with the following parties:

- Mr M & Mrs R Goosen from Noordeinde Ontwikkelings (Erf 178) – 20 October 2012;
- Ms P Mickelburgh from Avontuur Estate (Erf 211) – 25 October 2012;
- Mr P Rossouw from Ken Forrester Wine Estate (Erf 169) – 25 October 2012;
- Mr T Strydom from Audacia (Farm 537) – 5 December 2012;
- Mr J & Mr D Zetler from Mooiberge (Farm 537/6/7/20 538/1, 539/1 & 540) – 5 December 2012; and
- Mrs E du Plessis from Klein Akkerdraai (Farm 537/18) – 19 December 2012.

4. Distribution of the Background Information Document (BID)

A BID was compiled and made available as part of the initial notification and registration period between 1 February and 22 March 2013 (see Appendix F3). It was also placed on the CCA website. The main purpose of the BID was to inform I&APs about the proposed project and to obtain input and comment from them and the project team on the key issues and concerns to be addressed in the BAR.

5. Public notification of commencement of application and BA process

Six site notices were erected on 30 January 2013 at the various intersections along the R44 including Steynsrust Road, Bredell Road, Winery Road, Annandale Road, Techno Road and Van Rheede Street (see text and proof of placement of the site notices in Appendix F4). An advertisement publicising the project and the availability of the BID was placed in two local newspapers, the District Mail (English) and the Eikestadnuus (Afrikaans) respectively on 31 January and 1 February 2013. An initial registration and comment period was provided between 1 February and 8 March 2013; however, this period was extended until 22 March 2013 based on various requests received in this regard. See text and proof of placement of the advertisements in Appendix F4.

6. Open day and Information Sharing Meeting

An Open Day and Information Sharing Meeting were held at the Protea Hotel in Techno Park on 27 February 2013. Notes on the meeting are attached in Appendix F5.

7. Comments and responses

The various comments received following the press release and the BID distribution have been collated into a BID Comments and Responses Report which is attached hereto in Appendix F6. A total of 128 comments were received from authorities and I&APs.

2.2.2.2 Issues and concerns identified during the initial I&AP interaction phase

The key issues and concerns identified by the project team (including the analysis of comments received during the initial I&AP interaction phase) are summarised in Table 2.4. This information provided the basis on which the relevant specialist studies and terms of references were determined.

Table 2.4: Key issues and concerns identified during the initial I&AP interaction phase

Key issues		Summary description of the issue
Biophysical:		
1	Impacts on natural environment	• Conservation of biodiversity with specific reference to Oak trees and certain owl species • Surface and groundwater • Air pollution due to increased traffic • Disturbance of flora and fauna in the area
2	Heritage	• Historic farm buildings • Other heritage sites & places of cultural interest • Stellenbosch agricultural / rural heritage • Sense of place

Key issues		Summary description of the issue
Socio-economic:		
3	Alternatives	• Upgrading the urban section of the Stellenbosch roads • Developing a Rapid Bus Transit system • Constructing bus lanes along the R44 • Improving the train and Integrated Rapid Transport system • Installation of a signalised intersection at the Winery Road Intersection • Installation of a signalised intersection or a roundabout at Bredell Road • Construction of a Stellenbosch bypass • Provision of an alternative entrance/egress point for the Stellenbosch Techno Park
4	Infrastructure design	• Impracticality of the designs i.t.o. scale and positioning • Integration of the proposed project with previous work undertaken at Winery Road • Sight distance issues at Bredell Road • Access to Mountain-breeze Resort • Adjacent landowners access • Closure of median openings • Request for an additional exit at the Jamestown Intersection (Webersvallei Road) • Alternative placement suggestions for roundabouts • Preference of at-grade roundabouts *vs.* grade-separated roundabouts • Issues with the proposed left-out only at the Bredell Road/ Klein Helderberg Road Intersection which may cause access problems for buses used by workers in the area and school children • Traffic speed U-turn requirements • Speed limit increases or decreases • Additional travel distance due to closed median openings
5	Non-motorised transport	• Cyclist and pedestrian safety • Accommodation of cyclists and pedestrians in road infrastructure design • Provision of pedestrian crossings
6	Safety (not inclusive of pedestrian or cyclist safety)	• Requirement for more visible traffic staff and implementation of road rules • Installation of speed control measures • Accidents at Winery Road and Annandale Road Intersections • Safety of motorists at U-turn points • Safety of adjacent landowners when accessing a high-speed road
7	Spatial planning	• Traffic planning – congestion at end destinations • Techno Park traffic control • Scale of the project is too large for the requirements of the area • Need and desirability considerations i.t.o. the Provincial Spatial Development Framework (PSDF) • Principle driven transport planning solution • Function of the R44
8	Visual	• Visual impacts due to the scale of the proposed roundabouts • Impact on tourism if the rural scenic quality of the area is destroyed • Changes in sense of place – mainly concerns over a change in the rural landscape character to that of an urban landscape
9	Noise	• Increased road noise due to increased traffic volumes
10	Economic considerations	• Economic impact on tourism, trade and businesses along the R44 • Negative impact upon property and leasing operations • Expropriation / land acquisition • Cost-benefit ratio • The impact of traffic data on economic consideration

2.2.3 BASIC ASSESSMENT PHASE

2.2.3.1 Specialist studies

Seven specialist studies were undertaken in three stages to address the potential impacts associated with the key issues raised during the BID Phase and in response to the Draft BAR and subsequently the Revised Draft BAR.

Initially six specialist studies were undertaken, as listed in Table 2.5. Specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the project, according to the relevant guidelines for specialist studies (DEA&DP, 2005). These impacts were assessed according to pre-defined rating scales (see Appendix H2). Specialists also recommended appropriate mitigatory or control measures to minimise potential impacts or enhance potential benefits.
The further project alternatives developed in response to the public reaction to the findings of the Draft BAR (as described in Section 1.1 above) were subsequently subjected to a detailed traffic operational analysis specialist study. The purpose of this study was to test the viability of the various alternatives in terms of overall performance in relation to system-wide traffic flows. This served as a basis to formulate a revised project scheme and alternatives. Relevant viable alternatives were again assessed by the specialists who supplemented their original reports with addendum reports.

An additional specialist study was subsequently commissioned in July 2016 in order to comply with the recommendation from HWC that the HIA should be reviewed and updated. The purpose of this study was to ensure compliance with that the provisions of Section 38(3) of the NHRA in respect of applications submitted to HWC for comment in terms the latter Act.

A list of the specialist studies undertaken at each stage of the BA process and where copies are included in the BAR is provided in Table 2.5.

Table 2.5: List of specialist studies

Specialist Study	Specialist	Company	Draft BAR	Revised Draft BAR	Final BAR
Vegetation	Dr D McDonald & Mr P Emms	Bergwind Botanical Surveys and Tours CC.	Assessment – Appendix E1.1	Addendum – Appendix E1.2	N/A
Freshwater ecology	Ms A Belcher	Blue Science	Assessment – Appendix E2.1	Addendum – Appendix E2.2	N/A
Groundwater	Dr R Parsons	Parsons and Associates Specialist Groundwater Consultants	Assessment – Appendix E3.1	Addendum – Appendix E3.2	N/A
Heritage	Dr J Orton	ACO Associates	Assessment – Appendix E4.1	Addendum – Appendix E4.2	N/A
	Mr C Snelling	On behalf of ACO Associates	N/A	N/A	Review and additional report – Appendix 4.3
Visual	Ms M Anderson	Megan Anderson Landscape Architects	Assessment – Appendix E5.1	Addendum – Appendix E5.2	N/A
Economic	Dr H van Zyl	Independent Economic Researchers	Assessment – Appendix E6.1	Addenda – Appendices E6.2 and E6.3	N/A
	Mr B Standish / Mr A Boting	Stratecon Applied Economic Research			
Operational analysis / Traffic modelling	Dr C Krogscheepers, Mr S van der Sluys, Mr F Zimmerman & Mr N Platte	ITS Engineers (Pty) Ltd	N/A	Appendix E8	N/A

2.2.3.2 Integration and assessment

The specialist studies, which address the key issues identified during the BA process to date, and other relevant information, have been integrated into this Revised Final BAR. The Revised Final BAR aims to present all information in a clear and understandable format, suitable for easy interpretation by I&APs and authorities. This Revised Final BAR has also been made available to I&APs and authorities for review and comment (see Section 1.7).

The key steps in the BA Phase to date include the following (see details in Box 2.2 below):

- The initial six specialist studies were commissioned and completed;
- The Draft BAR was compiled and distributed for review and comment;
- In response to public reaction to the Draft BAR, further project alternatives were developed and specialists studies were undertaken and/or updated to assess the potential impacts, as described in Section 2.2.3.1 above;
- Comments received on the Draft BAR have been collated and responded to in two Comments and Responses Reports, presenting submissions from commenting authorities and I&APs, respectively;
- The Draft BAR was updated to a Revised Draft BAR and distributed for review and comment;
- Representatives of six commenting authorities and 38 other I&APs submitted comments in response to the Revised Draft BAR;
- In response to interim comment provided by HWC, the Heritage Impact Assessment was reviewed. This additional specialist study was included in the Final BAR, as described in Section 2.2.3.1 above;
- Comments received on the Revised Draft BAR were collated and responded to in two Comments and Responses Reports representing comments from commenting authorities and I&APs, respectively (see Appendices F12 and F13);
- The Revised Draft BAR was updated to the Final BAR;
- The Final BAR was released for a 30-day (plus exclusion period) review and comment period.
- A total of 47 submissions were received in response to the Final BAR, four of which were from representatives of commenting authorities and 43 other I&APs. These comments were collated and responded to in two Comments and Responses Reports representing comments from commenting authorities and I&APs, respectively (see Appendices F15 and F16);
- In response to DEA&DP's feedback on the Final BAR, the necessary steps were taken to include the additional information requested, as reported in Sections 1.1, 2.1.2 and 2.1.3 of the Revised Final BAR;
- The Final BAR was updated to this Revised Final BAR, and detail regarding the additional information has been included in Appendices G, H3 and H4;
- The Revised Final BAR has been released for a further 21-day review and comment period.

The key issues I&APs raised in response to the Draft BAR were similar to those raised during the previous I&AP interaction phases. Full details are available in the two Draft BAR Comments and Responses Reports and are summarised in Table 2.4. The main issues raised in response to the Revised Draft BAR again focused on similar themes as those raised previously during the BA process, with full details available in the two Draft Revised BAR Comments and Responses Reports (see Appendices F12 and F13). Most respondents were strongly opposed to the grade-separated interchange component of the proposed project. Responses to the Final BAR generally reiterated the same themes raised in responses to the Revised Draft BAR (see Appendices F15 and F16).

Specific steps undertaken as part of the integration and assessment phase of the BA process are described in Box 2.3 below.

BOX 2.3: ACTIVITIES UNDERTAKEN AS PART OF THE INTEGRATION AND ASSESSMENT PHASE OF THE BA PROCESS

1. Compilation of Draft BAR

The project and affected environment descriptions and the findings of the specialist studies were integrated to produce the Draft BAR. The Draft BAR also provided an assessment of the impact of the alternatives considered and provided conclusions regarding the preferred alternative.

2. Distribution and public review of the Draft BAR

The Draft BAR was released for a 40-day public comment period from 2 April to 19 May 2014. A notification letter was sent to all Registered I&APs on the project database informing them of the release of the Draft BAR and that the report would be available for viewing at the Stellenbosch and Somerset West Public Libraries and on the CCA website. I&APs were also invited to participate in a second open day and information sharing meeting held on 5 May 2014 (see Appendix F7).

Copies of the Draft BAR were sent to the following commenting authorities for their review and comment:

- Department of Water and Sanitation;
- Western Cape Government: Department of Agriculture;
- Heritage Western Cape;
- Cape Winelands District Municipality;
- Stellenbosch Local Municipality;
- City of Cape Town; and
- CapeNature.

3. Open day and Information Sharing Meeting

An Open Day and Information Sharing Meeting were held at the Protea Hotel in Techno Park on 5 May 2014. Notes of the meeting are attached in Appendix F8.

4. Comments and responses

Six commenting authorities and 59 I&APs submitted written comments in response to the Draft BAR. These comments have been collated and responded to in the following two reports:
Draft BAR Comments and Responses Report 1 – Commenting authorities (see Appendix F9); and
Draft BAR Comments and Responses Report 2 – I&APs (see Appendix F10).

5. Reconsidering alternatives

The feedback on the Draft BAR that I&APs provided during the public meeting and the written submissions served as a basis for DTPW to reconsider project alternatives. Additional proposals for alternative project designs were thus developed. The viability of various alternatives was investigated by means of detailed traffic modelling and further economic specialist input. Specialist studies were undertaken and updated to assess the potential impacts of viable alternatives.

6. Compilation of Revised Draft BAR

The Draft BAR was updated to include new and additional information regarding the proposed project. The new and updated findings of specialist studies have also been integrated to produce the Revised Draft BAR. The Revised Draft BAR therefore contained the key information from each of the specialist studies, including the description and assessment of impacts.

7. Distribution and public review of the Revised Draft BAR

The Revised Draft BAR was released for a 40-day public comment period from 1 March to 13 April 2016 (including three intervening public holidays). A notification letter was sent to all registered I&APs on the project database informing them of the release of the Revised Draft BAR and that the report would be available for viewing at the Stellenbosch and Somerset West Public Libraries and on the CCA website (see Appendix F11).

Copies of the Revised Draft BAR were also provided to those commenting authorities listed under item 2 above for their review and comment.

8. Compilation and distribution of the Final BAR

In response to HWC's recommendation that the HIA should be reviewed and updated, an additional specialist study was commissioned for this purpose and the findings of this study were incorporated into the Final BAR. Comments received on the Revised Draft BAR were collated and responded to in two reports, namely the Revised Draft BAR Comments and Responses Report 1 – Commenting authorities (see Appendix F12); and the Revised Draft BAR Comments and Responses Report 2 – I&APs (see Appendix F13). The Final BAR was released for a 30-day review and comment period from 12 December 2016 to 30 January 2017 (including 19 days to cover the intervening holiday exclusion period in terms of the NEMA EIA Regulations). A notification letter was sent to all registered I&APs on the project database informing them of the release of the Final BAR and that the report would be available for viewing at

the Stellenbosch and Somerset West Public Libraries and on the CCA/SLR website (see Appendix F14). Copies of the Final BAR were also provided to those commenting authorities listed under item 2 above for their review and comment.

9. Submission of and response to the Final BAR

The Final BAR was also submitted to DEA&DP as part of the application process at the same time that the Final BAR was made available for comment. After the conclusion of the comment period, all comments received on the Final BAR were collated into two Final BAR Comments and Responses Report, which with the Final BAR were submitted to DEA&DP on 31 May 2017. I&APs were notified that the documentation was available on the CCA/SLR website for information purposes.

On 14 July 2017, DEA&DP informed DTPW that the Final BAR had been rejected, and would have to include certain additional information to be accepted, namely adequate response to the concerns HWC raised in its final comment; proof of submission of an application for Water Use Authorisation in terms of the National Water Act, 1998; and an MMP for future maintenance work within watercourses.

10. Compilation, distribution and public review of the Revised Final BAR

The Final BAR was updated into this Revised Final BAR to include the additional information DEA&DP requested (see item 9 above for detail). The two Final BAR Comments and Responses Report have also been appended to the Revised Final BAR (see Appendices F15 and F16).

The Revised Final BAR was released for a 21-day public comment period from 23 November to 14 December 2017. A notification letter was sent to all registered I&APs on the project database informing them of the availability of the Revised Final BAR for review and comment (see Appendix F17). Copies of the Revised Final BAR were also provided to those commenting authorities listed under item 2 above for their review and comment.

2.2.4 WAY FORWARD

The specific steps that will be undertaken once the Revised Final BAR comment period is complete include the following:

- The Revised Final BAR, together with all comments received by the conclusion of the comment period, will be submitted to DEA&DP for their consideration and decision-making.
- After DEA&DP has reached a decision, all I&APs on the project database will be notified of the outcome of the application and the reasons for the decision; and
- A statutory Appeal Period in terms of Chapter 7 of the EIA Regulations 2010 will follow the issuing of the decision.

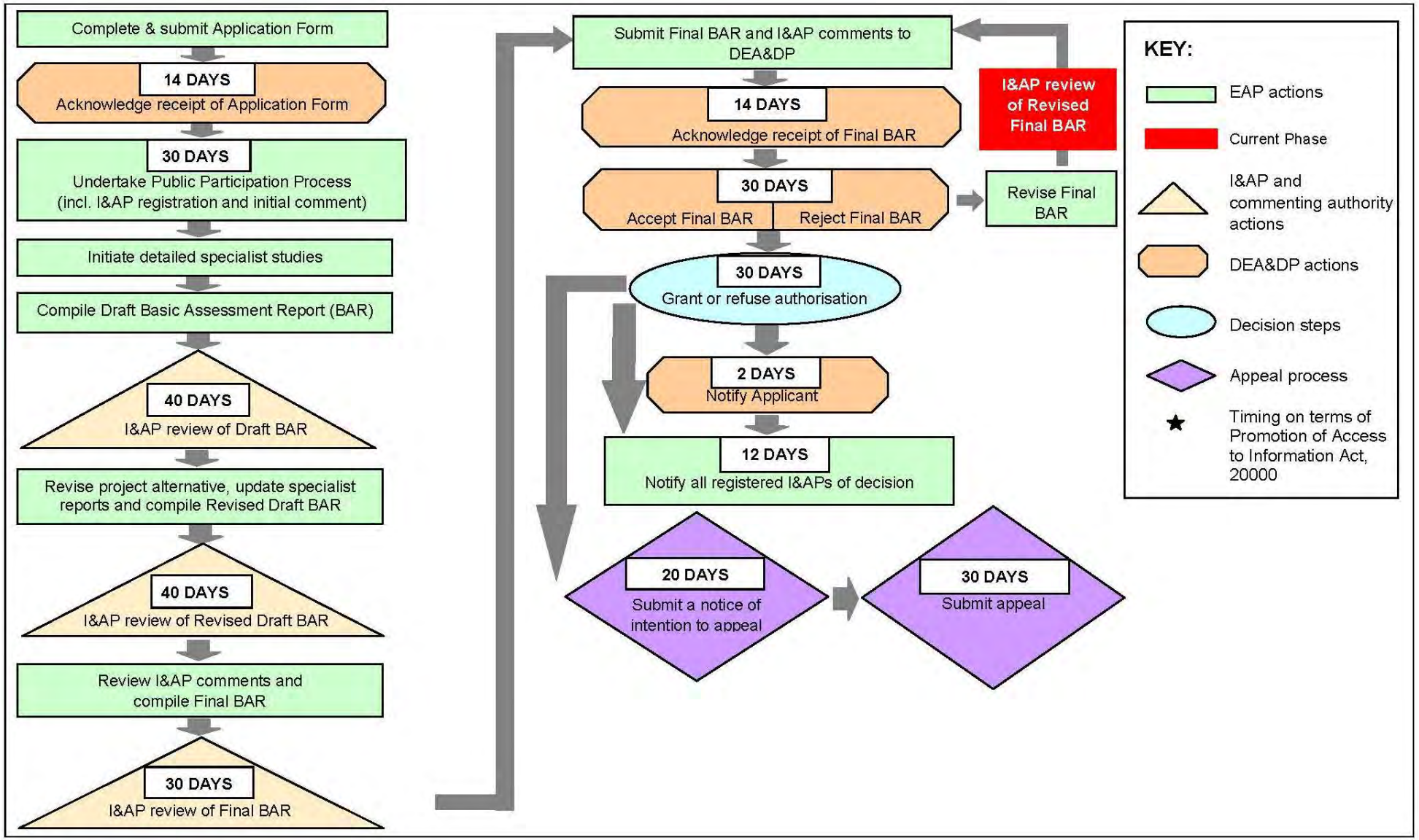


Figure 2.1: Basic Assessment process.

3. PROJECT RATIONALE AND ALTERNATIVES

This chapter firstly describes the rationale and motivation for the safety and level of service (LOS) improvements proposed for the R44 between Somerset West and Stellenbosch. This is followed by a discussion on the process of conceptualising various alternative project schemes during the course of the project development.

3.1 PROJECT MOTIVATION

3.1.1 DESCRIPTION OF THE R44 BETWEEN SOMERSET WEST AND STELLENBOSCH

3.1.1.1 History and overview of the road function

The R44 (Main Road 27) is a dual carriageway that links Somerset West and Stellenbosch. The area along the R44 is prized for its scenery, culture, heritage and semi-rural lifestyle.

The R44 was developed in its current form in the 1970s to provide a regional link between Somerset West and Stellenbosch and as part of the larger provincial route between Kleinmond and Malmesbury via Wellington. The R44 was a single lane undivided rural roadway prior to the construction of the dual carriageway. Historically the R44 was situated in a largely rural context with mainly medium to large production farms involved in the wine industry located along the road. The area between Somerset West and Stellenbosch has a long tradition of viniculture since the first vines were planted more than 300 years ago. As the urban environment of greater Cape Town and the surrounding Winelands areas developed over time, the character and functions of the R44 have also changed. This is evidenced by growth in traffic volumes from an average daily traffic volume of approximately 2 000 vehicles in 1980 to approximately 30 0000 vehicles presently. Past trends and anticipated future growth are highlighted later in this chapter (refer to Section 3.1.2 and Boxes 3.1 and 3.2).

Various development trends have contributed to the traffic growth. While agricultural activities remain predominant in the area, other business and especially tourism related activities have developed, with numerous farms converting to tourist-orientated businesses such as farm stalls, restaurants and tourist accommodation. Educational institutions have grown, e.g. many students commute daily to the University of Stellenbosch due to limited student accommodation within the town. The area is also sought after for residential purposes due to its rural atmosphere within relative close proximity to the urban context of the two large towns as well as the City of Cape Town. Some farms have been subdivided into residential smallholdings and numerous housing developments close to Stellenbosch have taken place. The development of businesses, business and office parks and shopping centres has further contributed to increased local traffic demand along the R44.

The R44 thus has an important local function, serving agriculture, business and the local tourism industry, in addition to providing a daily commuter route between Somerset West and Stellenbosch to and from work, schools and the university.

At the same time, the R44 also serves as mobility corridor between the N2 and N1. The next direct opportunity to cross between the N1 and the N2 towards Cape Town is the R310 to the west and after that the R300. From the provincial road network perspective, the mobility of this road section is further important as it serves part of the link between Malmesbury and the N2. This mobility function is, however, currently hindered by traffic congestion in the urban areas on either end of the route, especially through Stellenbosch and to a lesser degree through Somerset West. From a strategic perspective, the long-term mobility function of the route is thus also critical to the road network belonging to DTPW.

3.1.1.2 Road classification

The provincial roads authority classifies the R44 as a high speed mobility corridor that forms a strategic link between Somerset West and Stellenbosch.

The R44 is a Class 2 Primary Arterial. It is currently a dual carriageway with two 3.7 m wide lines per direction, 2.5 m wide shoulders on the outer lanes and 1.0 m on the inner lanes and a 10 m wide median between the two carriageways. The R44 has a number of intersections where side roads join via unsignalised or signalised intersections, with the latter occurring mainly within the Stellenbosch Municipal area northwards of Jamestown. Many private properties abutting the R44 have direct access onto the R44. To provide access to the private properties from both directions, there are over 20 median openings within an eight kilometre stretch of road. The median openings are concentrated in the semi-rural part of the route between Steynsrust Interchange and the Webersvallei Road Intersection.

Thus, while the route functions predominantly as a high speed mobility corridor with a posted speed limit of 100 km/h reducing to 80 km/h at certain signalised intersections, it serves the dual purpose of providing local access at frequent intervals. The access function is also important as the network does not provide many alternatives in this regard.

3.1.2 PROJECT RATIONALE

3.1.2.1 Safety concerns

Safety concerns have dominated the media at various times in the past as a result of serious accidents that have occurred along the R44. Solutions to such safety problems then focused on secondary roads intersecting with the R44 rather than the overarching corridor safety implications for the R44 mobility route between Somerset West and Stellenbosch.

Thus this R44 improvement project was initiated as a result of DTPW identifying the need to introduce an overall holistic approach to improve the safety along the R44. The strategic mobility function of the R44 necessitates that such safety improvements would have to be effected without sacrificing capacity and mobility. The aim of the conceptual planning and design of the proposed project is thus to improve the safety of the R44 while maintaining its capacity and mobility along the route.

The initial analysis of the problem determined that the primary safety issue relates to various conflicting traffic movements required due to the numerous median openings and property accesses within the context of the R44 as a high speed mobility route. High speed differentials between the turning movements compound the problem, with vehicles having to decelerate and accelerate to and from stationary in the midst of through traffic travelling in both directions along the R44 dual carriageways at higher speed. These safety risks all contribute to the high accident rates recorded for the route.

Thus the overall solution that is being proposed to improve safety along the route is the closure of all median openings between Steynsrust and Webersvallei Roads. With the medians closed access to properties would only be via left-in and left-out movements, which are safer. Thus local users would have to travel to the nearest major intersection in order to be able to turn and travel in the opposite direction. To facilitate this ease of movement or U-turn movement, there is then a necessity to provide improved facilities over and above what already exists. The LOS implications of not providing upgraded facilities for turning movements would be significant on the overall operation of the route.

3.1.2.2 Conflict movements

In the context of the R44, traffic accidents can be attributed to the number of conflicts at each location. A conflict point is defined as the point at which a roadway user crossing, merging with, or diverging from a roadway conflicts with another road user using the same roadway. Conflict points are associated with increased levels of roadway accidents. Although this does not appear to be a simple, direct relationship, reducing conflict points have been shown to reduce the accident rate significantly[1].

Median openings between two dual carriageways as in the case of the R44 are typically associated with a high number of conflicting movements. The combination of the turning movements and the opposing through traffic movements on the R44 is especially problematic. The right-turn movement from intersecting side roads and/or private accesses is particularly difficult. Access traffic has to cross two lanes of the carriageway and stop in the median opening before then entering the opposite carriageway before merging with opposing traffic (see median opening examples in Figure 3.1). Also problematic is accessing an intersecting side road or private access along the opposite carriageway, as this requires deceleration so as to undertake a right-turn movement from the fast lane into the median opening before crossing two lanes which may carry opposing traffic approaching at speed from the opposite side (see Figures 3.2 and 3.3). Traffic speed and significant historic traffic growth have meant that such movements are becoming increasingly difficult and unsafe. So-called “gap acceptance” is limited and the opposing flows are significant during peak hours and off peak.

Figure 3.1: Examples of median openings along the R44 (Google street view)

Figure 3.2: Example of traffic in median waiting to enter traffic flow along the R44 (photo taken opposite Jamestown Cemetery on 3 August 2015)

[1] TRB, Access Management Manual, Washington, 2013

Figure 3.3: Example of traffic in median waiting to enter traffic flow along the R44 (Google street view 2015)

3.1.2.3 High frequency of U-turns

A further cause of conflicting traffic movement is the high frequency of U-turns required to access properties that are currently served by left only driveways on the opposite side of the R44, such as the aerodrome access, various restaurants, wineries and private properties. The U-turns at median openings require deceleration from the fast lane and entry into the fast lane and/or the slow lane by crossing two lanes of opposing and oncoming traffic, thus undertaking a number of traffic conflict movements. This manoeuvre is potentially even more dangerous than the turning movements shown in Figures 3.2 and 3.3.

3.1.2.4 High speed differentials

High speed differentials in the form of slower turning movements, which entail decelerating and accelerating to and from stationary, compared to the higher speed of the through traffic travelling along the R44 are characteristic of the route. These prevailing high speed differentials compound the above-mentioned conflicting movements. The right turning movements take place from the fast lane at median openings that in many instances do not have adequate provision of auxiliary lanes. One measure that was considered to deal with this problem was the introduction of offset auxiliary lanes at all accesses. However, this was not considered a practical solution given the lengthy taper rates required and the high number of side road accesses per kilometre. The access spacing is below the recommended standard as specified in the Provincial Road Access Guidelines document.

3.1.2.5 Traffic congestion and delays

The rural environment combined with prevailing speed and high traffic volumes of up to 30 000 vehicles per day causes delays at the side roads (opposite the median openings) and vehicles typically take smaller gaps during higher traffic flow, get delayed in the median opening and have difficultly entering the fast lane. An element of risk is thus introduced in making these movements. This phenomenon is set to become more pronounced and hence more unsafe with the ongoing development pressures along this section of the R44 and the ongoing traffic growth.

3.1.2.6 Accident rates

The above-mentioned safety risks all contribute to high accident rates. In 2013, 276 accidents were recorded along the affected length of the R44. Accidents statistics for the major intersections are shown in Table 3.1.

General accident statistics indicate that more collisions occur at signalised intersections (2 – 3 accidents per million vehicles are recorded) in comparison with unsignalised intersections (0.7 –1.2 accidents per million vehicles). There are more collisions at traffic signals for a number of reasons but mainly due to motorists running the red signal phase and turning on the inter-green phase of the signal.

As the traffic volume on the R44 has increased, intersections have become busier and farm and private access roads carry more traffic (e.g. related to wine cellars and restaurants), road safety has decreased and the number of accidents has increased.

Table 3.1: Accidents statistics for the major R44 intersections

R44 INTERSECTION	ANNUAL AVERAGE ACCIDENT RATE	FATAL AND SERIOUS ACCIDENTS
Bredell/Klein Helderberg Road	9.2	0.4
Winery Road	6.8	0.7
Annandale Road	24.6	0.9
Techno Road	31.0	1.1

3.1.2.7 Issues relating to operating capacity

As a result of growth and subsequent high traffic volumes, congestion along the route has increased with resulting increases in delays, queuing and a decrease in LOS. This is experienced during peak hours, and especially at the key intersections along the route. The results of an analysis of traffic flow capacities during the morning and afternoon peak hours confirmed that delays and queuing typically result in low LOS in the peak direction of flow, from Somerset West to Stellenbosch in the morning peak and in the opposite direction in the afternoon peak. The LOS decreases even further at intersections at the Stellenbosch end of the corridor. This analysis concluded that future operating conditions are likely to deteriorate as prevailing traffic volumes continue to grow (K&T, 2012 – see Appendix E7).

The growth in traffic volumes due to development trends in the Somerset West and Stellenbosch areas surrounding the R44 corridor are expected to continue in the future. One example is the growth in student and staff numbers at the University of Stellenbosch, and the implications this has had for traffic growth in the area – see Box 3.1 for detail in this regard.

The successful economic growth of Stellenbosch and the surrounding area is the main contributor to the traffic growth that has been experienced over the last few years on the R44 and into Stellenbosch. The above example of the growth of Stellenbosch University illustrates another specific key reason for the increase in traffic volumes. In addition, the Stellenbosch Spatial Development Framework indicates that in the long term there is likely to be further development adjacent to the R44 that would continue to add traffic to the existing road network. Details in this regard are included in the description of the affected environment later in this report (see Section 5.3.10), which is presented in Box 3.2 for easy reference.

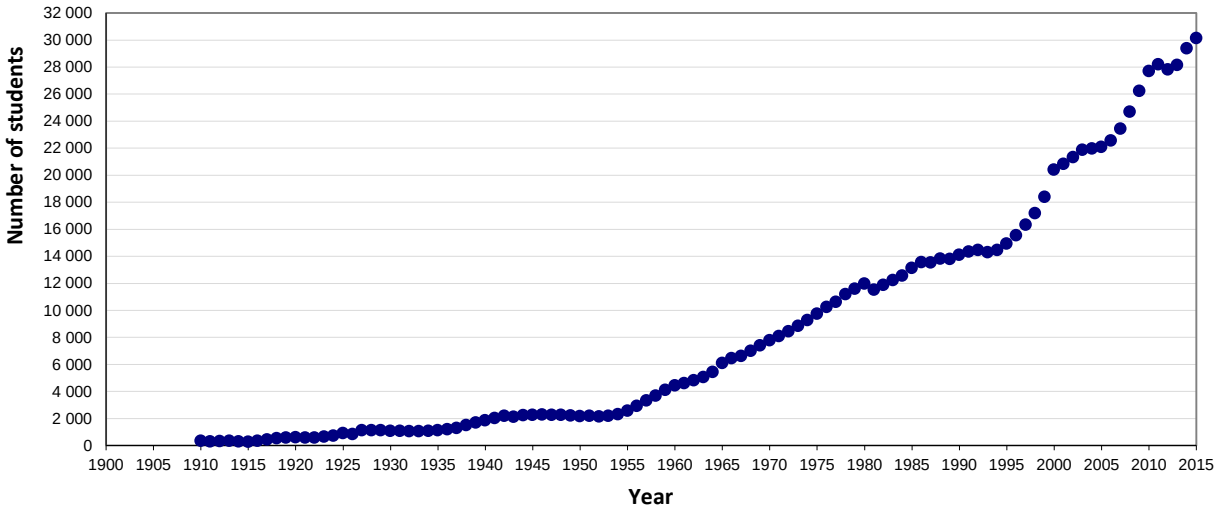
The traffic operational analysis (ITS, 2015) projected the growth rate of the traffic along the R44 to vary between 2% and 4%. Furthermore, the capacity limit of the R44 road network was calculated at a traffic demand increase of 15%, which caps the number of years at 4-5 years into the future. This means that after this point, the network would become overwhelmingly congested and the flow rates throughout the network would begin to decline. Full details regarding this study and its findings follow in Section 3.2.4.2.

BOX 3.1: STATISTICAL PROFILE OF STELLENBOSCH UNIVERSITY

Total numbers of students enrolled at Stellenbosch University (SU) increased rapidly over the past 2 decades – from approximately 15 000 in 1995 to just over 30 000 in 2015. Growth continues, as evidenced by the most recent years, with the 30 150 student figure of 2015 showing an increase of 2.6% relative to the 2014 figure; while the latter figure was 4.4% more than 2013. The number of postgraduate students represent about a third of all students. In 2015, the size of the permanently employed personnel corps was 3 211. It should be noted that the majority of SU students are attached to the main campus in Stellenbosch (over 20 000).

The rapid growth of SU student numbers post 1995 is clear from the below graph showing growth from 1910 to 2015 (note that SU's student number total for 1981 is estimated).

Number of SU students for the years 1910 to 2015



The outcomes of an in-depth and comprehensive mobility study by SU into the transport options which SU students and staff use to reach the campuses and to move around when on campus, showed that a third of all students live in university accommodation on campus while a third live in the greater Stellenbosch with another third in the surrounding towns. Approximately 43% of students primarily use car transport to travel to campus daily. In addition, 83% of SU staff, of which a large group live outside Stellenbosch, also use their cars to travel to and around campus. The car utilisation of both students and staff therefore explains the parking problems and traffic congestion (Source: SU website, 15 September 2015 and 9 December 2015).

BOX 3.2: EXCERPT FROM SECTION 5.3.10

The Stellenbosch SDF identifies a number of new development areas aligned with their vision of creating compact and connected nodes. In addition to 461 ha earmarked for development in Stellenbosch, the SDF earmarks 56 hectares of developable land at the Jamestown / De Zalze node situated approximately 4 km north of the Annandale / R44 Intersection. This includes the expansion of Techno Park and a mixed income development on the municipal land in this vicinity (the Stellenbosch Airfield location). The Municipality is also in the process of developing low income housing to the south of Jamestown along the R44 for 570 units; the first phase of 162 units is currently being completed. These future developments could add additional traffic to the R44 and to Winery Road in the case of Raithby, where 20 ha of land have also been earmarked for development.

3.1.3 SOLUTION

The project rationale above clearly shows that road safety along the R44 is compromised by the turning movements associated with crossing medians in order to access side roads and/or private accesses as well as U-turns for this purpose.

The approach to resolving the safety problem is thus to close all median openings between Steynsrust Road Interchange at the Somerset West end of the R44 and Webersvallei Road at the Stellenbosch end. This would require associated safe turnaround (U-turn) facilities in order to improve the safety along the R44 without sacrificing the operating capacity and mobility along the route. Closing the median openings would improve safety aspects by eliminating right turns across oncoming traffic, dangerous deceleration, U-turn movements and reducing the number of conflict points. The proposed improvements would further increase safety along the R44 for all road users.

A secondary benefit that is anticipated to occur as part of the proposed project is an improvement in the LOS. Traffic congestion and time delays during peak hours would be alleviated along the R44 as a result of the free flow of traffic between Somerset West and Stellenbosch. The dedicated U-turn facility at the Steynsrust Interchange would serve to keep U-turning traffic off the surrounding suburban road network, while the proposed improvements to the five signalised intersections, from Webersvallei Road to Van Rheede Street, would alleviate congestion at the Stellenbosch end of the upgrade road section.

3.2 CONSIDERATION OF ALTERNATIVES

A range of possible alternatives have been considered during the various stages of conceptualising the project. This section describes this process of identification and investigation of potential alternatives.

3.2.1 CONCEPTUAL DESIGN OPTIONS

Various alternatives considered early in the conceptual design phase were not pursued as preliminary investigations indicated that they were not feasible or reasonable for further assessment. These are described in Table 3.2 below.

Table 3.2: Options considered early in the conceptual design phase

Discarded alternative	Rationale for not further considering alternative
The introduction of a diamond interchange at Annandale and Winery Road intersections	When considering grade separation the aim is to provide free-flow for the U-turn. The diamond interchange is less desirable than the roundabout interchange in terms of the type of movements anticipated and the number of stops associated with the U-turn. This option was thus not further considered as an above-ground alternative.
The construction of secondary roads along the route (including options for connecting these roads to the R44)	Specific reasons for not considering secondary roads (either frontage or backage) includes the following: • It is estimated that frontage roads would result in an additional 13 or 26 km of road on one or both sides of the R44. This would require approximately 39 ha of land to be obtained from existing properties for a 30 m road reserve; • Backage roads would require more than 39 ha of new road network to link properties which have had direct access to the R44 closed, back to a limited number of new intersections / interchanges due to the additional distance required for many properties to connect to a new secondary road network; • Closure of R44 access points would obviously remove the existing direct access for visitors from the R44 and require a more indirect route to such properties; • The current traffic volumes are such that “freeway” standards are not yet required. Thus the additional expense of secondary roads is not cost effective; and • The socio-economic and biophysical impacts of a secondary road network would be substantially higher than for the proposed project as it would require substantially more land that the current proposal.

Discarded alternative	Rationale for not further considering alternative
The closure and/or consolidation and/or relocation of certain private accesses along the R44	The closure or consolidation of private accesses would require the construction of secondary roads parallel to the R44, which would require access at some point along the R44. For practical reasons this option was not considered to be viable given the amount of third party property involved.
The introduction of turning lanes and tapers	DTPW initially considered closing only certain median openings while leaving some strategic median openings in place. Crossing these median openings would then be facilitated through the addition of turning lanes and tapers allowing for traffic to slow down on the approach and speed up prior to connecting with the fast lane. However, this was not considered feasible as a safety improvement as vehicles would still cross into the fast lane of oncoming traffic.
The introduction of "loons" in order to facilitate U-turns	A loon is a modified U-turn facility consisting of a turning point to the left side of the road where vehicles wishing to turn right can exit the R44 to the left, where they can wait out of the traffic flow for a gap in the traffic. When there is a gap they can cross to the median opening and wait for an opportunity to enter the oncoming traffic stream in order to complete the U-turn manoeuvre Consideration was initially given to providing a loon to accommodate U-turns in the vicinity of Yonder Hills near Bredell Road. Upon further investigation into the short sight distances and slowing down / speeding up distances between Yonder Hills and nearby intersections this option was not considered viable. Also, both the horizontal and vertical geometric alignment does not support this type of intervention.

3.2.2 INITIAL PROJECT SCHEME PROPOSALS AND PUBLIC RESPONSE

The initial project scheme proposed to meet the overall safety and LOS and/or operational improvement aims of the project comprised the following project components:

- Consolidation of minor roadways and closure of median openings along the R44;
- Improvements of sections of road along the R44 including intersections of the R44 with Steynsrust Road, Bredell Road, and Technopark Road; and
- Introduction of U-turn opportunities which would be facilitated by the introduction of grade-separated roundabouts – one located at the Winery Road / R44 intersection and the other at the Annandale Road / R44 intersection.

During the public consultation process following the distribution of the BID it became apparent that many I&APs did not, for various reasons, consider the proposed grade-separated roundabouts a suitable solution. This was largely based on concern over the visual impact that the roundabouts would have in a largely rural environment and associated negative impacts on cultural heritage and tourism. Directly affected neighbours were also concerned about the impact it could have on issues such as access, business and agriculture. Regarding the median closures, a number of landowners and businesses located between the proposed interchanges were concerned about additional travel distance associated with closed medians.

I&APs thus suggested various other options as potential solutions to the safety and LOS problems along this stretch of road. These included suggestions such as a Stellenbosch bypass, an additional access to Techno Park, secondary service roads running parallel to the R44, an additional new road closer to the mountain foothills, improved public transport, dedicated bus lanes and a reduction in the speed limit. These alternatives were then considered by the technical team, however, none of these alternatives were deemed as suitable/viable to resolve the safety and LOS deficiencies that precipitated this project. These suggested alternatives and DTPW's rationale for not considering them further are described in Table 3.3 below.

Table 3.3 Options proposed by I&APs and DTPW's response for not considering them further

Suggested alternative	Rationale for not further for considering alternative
Stellenbosch bypass	The Stellenbosch bypass project was initially raised many years ago. It is not seen as an viable alternative to the proposed project for the following reasons: • A bypass would not resolve the safety and LOS issues along the R44 for motorists travelling between Somerset West and Stellenbosch. It would simply remove traffic from the northern section of the R44 that is destined for locations beyond Stellenbosch. With an estimated 90 % of R44 traffic destined for Stellenbosch (from Somerset West) there would only be a small reduction of traffic volume on the R44; and • A bypass would be of a similar scale of road as the R44 and would have very high impacts in terms of loss of agricultural land, biophysical and visual impacts. • A grade-separated interchange would be required to link a proposed bypass to the existing R44, thus not addressing the current concern of an above-ground interchange.
An additional new road closer to the mountain foothills	In essence this proposal would entail a second road of a similar scale to the R44 between Somerset West and Stellenbosch. The scale of this suggested solution is substantial as it would require up to 70 ha of land. It would thus have substantial biophysical and environmental impacts, including a substantial effect on current land use. There is likely to be a very strong reaction from landowners where substantial portions of highly intensive farm land would have to be acquired. The implications of an additional new road would thus far outweigh the proposed improvements to the R44. In addition, such a new road would still require appropriate link roads with the existing R44, which would in all likelihood have to be via the main link roads with an interchange as has been proposed.
Public transport – train system	Trains in South Africa are the responsibility of PRASA. It cannot be considered part of a proposed project by DTPW. Currently there is a metro train line running between Somerset West and Stellenbosch. However, many commuters still prefer the convenience of a motor vehicle rather than using a train. Thus unless people are forced onto trains, they will continue to use more convenient private vehicles. The merit of considering a public transport option was further considered in the traffic analysis study (see Appendix E8). The traffic specialist (ITS) explained that the implementation of public transport initiatives could contribute to a reduction in traffic initially, but that it would not address safety and LOS issues along the R44 and would need to be supplemented by other interventions.
Public transport – bus lanes	Implementation of a bus system, whether it functions within the median of the R44 (Bus Rapid Transit [BRT]), along the R44 (normal bus systems) or on a parallel route would be the responsibility of the local municipalities (in this case Stellenbosch Municipality and City of Cape Town). Bus services are currently available between Somerset West and Stellenbosch but as mentioned above commuters still prefer the convenience of using their own vehicles. This might change should a BRT system be implemented as is currently being undertaken in the Cape Town metropolitan area (e.g. My City). The development of such a system would, however, take many more years before it could be fully functional. In the meantime the unsafe conditions on the R44 would persist. A BRT system is often equated with replacing the commuting motor vehicle, However, in reality a system such as the BRT simply reduces the growth of motor vehicle use rather that actually reducing vehicle numbers. Most big cities in the world have highly developed bus, train and underground transport systems, yet their roads continue to remain extremely busy.
Reducing speed to 60 km/h	As mentioned previously, the R44 is a Class 2 road with mobility as its primary function. While reducing the speed limit to 60 km/h would allow adjacent landowners easier access similar to a residential suburb, this would have a negative impact on the function of the road and the daily commuters. The road has a posted speed of 100 km/h and reductions in speed to 60 km/h for such a long length of dual carriageway road are not seen by DTPW as being feasible.

Suggested alternative	Rationale for not further for considering alternative
Turbo roundabout (roundabout with preselected lanes)	While this type of roundabout has many advantages, it is not considered feasible for the type of road and mobility function of the R44. Such roundabouts are also not well known in South Africa and would likely cause their own traffic problems. In an area where many tourist attractions rely on drive-by clientele, confusion regarding the use of such a roundabout may lead to tourists not being able to reach their destination.
Cycle paths along the length of the R44	A significant number of people use bicycles on sections of the R44 between Somerset West and Stellenbosch, whether for commuting to work or for recreation or training. A shared pedestrian and cycle facility is currently being put in place at the northern end of the project study area by Stellenbosch Municipality. DTPW has agreed in principle that the facility can be extended to Jamestown. The issue of extending the cycle path further southwards may be considered by DTPW. However, this is not a specific requirement to meet the main aims of this project. It should be noted that cyclists using the road for training are more likely to use the shoulder of the road than cycle paths. Observations in February prior to the Argus Cycle Tour confirm that training takes place in the relative safety of the shoulder lane.
Construct an additional entrance to Techno Park	A high traffic volume enters Techno Park during the peak traffic hours. Currently there is only one entrance into the park which causes heavy congestion along the R44 and within Stellenbosch. The construction of an additional entrance to Techno Park would be the responsibility of the Techno Park Owners Association and not DTPW. Separate agreements would have to be reached with either the Stellenbosch Municipality and / or DPTW should assistance in this regard be required. This solution would, however, not solve the current problem along the R44 and thus does not form part of the proposed project.
Lowering the existing road level of the R44 to reduce the visual impact of the grade-separated roundabout.	To lower the grade separated roundabout to ground level, would require the vertical re-alignment of the R44 over an approximate distance of 1.4 km. Construction would necessarily require the closing of lanes leading to the unavailability of one lane in each direction for the duration of the construction period. Watercourses crossing the R44 near the Annandale Road Intersection would also need to be realigned or diverted for a considerable distance. Significant infrastructure would also be required to ensure adequate drainage from the R44 to a lower point downstream. The anticipated cost for this alternative would be significantly greater than proposed. Due to the extensive works that would need to be undertaken and the costs involved this alternative is not considered feasible. In reconsidering the project scope to address visual and heritage impacts of a raised roundabout, DTPW is now considering, as an alternative, keeping the R44 at the current level and placing Winery and Annandale Roads below the R44 in the form of a diamond interchange. This is described in more detail in Section 3.2.4 below.

3.2.3 PROJECT SCHEME PROPOSALS AND ALTERNATIVES INCLUDED IN THE DRAFT BAR

During the initial interaction period, various suggestions were also raised as alternatives to the proposed grade-separated roundabouts. This resulted in the consideration of two alternatives that would provide at-grade U-turn opportunities being included for assessment in the Draft BAR. Thus three alternatives were assessed in the Draft BAR for both the Winery Road and Annandale Road Intersections, namely:

- signalised intersections;
- at-grade two-lane roundabouts (traffic circles); and
- grade-separated roundabouts.

During the BID comment period the issue was raised of formally assessing the overall scheme and various alternatives in terms of a cost benefit analysis. This was supported by DTPW and a specialist economic assessment was commissioned to assess the overall economic efficiency of the project by means of conducting a cost benefit analysis (CBA).

Based on the results of the CBA, the economic specialists concluded that the grade-separated roundabout alternative would be economically efficient, despite it being the most expensive alternative. In comparison, the at-grade roundabout and signalised intersection solution would not provide sufficient benefits to justify the cost. It was thus concluded that, from an economic perspective, the project scheme which included the grade-separated roundabout option was the only one of the three proposed alternatives that should be implemented.

The public reaction following the release of the Draft BAR for comment was substantial, strongly stated and very much opposed to a grade-separated roundabout solution. Generally I&APs showed continued support to urgently address the existing safety issues on the R44 and that the median openings should be closed. Nevertheless, many concerns were again raised in relation to the proposed project scheme. I&APs questioned the economic analysis and validity of findings that at-grade options would not be efficient. They were also opposed to the perceived high cost of the project, specifically the cost implications of the grade-separated roundabouts compared to the other alternatives as it is perceived to be an unnecessary expense. There was also further strong reaction against the potential visual and sense of place impacts of grade-separated roundabouts. A further concern raised was that the grade-separated roundabouts were investigated in isolation from the system-wide traffic flows as the impact on the local traffic system on each end of the R44 corridor had not been fully analysed. Thus objections were raised on this basis that improving free-flow traffic between Somerset West and Stellenbosch would simply result in compounding congestion at both ends of the route where they enter the "urban environment". A number of I&APs also insisted that providing public transport facilities would resolve the safety and LOS issues along the route.

3.2.4 INVESTIGATION OF AT-GRADE ROUNDABOUT OPTIONS AND RELATED INFRASTRUCTURE

3.2.4.1 Interim revised project scheme

In light of the public reaction to the findings of the Draft BAR, the technical engineering team was tasked to consider a revised scheme that would address the key technical perspective issues that had been raised. The following were key considerations to identifying a revised project scheme:

- The increased traffic that would be generated on Steynsrust Road and the surrounding street network due to the closure of medians, including the additional loading that would be placed on this network while the "left-in" at Bredell Road would be closed;
- Requests from Somerset College and Klein Helderberg to enter into and exist out of Bredell Road onto the R44;
- The visual impacts and the considerably higher expense associated with the grade-separated roundabouts at Winery and Annandale Roads; and
- The provision of an acceptable U-turn opportunity at Webersvallei traffic lights in the light of the indication that traffic lights at Winery and Annandale Roads would not be efficient to provide safe U-turn opportunities.

K&T thus identified a revised project scheme that would involve U-turn facilities and at-grade roundabouts including the following components:

- A dedicated U-turn bridge at the Steynsrust Road Intersection which would avoid loading traffic onto the street network in this area;
- The provision of an at-grade roundabout at the Bredell Road Intersection;
- The provision of at-grade roundabouts at Winery and Annandale Roads, which would result in lower land acquisition requirements; and

- An at-grade roundabout near the Jamestown Cemetery which would function as a dedicated U-turn facility.

ITS Engineers (Pty) Ltd (ITS), an independent traffic specialist, was subsequently appointed to provide an operational analysis of the interim revised scheme and alternatives. The scope of work was also to include a comparison of any revised solution with the originally proposed grade-separated roundabout solution. The purpose of the ITS study was to quantify and evaluate in detail the different upgrade alternatives along the R44 within the context of the current capacity constraints on either side of the study section, i.e. in Stellenbosch and Somerset West (refer to Appendix E8 for a copy of the report).

The specialist report tested 10 different combinations of the quantity, positions, number of lanes of at-grade roundabouts and / or grade-separated interchanges along the R44 as well as other intersection upgrades within Stellenbosch.

3.2.4.2 Traffic modelling approach and findings

A micro-simulation model of the R44 corridor was created to test the traffic-related impacts associated with various alternatives and combinations. The 10 modelled alternatives are shown in Table 3.4 below. The modelling process included the evaluation of the R44 travel times, overall average network speed and trip times between major destinations as well as the future capacity constraints of the network.

Table 3.4 Alternatives modelled in traffic operational analysis

ID	Abbr.	Action / Implementation
A1	EX	Existing geometry and control
A2	EX + Closed	Existing scenario with closed medians + 6 second dedicated U-Turning phase at the Annandale signalised intersection
B1	2 x 2RBS	Two double-lane roundabouts at Annandale Road and Winery Road + closed medians
B2	2 x 3RBS	Two triple-lane roundabouts at Annandale Road and Winery Road + closed medians
B3	2 x 3RBS + O	Two triple-lane roundabouts at Annandale Road and Winery Road + closed medians + other signalised Intersection upgrades
C1	4 x 2RBS	Four double-lane roundabouts at Annandale Road, Winery Road, Bredell Road and Jamestown Cemetery access + Steynsrust Bridge U-turn facility + closed medians
C2	4 x 3RBS	Four triple-lane roundabouts at Annandale Road, Winery Road, Bredell Road and Jamestown Cemetery access + Steynsrust Bridge U-Turn facility + closed medians
C3	4 x 3RBS + O	Four triple-lane roundabouts at Annandale Road, Winery Road, Bredell Road and Jamestown Cemetery access + Steynsrust Bridge U-turn facility + closed medians+ other signalised Intersection upgrades
D1	2 x ICS	Two grade-separated interchanges at Annandale Road and Winery Road + Steynsrust Bridge U-turn facility + closed medians
D3	2 x ICS + O	Two grade-separated interchanges at Annandale Road and Winery Road + Steynsrust Bridge U-turn facility + closed Medians + other signalised intersection upgrades

As a first step, a base model representing the existing geometry and traffic control along the R44 was coded and validated until satisfactorily authenticated against reality. This base model was then recoded for various alternatives and combinations of new interventions.

Traffic volume scenarios were investigated by using historical counting data to plot likely growth estimates, as represented in Figure 3.4. The figure indicates that the growth rate of the traffic along the R44 is likely to vary from 2% to 4% per annum. However, the study notes that as this growth continues the R44 will reach a vehicle capacity limit at which point the LOS would be deemed to have failed.

The traffic analysis determined that the capacity limit of the R44 road network was calculated at a traffic demand increase of 15% over the 2014 traffic volumes. This means that after this point, the network would become overwhelmingly congested and the flow rates throughout the network would begin to decline. Traffic congestion is characterised by slower speeds, longer trip times, delays and vehicular queuing. On this basis, the modelling results of all the upgrade alternatives were compared to current demand and at a 15% increase in demand.

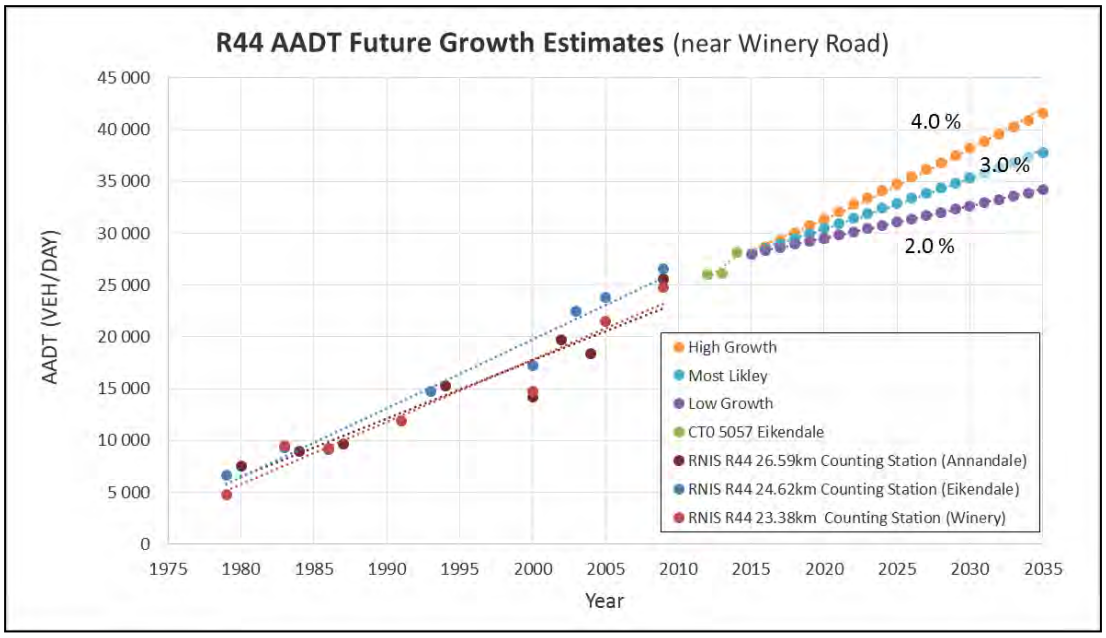


Figure 3.4: R44 Future traffic growth estimations, measured in average annual daily traffic (AADT)

Whilst road user costs can be divided into four categories, i.e. time related costs; safety costs; vehicle operating costs; and environmental costs, the simulation modelling focussed primarily on time-related costs in terms of vehicle delays. These delays result from capacity constraints in the road network and would be impacted by possible upgrade alternatives.

Overall system performance measures were extracted from the simulation model in order to determine the network-wide impacts of the range of upgrade alternatives. These system performance measures included:

- Total network travel time;
- Network travel time per vehicle trip, or average trip time; and
- Network capacity constraints at intersections.

The alternatives were analysed for two demand scenarios, namely:

- The existing demand volumes in 2014; and
- At a 15% increase in the current demand, which is representative of the projected situation on the road within a period of five years.

(i) <u>Total network travel time</u>

The overall network travel time was calculated in order to determine the total savings/gains in travel time due to the various alternatives.

The key findings were as follows:

- Double-lane at-grade roundabouts would add network travel time in every relative alternative.
- Triple-lane at-grade-roundabouts would result in similar travelling time per day (at current demand) for the commuters within the modelled network. However, with a 15% increase in demand when compared to the existing geometry (A1), the triple-lane at-grade roundabouts would reduce travel

time per day by 3% and 4.3% for two and four roundabouts, respectively. The four roundabouts would have a higher reduction in travel time per day than two roundabouts because they would distribute the bottlenecks along the R44 more evenly during the peak periods. This is because vehicles would temporarily be stored at the at-grade roundabouts, thus alleviating congestion downstream of the network.

- Grade-separated roundabouts (at current demand) would result in 4.1% reduced travelling time per day within the modelled network. With a 15% increase in demand, the grade-separated roundabouts would reduce travel time by 5%. The grade-separated roundabouts would, however, not create multiple bottlenecks, but rather concentrate the bottleneck at Stellenbosch.
- Upgrading of the signalised intersections within Stellenbosch would alleviate the congestion bottlenecks formed within this area. This would result in a reduction in travel time for the two triple-lane at-grade, four triple-lane at-grade roundabouts and the two grade-separated roundabouts of 9.6%, 8.9% and 12.7% respectively.

From these results it is clear that the triple-lane at-grade roundabouts perform satisfactorily and that the grade-separated roundabouts perform the best in terms of reducing road user costs. However, upgrades to the signalised intersections within Stellenbosch would be required in all cases.

(ii) Average trip time

In-depth investigation of the average trip time experienced by vehicles travelling between major origin-destination pairs within the network yielded the following key findings:

- During the off-peak periods, all the at-grade roundabout alternatives add network trip time because motorists would have no choice but to slow down at the roundabouts where free-flow conditions currently exist. Providing roundabouts at four positions would thus add more network trip time compared to two positions.
- During the peak periods, the double-lane roundabouts would experience difficulty to accommodate the high through flow, and cause even greater delays than under existing conditions. The addition of an extra through lane in the form of triple-lane roundabouts would reduce the average network trip time. Upgrading the signalised intersections in Stellenbosch would further reduce the average network trip time.
- The grade-separated roundabout interchanges would perform the best of all the scenarios as they would facilitate free-flow conditions for both directions of travel at each interchange.

(iii) Network capacity constraints at intersections

Capacity refers to the maximum flow possible along a route, which is determined by the critical intersection capacity along a route such as the R44. The total travel time along a road corridor partly depends on the delay associated with the waiting time in queues along the route. The closer a particular intersection is to reaching capacity, the higher the waiting time would be at that intersection and the associated added travel time along that route. Once the demand at an intersection passes its capacity point, delays increase significantly. This has the following implications:

- Signalised intersections: Capacity is determined by the number of lanes approaching the intersection; the number and length of receiving lanes; and the amount of green signal time given to the approach. The total green time available decreases as a result of more red and yellow “lost time” should more signal phases be included in the signal sequences.
- Roundabouts: Capacity is determined by the ability of traffic to enter the stream of vehicles in the circulating roadway. With little or no circulating flow, a double-lane roundabout can accommodate approximately 2 600 vehicles per hour. As flow in a roundabout approaches 1 800 vehicles per hour, entering the stream of circulating motor vehicles within the roundabout becomes more difficult.
- Open road with free-flow conditions: Capacity is determined by the following distance that vehicles keep between themselves, typically between 2 and 3 seconds. This translates to a saturation flow

rate of approximately 2 000 vehicles per hour per lane. Therefore, the open stretches of the R44 with two lanes under free-flow conditions have a capacity of approximately 4 000 vehicles per hour.

In order to determine the capacity constraints along the R44 corridor, the modelled networks were "flooded" with vehicles to determine at which points the intersections would reach capacity. For each scenario investigated (see Figures 3.5 to 3.10), the existing volumes travelling along the R44 in the morning peak direction were plotted against distance from Somerset West. The blue line represents the current capacity volume of the northbound approach leg (including left, right and through movements) at each of the study intersections, while the red line represents the capacity of the northbound approach leg under the modelled alternative (including left, right, and through movements) at each of the study intersections.

The results of these investigations are presented in more detail below.

Alternative 1 – Existing geometry and control: The results indicate that the existing network could potentially accommodate an extra 15% of traffic growth, which amounts to a remaining design life of between 0 to 5 years (refer to Figure 3.5). The intersections with constrained capacity are located within Stellenbosch, the most critical of which is Webersvallei Road, with only 4% spare capacity at present.

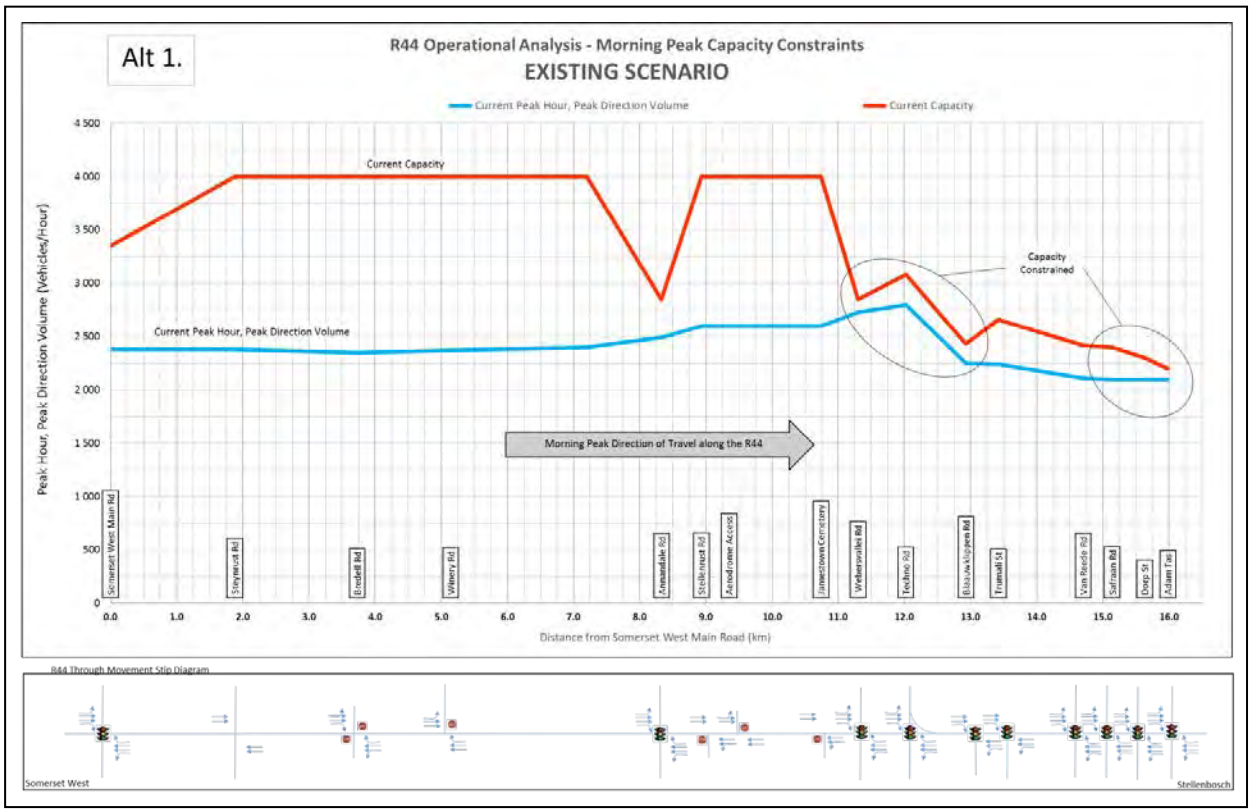


Figure 3.5: Volume and capacity constraints along R44 corridor: Existing scenario (Alternative 1)

Alternative 2 – Short to medium term solutions: The results of the investigation into the following potential short to medium term solutions have been included in the same graph to indicate the impact of each of them individually (see Figure 3.6 below):

- Public transport services: It was assumed that a public transport service (e.g. a bus rapid transit system) would reduce the number of vehicles on the road by 3 % to 10%, as represented by the blue

dotted line in the graph. However, the traffic analysis noted that a bus service would not in reality reduce traffic volumes along the R44, but would serve to accommodate future growth demand.

- Improving the efficiency of the existing signals: The capacity of the existing signalised intersections was modelled with improved signal phasing, cycle times and synchronisation by assigning more green time to the through movements, thus adding delay for the cross traffic. This would result in an increase in capacity of approximately 10% along the R44 north of Webersvallei Road (represented by the dashed red line in Figure 3.6), which is assumed to be the best case scenario for this medium-term solution.
- Adding a dedicated U-turning phase at the existing Annandale Road signalised intersection: If all the median openings along the R44 were closed and users would have to make U-turn movements at Annandale Road (an amount of 40 U-turns in each direction during peak hour), the capacity of this intersection would be reduced by 11% if a dedicated U-turning phase was added to the signal control. The red dot on the graph indicates that the intersection would not be able to accommodate this intervention under existing conditions.

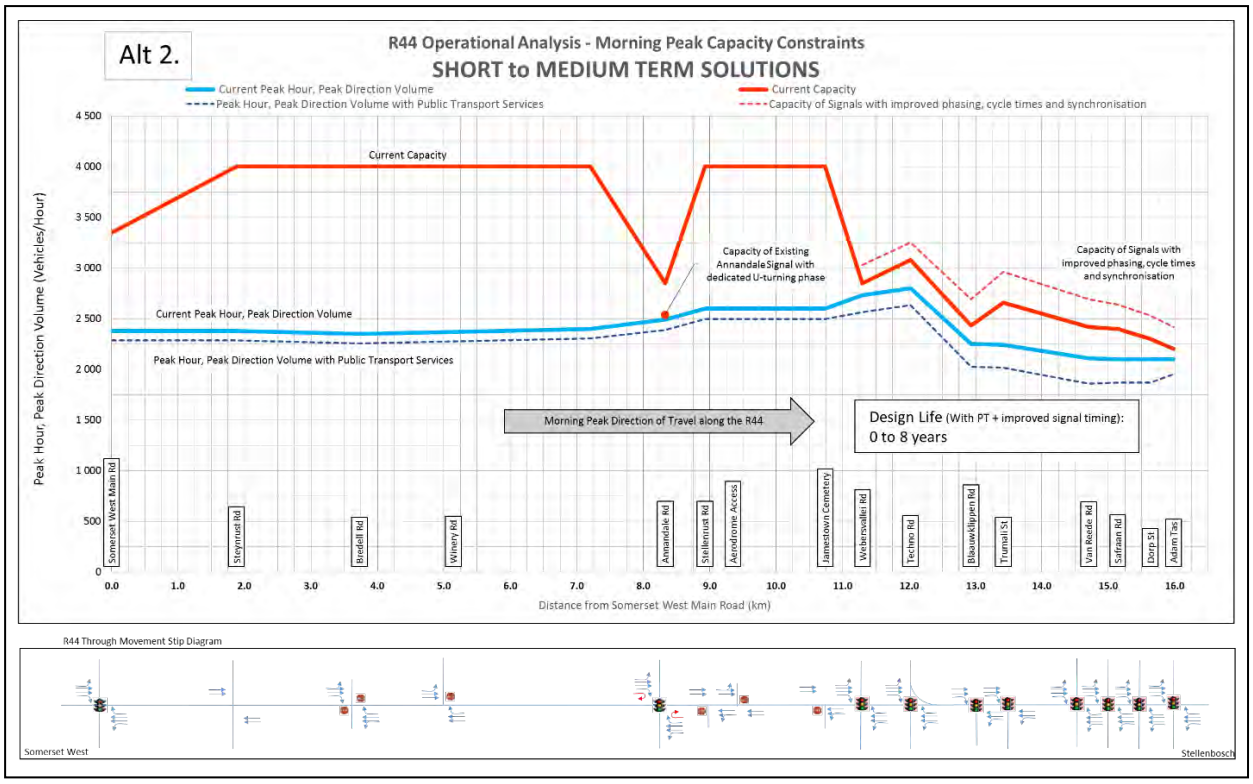


Figure 3.6: Volume and capacity constraints along R44 corridor: Short- to medium-term solutions (Alternative 2)

***Alternative 3 – Double-lane roundabouts**:* This alternative included three double-lane at-grade roundabouts, at Bredell, Winery and Annandale Roads, combined with two U-turn facilities, at Steynsrust Interchange and the Jamestown Cemetery access (refer to the strip diagram at the bottom of Figure 3.7). The following results obtained from the simulation modelling are pertinent:

- At current demand, a double-lane at-grade roundabout at the existing Annandale Intersection would reach its capacity limit as soon as it is built. This is indicated by the red line (representing the modelled alternative) dipping below the blue line (representing existing capacity). Vehicles travelling from Somerset West towards Stellenbosch would thus be delayed in long queues during peak hours. This would lead to an alleviation of congestion at the signalised intersections on the Stellenbosch side of Annandale, as the volume of vehicles downstream of the roundabout would be reduced

(represented by the dashed blue line). The traffic analysis states that an Annandale at-grade roundabout would not be possible at the current demand.

- Double-lane at-grade roundabouts at Winery Road and Bredell Road would have a slightly higher capacity than that of Annandale as a result of lower circulating flow within the roundabout. This means that there are more vehicles attempting to turn into Annandale from the R44 than there are vehicles attempting to turn into Winery or Bredell Road from the R44.
- The double-lane at-grade roundabout network could accommodate an extra 15% of traffic growth, which amounts to a remaining design life between 0 to 5 years.

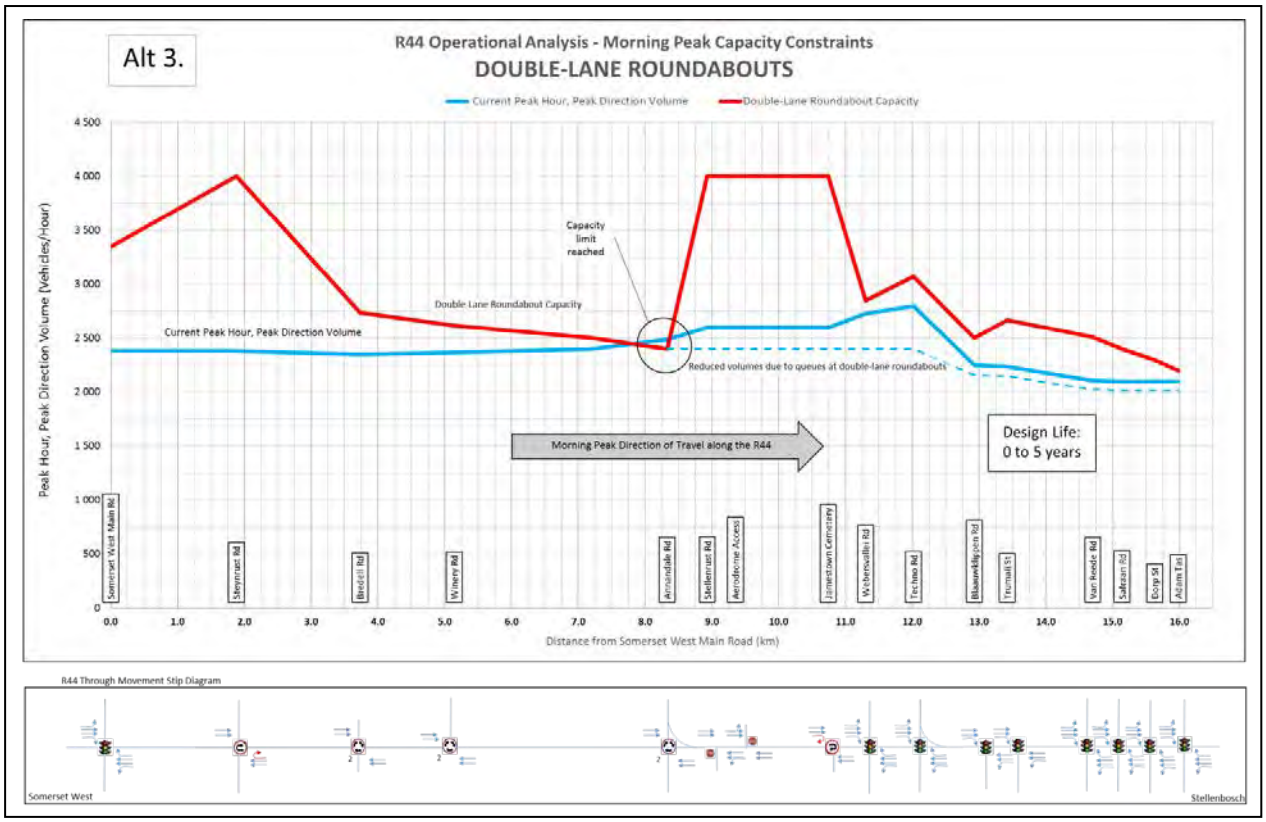


Figure 3.7: Volume and capacity constraints along R44 corridor: Double-lane roundabouts (Alternative 3)

***Alternative 4 – Triple-Lane Roundabouts**:* This alternative included three triple-lane at-grade roundabouts, at Bredell, Winery and Annandale Roads, combined with two U-turn facilities, at Steynsrust Interchange and the Jamestown Cemetery access (see Figure 3.8 below). The main results of the traffic simulation relating to this alternative are as follows:

- As a result of the extra lane on each approach and through the roundabout, a triple-lane at-grade roundabout should offer approximately 40% to 50% more capacity compared to a double-lane roundabout. The extra lane through the roundabout would reduce the queues and delay significantly. Thus it is concluded that at-grade roundabouts would be a viable option on condition that they have three circulating lanes to allow for the through movements along the R44. The theoretical design life of these triple-lane roundabouts would be in the order of 8 to 10 years.
- It is important to note that a triple-lane roundabout is a theoretical concept which is not considered viable in practice. The operational efficiency, safety and driver behaviour at high capacity (triple-lane) roundabouts along a mobility corridor in a semi-rural environment are considered problematic in the current South African road user context. There are no similar examples anywhere in South Africa from which to determine the actual operations. Thus the design life is considered to be purely theoretical and based on ideal driver behaviour. In addition to challenges regarding the operational

performance of triple-lane roundabouts, crashes on entry and exit would be an issue. This specifically relates to the entry and exiting conflicts where three vehicles would enter and exit alongside. This frequently would result in path overlaps and in sideswipe crashes. For example, in Germany two-lane exits out of two-lane roundabouts are not being constructed any more. Exits are restricted to single lanes only. This avoids the occurrence of critical exiting path overlaps. Hence, the traffic operational analysis does not recommend the use of triple-lane roundabouts in the high speed, high capacity environment of the R44.

- The capacity of signalised intersections within Stellenbosch may be improved to increase the capacity of the whole network. Upgrades, including an extra right turning lane at Van Rheede Road, a left turn slip lane at Techno Road and three through lanes at all intersections, were modelled to accommodate the specific capacity constraints at each intersection.
- The results indicated that the triple-lane at-grade roundabout network without signal upgrades could accommodate an extra 15% of traffic growth, which would amount to a remaining design life of 0 to 5 years. The same network with signal upgrades could accommodate an extra 30% to 40% of growth, which would amount to a remaining design life of 10 to 15 years.

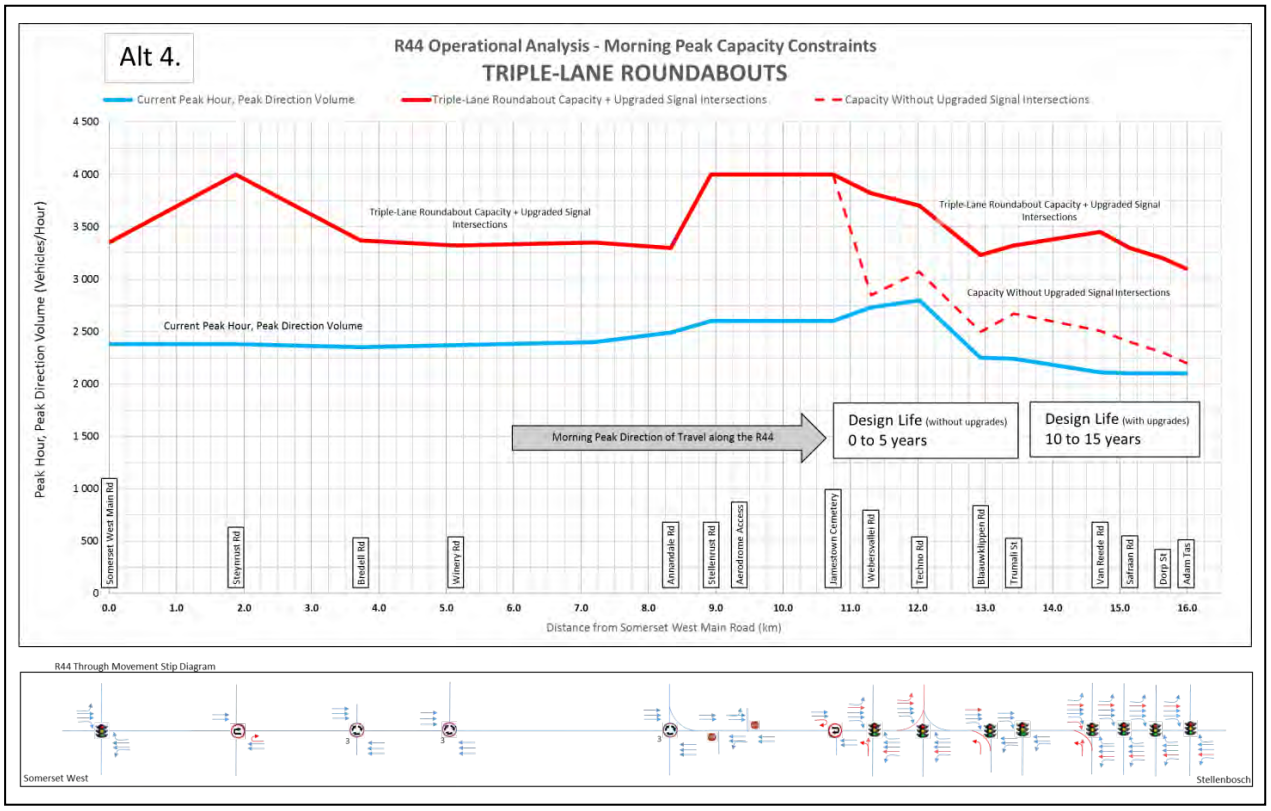


Figure 3.8: Volume and capacity constraints along R44 corridor: Triple-lane roundabouts (Alternative 4)

Alternative 5 – Grade-separated roundabouts: The grade-separated roundabouts alternative includes two grade-separated roundabout interchanges, at Winery and Annandale Roads, and two U-turn facilities, at Steynsrust Interchange and at the Jamestown Cemetery access (see Figure 3.9). For this alternative, the main results of the traffic simulation are as follows:

- The capacity limit along the R44 would be similar to the capacity limit of the existing scenario. The exception would be that the grade-separated roundabout interchanges would improve the capacity at Annandale Road as it would facilitate free-flow conditions for both directions of travel at the interchange. This means that for this alternative, the existing capacity along the R44 would be maintained, compared to the at-grade roundabouts which would reduce the capacity of the system.

- It is important to note that the bottlenecks would remain at the signalised intersections in Stellenbosch. In this case with the grade-separated roundabouts vehicles would experience no delay at Annandale Road and therefore reach Stellenbosch sooner. The capacity of the signalised intersections within Stellenbosch would need to be improved to increase the capacity of the whole network.
- The grade-separated roundabout network without signal upgrades could accommodate an extra 15% of traffic growth, amounting to a remaining design life of 0 to 5 years. The same network with signal upgrades could accommodate an extra 30% to 40% growth, amounting to a remaining design life of 10 to 15 years. It should be noted that the traffic constraints would be the signalised intersections in Stellenbosch and not the proposed interchanges.

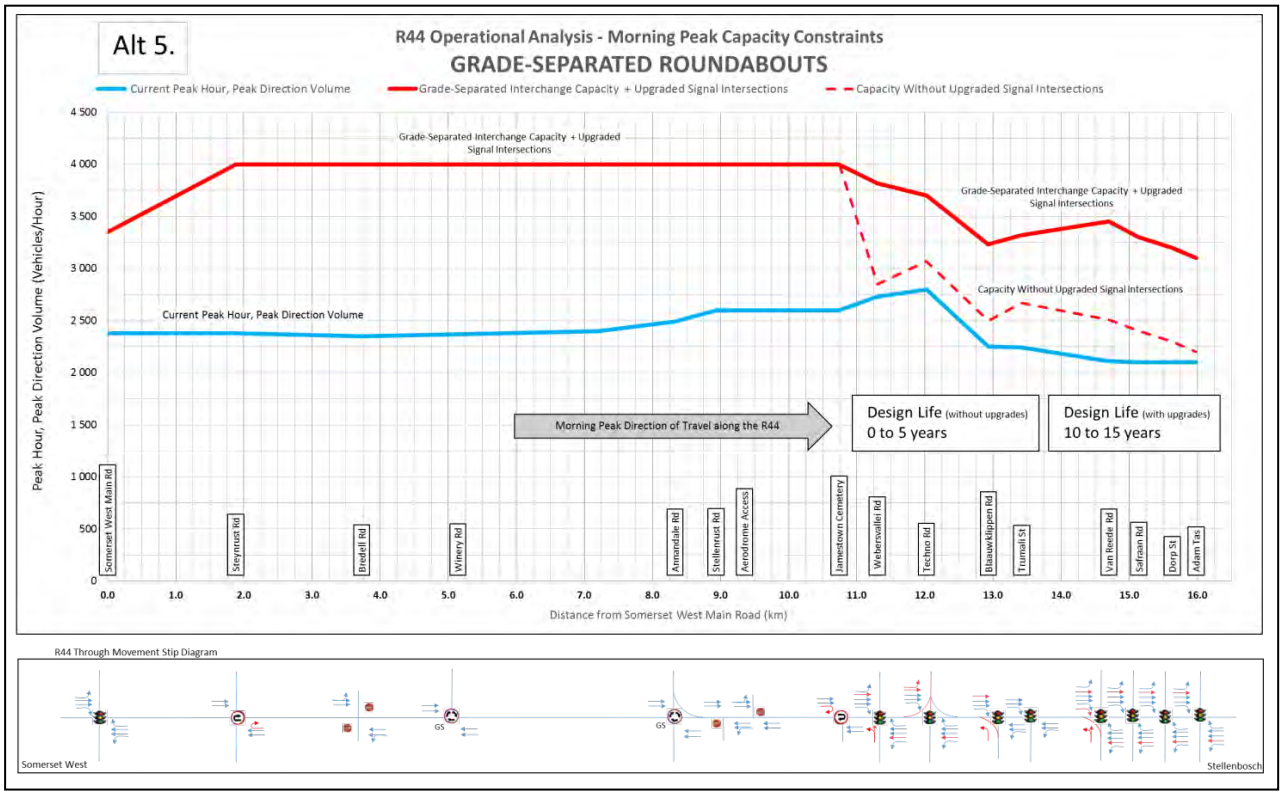


Figure 3.9: Volume / capacity constraints along R44 corridor: Grade-separated roundabouts (Alternative 5)

Alternative 6 – Grade-separated roundabouts plus bypass or tunnel: This alternative included two grade-separated roundabout interchanges and two U-turn facilities as in Alternative 5 and it assumed that a bypass or tunnel would be built to alleviate congestion by directing traffic past the Stellenbosch centre (see Figure 3.10). The alternative was modelled with the assumption that the bypass/tunnel would divert approximately 1 000 vehicles away from the R44 corridor. It was found that the grade-separated roundabout network with a by-pass or a tunnel could accommodate an extra 50% of growth, which translates to a remaining design life of 20 to 25 years.

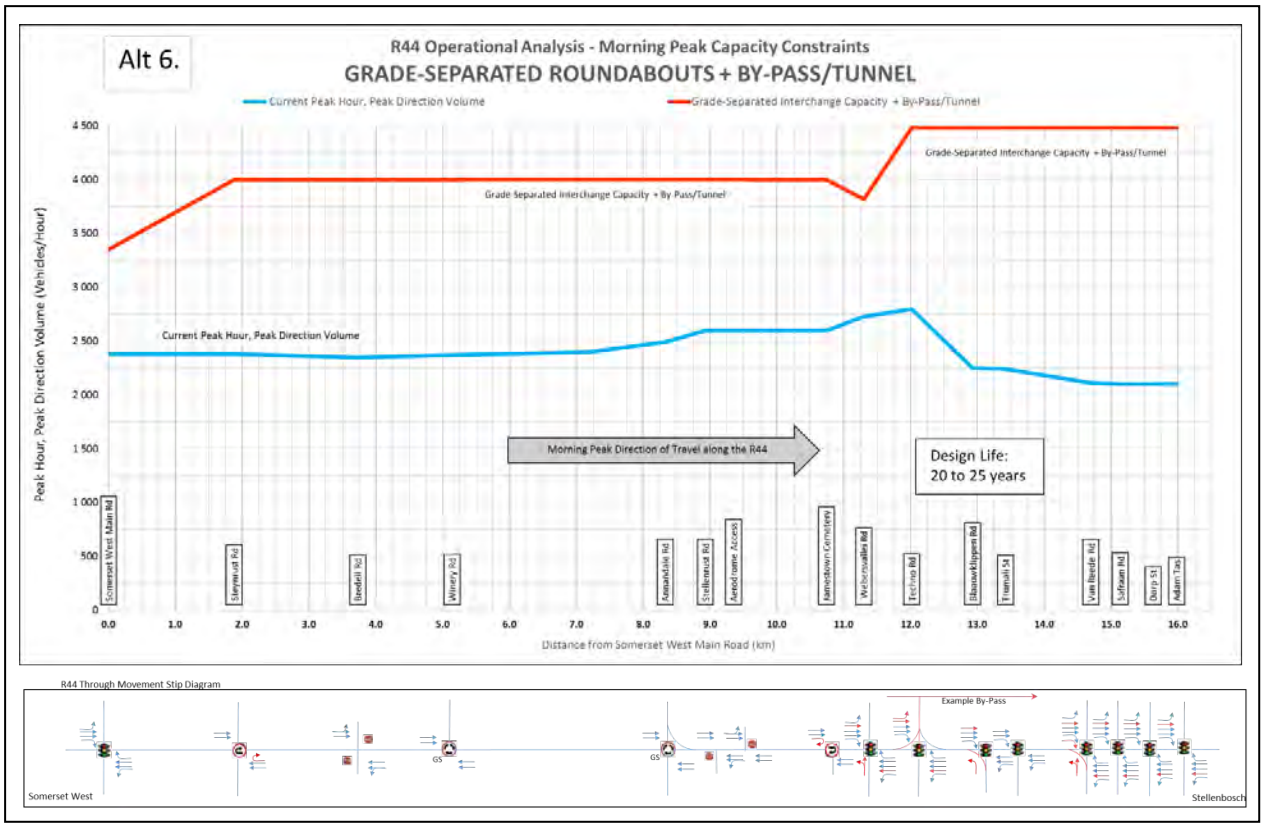


Figure 3.10: Volume and capacity constraints along R44 corridor: Grade-separated roundabouts with bypass or tunnel (Alternative 6)

(iv) Traffic operational analysis discussion/findings

The key findings and conclusions of the traffic operational analysis are summarised as follows:

- In relation to the R44 capacity:
  - The capacity limit of the R44 road network was calculated at a traffic demand increase of 15%.
  - The R44 is operating close to capacity, thus most intersections within Stellenbosch would operate above capacity with a 15% increase in traffic demand, which translates to five years' growth.
  - The signalised intersections within Stellenbosch would therefore require upgrading in the near future regardless of upgrades implemented elsewhere along the R44 corridor. This issue would become even more apparent if a grade-separated interchange were to be introduced at Annandale Road Intersection as vehicles would arrive sooner at the first of the signalised intersections at the Stellenbosch end of the R44.

- In relation to at-grade intersections:
  - The existing signalised intersection at Annandale Road would not be able to accommodate the addition of a dedicated U-turn phase at current traffic levels. This would be further exacerbated with additional traffic growth.
  - Double-lane at-grade roundabouts would not be viable to provide U-turn facilities in addition to accommodating all through traffic and turning movements associated with secondary roads as they would add network travel time in every scenario. This applies especially at the existing Annandale Intersection, where its capacity limit would be reached as soon as it is built. While double-lane roundabouts at Winery Road and Bredell Road would be able to accommodate a higher entering flow due to less conflicting flow, the capacity would be reached within five years.

- Three-lane at-grade roundabouts were also investigated and analysed to determine whether better operational capacity and LOS could be achieved along the R44. While the theoretical design life of triple-lane roundabouts would be in the order of 8 to 10 years, this is not considered viable in practise (refer to the discussion under Alternative 4 above for the reasons in this regard).

- In relation to grade-separated interchanges:
  - Grade-separated roundabout interchanges would provide the best LOS and most efficient network travel times as a result of facilitating free-flow conditions for both directions of travel along the R44 while the side road traffic would experience minimal delays. This effect would apply to most forms of interchange, which would serve to separate the R44 traffic from the cross road traffic. Removing the at-grade control constraints (in the form of either at-grade roundabouts or traffic signals) would thus result in traffic moving more freely towards Stellenbosch and/or Somerset West with a concomitant increase in congestion at the end points of the study section of the R44. This means that the design life of any solution incorporating grade-separated interchanges in the middle section of the R44 is dependent on the bottlenecks or constraints on either side, i.e. at the Stellenbosch and/or the Somerset West end. As the current spare capacity of the R44 entering/exiting Stellenbosch is less than 10%, there is very little design life left if measured against the capacity of the overall system.
  - The capacity constraints of the R44 at the Stellenbosch end could be improved by adding more through lanes at the signalised intersections from Webersvallei Road to Van Rheede Street. This could add another 30% to 40% capacity, i.e. a design life of 10 to 15 years. Beyond that timeframe, the traffic operational analysis recommends that a bypass should be considered. (It should be noted that the recommendation regarding a Stellenbosch bypass does not fall within the scope of this proposed project. The analysis states that the alignment of a bypass and the various options should be studied and planned as soon as possible to ensure the long term sustainability of Stellenbosch. This information has been provided to the Stellenbosch Local Municipality for consideration.)

3.2.5 REVISED PROJECT SCHEME AND ALTERNATIVES

3.2.5.1 Further investigation of alternative considerations for grade-separated interchanges

The findings of the traffic analysis thus determined that an at-grade scheme with either traffic lights or at-grade roundabouts was not viable. It further confirmed that grade-separated interchanges would be the most effective alternative to provide U-turn movement facilities, especially if capacity constraints were improved by including upgrading of signalised intersections within Stellenbosch into the project scheme.

These findings led to further investigation of alternative considerations for grade-separated interchanges. Firstly, various other options for grade-separated above-ground interchanges were compared to reconsider the potential visual effect to that of the grade-separated roundabouts. This exercise focussed on various configurations of diamond interchanges. However, it was found that the bridge deck surface area as well as the footprint areas of the structures would be comparable to that of the above-ground roundabouts. Also, the visual effect of an above-ground structure from a distance perspective is caused in the first instance by its elevated position in relation to its surrounds rather than by the deck surface. Thus a smaller deck surface would not have any significant mitigation with regards to the visual effect of one above-ground structure compared to another. In addition, from a technical perspective traffic flow on a diamond interchange would be less efficient than that of a grade-separated roundabout.

Secondly, the technical and engineering implications of below-ground grade-separated interchange options were further investigated. Below-ground construction takes longer, has higher construction costs than above-ground construction and results in far greater traffic disruption during the construction phase. This is due to more complex construction procedures and sequences for below-ground works, which also require more complex and costly arrangements for traffic accommodation during the construction phase. It was thus estimated that a below-ground structure would take approximately eight months, or 30%, longer to construct than a similar above-ground structure, resulting in higher costs in the range of 35% to 45%. Costs would furthermore be significantly increased by any rock being encountered, a highly likely scenario in this region.

The question the project team then posed was whether the higher monetary cost of a below-ground option could be offset against the largely unquantified benefits to society, such as mitigation of potential visual and sense of place impacts. This then led to the further investigations which are discussed in the next section.

3.2.5.2 Investigation into economic efficiency of project scheme alternatives / Cost benefit analysis

An investigation into the economic efficiency of a project scheme with above-ground versus below-ground structures was then undertaken to determine which alternatives could be considered viable for further consideration (Economic Study, Addendum 1 – see specialist report in Appendix E6.3)

(i) Methodology

The methodology that the economic specialists used to assess the economic efficiency of the proposed upgrades was an economic Cost Benefit Analysis (CBA). CBA treats the national economy as an entity in and of itself. It assumes, with some important caveats, that what is demonstrably good for the economy as a whole is a reasonable approximation of what would be good for the majority of the people living and working in that area.

CBA is a means of taking all the direct costs and all the direct benefits of a proposed project and comparing these. It is the conventional method that is used in project appraisal. The outcome of this analysis is the reporting of a net present value (NPV), a benefit cost ratio (BCR) and an internal rate of return (IRR). This provides both a financial and an economic CBA. The difference between the financial and economic results is that the financial analysis looks at monetary costs and benefits of the alternatives while the economic analysis includes the costs to society.

A high BCR is usually a good indicator that it would be possible to raise finance to implement a project. In the case of a private sector investment a good BCR would be part of the business case to funders. If it is a public infrastructure project, a high BCR should give confidence that it is worth funding the project directly from the Treasury.

If the evaluated benefits of a project are indeed greater than the overall project costs then the BCR would be greater than 1. A BCR greater than 1 indicates that the completed project would constitute an economic asset; a BCR less than 1 implies that the project would be an economic liability. The higher the BCR the less risk there is that the proposed investment could turn out to be less than viable economically. Low BCR's, even if greater than 1, provide a warning that a project could be risky and may turn out to become an economic liability instead of an asset.

In a CBA one always compares the new project to the base case or "do nothing" case. The **costs** of this project are the initial construction costs, rehabilitation and maintenance costs and the operating costs.

The **benefits** relate to the reduction (or increases in some cases) in road user costs from using the upgraded road network compared with the non-upgraded network. The analysis period incorporates all the costs and benefits over a 30 year period and values are discounted to present day values by using a real social discount rate of 8%.

Technically two different costs are defined in the use of a vehicle. The first are the so-called vehicle operating costs. These are specific to the cost of using a vehicle. Second are road user costs. These include vehicle operating costs but also include costs of potential accidents and time costs. Some analysts use the methodological approach and software of the Highway Design and Maintenance Standard Model (HDM4) directly to evaluate road user costs and benefits. The economic specialist notes, however, that the HDM4 software is very restrictive, somewhat 'black box' in nature and the results difficult to convey to the general public. As a consequence the economic specialist (SES) has developed its own spread sheet based software which, while it follows the HDM4 algorithms, is more flexible, transparent and the results are easier to convey to the lay person.

The economic specialist study has employed an economic CBA that has taken a number of costs and benefits into account. The costs are:

- The initial capital cost of constructing the intersections, road and signal upgrades;
- The acquisition of land (which would cover for the loss of productive use of the land);
- The costs of maintaining the intersections and upgrades to specific standards;
- Professional fees; and
- Additional travel for those landowners abutting the R44 that previously turned across the road median but would now have to travel to a roundabout or turning point to execute a U-turn.

The benefits of the project relate to:

- Reduced travel time on the local traffic network. This is based on the traffic analysis model which included local residents using the access points along the length of the R44;
- The reduction in accidents from the improved intersections;
- A reduction in accidents due to preventing vehicles from turning across the road median; and
- The reduction in CO_2 emissions from reduced congestion.

The economic analysis focused purely on direct costs and benefits and did not take any indirect costs and benefits into account. Indirect costs and benefits would include those costs and benefits resulting from multiplier effects. For example, the upgrading of a road would have spin off effects for the construction industry and the building materials supply industries. These, in turn, would have backward linkages with other commodity suppliers and retail industries. A cost that could not be quantified is the visual impact of the above-ground grade-separated roundabouts.

The key assumptions and limitations of the Addendum economic report are provided in Sections 3 and 5.2 of the Addendum 1 economic specialist study (see Appendix E6.3).

(ii) Alternatives assessed

The economic analysis focused on those alternatives that were considered viable in the traffic analysis model. The following four alternatives were thus considered further in the economic study:

- *Alternative 1*: Two above-ground, grade-separated roundabouts at the Annandale and Winery Road Intersections. These are similar to the only efficient alternative from the previous analysis (undertaken in relation to the three alternatives assessed in the Draft BAR), but with the addition of a grade separated U-turn bridge at the existing Steynsrust Road Interchange.
- *Alternative 2*: As per above, but with additional through lanes at five key signalised intersections leading into Stellenbosch from Webersvallei Road. There would also be changes to the timing and

phases of these signals entering Stellenbosch. A grade-separated U-turn bridge would also be included near the Jamestown Cemetery.

- *Alternative 3*: Two below-ground, grade-separated roundabouts at the Annandale and Winery Road Intersections, grade-separated U-turn bridges at Steynsrust and Jamestown Cemetery, with lane and signal improvements into Stellenbosch. This addresses the visual concerns related to the above-ground roundabout. This alternative assumes a cost with 30% underground rock.
- *Alternative 4*: Two below-ground diamond interchanges at the Annandale and Winery Road Intersections, grade-separated U-turn bridges at Steynsrust and Jamestown Cemetery and again with the through lanes and signal improvements into Stellenbosch. These below-ground diamond interchanges would be less expensive to construct than the below-ground roundabouts. This assumes a cost with 30% underground rock. However, they would result in a lower LOS due to reduced sight and stopping distances. A diamond interchange would also have more conflicting movements than a roundabout interchange (which has a left-turn only approach and departure and hence has fewer conflicting movements). Roundabout interchanges are more efficient in processing U-turn manoeuvres for which the project caters.

(iii) Results of the cost benefit analysis

The results of the cost benefit analysis for the four alternatives are shown in Table 3.5. The table includes the present value (PV) of all the costs as well as the benefits, NPV, the BCR and the IRR for each alternative. A discussion of the results follows below.

Table 3.5: Results of the Cost Benefit Analysis

Present Value of Costs and Benefits, Rm, 2013 Prices	Alternative 1 Two Grade-separated Roundabouts (GSRs) Above Ground	Alternative 2 Two GSRs Above Ground Plus Lane & Signal Improvement	Alternative 3 Two GSRs Below Ground Plus Lane & Signal Improvements 30% Rock	Alternative 4 Two Diamonds Below Ground Plus Lane & Signal Improvements 30% Rock
Costs				
Initial Capital Costs	175.6	207.7	354.6	276.8
Land Acquisition	6.1	6.1	6.1	6.1
Maintenance Costs	7.9	9.3	10.7	11.0
Professional Fees	27.8	32.9	55.3	43.6
Additional Travel	121.6	116.8	116.8	116.8
Total Costs	**338.9**	**372.8**	**543.5**	**454.2**
Benefits				
Time Savings	245.5	442.0	442.0	442.0
Accident Savings	296.1	295.8	295.8	295.8
Reduced Emissions	8.9	16.0	16.0	16.0
Total Benefits	**550.4**	**753.8**	**753.8**	**753.8**
NPV	211.5	381.0	210.3	299.6
BCR	1.62	2.02	1.39	1.66
IRR	15%	18%	12%	14%

Alternative 1

This alternative is considered to be economically efficient as it has a BCR above 1. However, without the proposed improvements for the Stellenbosch portion of the project, the BCR of 1.62 and IRR of 15% are much lower than that of Alternative 2. Without the improvements at the Stellenbosch section, overall travel time saved along the R44 would simply be lost due to continued delays at the Stellenbosch end of the project. This option was therefore dropped as it was not found to be a viable alternative for further consideration.

Alternative 2
This alternative addresses the shortcomings of Alternative 1 and is economically robust with a BCR of 2.02 and an IRR of 18%.

Alternative 3
The findings of the CBA are that this alternative is economically efficient although the results are marginal, i.e. a BCR of 1.39 and an IRR of 12%. This is the least efficient of the four alternatives investigated and is the most sensitive to changes in assumptions and variables. Due to the high capital cost of this option and the low BCR, this alternative was dropped from consideration as a future solution.

Alternative 4
Alternative 4 has a BCR of 1.66 and IRR of 14%. This alternative is economically efficient, though not as economically efficient as Alternative 2. However, it does address the issue of visual impact which has not been considered in the economic assessment.

Thus it was concluded to include Alternative 2, which is the most economically efficient solution, and Alternative 4, which addresses the visual aspects, for detailed further assessment.

3.2.5.3 Implications of the additional cultural heritage specialist study for the proposed project scheme

The additional HIA report assessed the potential cultural heritage impact of closing the R44 median openings as well as the various alternatives proposed at the Annandale and Winery Road Intersections. These are addressed in Chapter 6 of the Revised Final BAR.

As the additional HIA was required to review all details relating to the cultural landscape contained in the initial HIA, it also assessed the at-grade alternatives originally proposed and assessed in the Draft BAR. The findings are presented below:

(i) At-grade roundabouts

The cultural heritage impact of the at-grade roundabouts at both Winery and Annandale Roads was assessed as being of high significance due to the imposition of an urban morphology into a rural cultural landscape which is considered a valuable heritage resource. Similar to the grade-separated roundabout, the at-grade roundabout option would result in a physical and visual separation of the wider landscape. No mitigation in the form of landscaping or screening would be able to minimise the negative impact on the overall sense of place or heritage resources. This conclusion was reached even though the study indicated that the visual impact and loss of connection to the wider landscape would be less pronounced for the at-grade roundabouts compared to the grade-separated roundabouts and would present more opportunity for landscaped mitigation.

(ii) Signalised intersections

The additional HIA states that signalised intersections would result in the least change to the underlying footprint of the roads and land topography as the provision of traffic lights would not impose on the landscape in the same way as the grade-separated alternatives. However, the study argues that they are capable of being as detrimental to the overall sense of a rural cultural landscape and the character of the gateway nodes. The provision of traffic lights at the Annandale Road Intersection is an example where the cultural landscape is blurred, in that it is neither a rural nor an urban node. The study further states that, without exceedingly careful design and input from a planning, land use and urban design perspective, signalised intersections have the potential of leading to incremental changes of scale and

use that are not compatible with a rural environment. The impact of signalised intersections was thus assessed as being of medium significance.

The findings that these proposed alternatives, like for the grade-separated options, would have a significantly medium to high impact on cultural heritage would add further support to the findings of the traffic operational study and economic cost benefit analysis that at-grade solutions do not present feasible project alternatives.

3.2.5.4 Consideration of alternatives to provide viable U-turn facilities at the Somerset West and Stellenbosch ends of the upgrade section

The problem of congestion at both urban ends of the upgrade road section is an issue that received considerable attention from I&APs in response to the Draft BAR. Both the traffic operational analysis and the economic analysis clearly demonstrated that, at the Stellenbosch end, congestion would be alleviated by increasing capacity at the existing signalised intersections from Webersvallei Road to Van Rheede Street. These improvements are thus included in the proposal presented in the Revised Final BAR.

At the Somerset West end, the solution proposed is to provide a dedicated U-turn bridge at the existing Steynsrust Interchange which would serve to separate U-turning traffic from the urban road network, thus avoiding placing U-turn traffic on the existing road network. This solution in itself addresses almost all of the issues raised by I&APs regarding the Somerset West end of the project and is thus included in the proposal presented in the Revised Final BAR.

At the Stellenbosch end three alternatives were investigated to facilitate the U-turn movements which would need to be accommodated as a result of the closure of the median openings between Annandale and Webersvallei Road. These are:

- A grade-separated option in the form of a dedicated U-turn bridge near Jamestown Cemetery;
- An at-grade option in the form of a dedicated U-turn teardrop facility at the same location; or
- Accommodating U-turn movements at the Webersvallei Road Intersection. It should be noted that the proposed improvements at this intersection, which are included in the revised scheme, would provide additional turning lanes and a third through lane in each direction. These improvements would increase the intersection's capacity to accommodate heavy vehicles and trailers making a U-turn movement.

The above findings led to the project proposal and alternatives that were assessed in the Revised Draft BAR. This updated project description has been assessed in the Revised Final BAR and is provided in Chapter 4.

4. PROJECT DESCRIPTION

This chapter provides a detailed description of the proposed project scheme and of the alternatives that are assessed and compared in this Revised Final BAR.

4.1 INTRODUCTION

The revised project scheme consists of the following:

- Closing all median openings along the R44;
- Providing a grade-separated U-turn facility at Steynsrust Bridge;
- Providing a left in/left out access to Bredell Road;
- Providing grade-separated turning facilities at Winery Road and Annandale Road. Two alternatives are being considered for each of these intersections, namely:
  - Grade-separated roundabout interchange, above ground; and
  - Grade-separated diamond interchange, below ground.
- Providing a turning facility in the vicinity of Jamestown. Three alternatives are being considered for this purpose, namely:
  - Grade-separated U-turn bridge near Jamestown Cemetery;
  - At-grade teardrop turning facility near Jamestown Cemetery; and
  - Accommodating U-turn movements at the Webersvallei Road signalised intersection.
- Improving at-grade signalised intersections within the Stellenbosch Municipal area between Webersvallei Road and the end of the project at Van Rheede Street. This would entail road widening to provide turning lanes and three through lanes in each direction at the following five intersections:
  - Webersvallei Road (km 29.6);
  - Techno Park (km 30.3);
  - Blaauwklippen Road (km 31.2);
  - Trumali Road (km 32.0); and
  - Van Rheede Road (km 32.9).
- Additional safety measures:
  - Implementing average speed over distance (ASOD) control; and
  - Accommodating pedestrian and cycling facilities in the interchange design.

Enlarged versions of conceptual designs / lay-out plans shown in this chapter are provided in Appendix C.

4.2 DESCRIPTION OF KEY PROJECT COMPONENTS

4.2.1 CLOSURE OF MEDIAN OPENINGS

Safety concerns along the R44 result from right-turn movements from side roads across the dual carriageway and from U-turn movements at the median openings as vehicles have to slow down in the fast lane leading to speed differentials. This is especially problematic when vehicles turn into hidden accesses and along sections with poor sight distance. Certain median openings correspond to private accesses whereas other median openings are located opposite defunct accesses. It is therefore proposed to close all 22 median openings between Steynsrust Road and Webersvallei Road. The result would be that all public and private roads as well as private accesses along this section of the R44 would have only left in/left out access from and to the R44. U-turn facilities would be provided at both ends of the road section as well as at Winery and Annandale Roads in order to limit the additional travel distance to access properties along the R44.

4.2.2 STEYNSRUST ROAD U-TURN FACILITY

A grade-separated U-turn bridge in the form of a horseshoe is proposed adjacent to the existing Steynsrust Road Interchange bridge structure. The purpose of this facility would be to provide southbound traffic wishing to go north with the opportunity to make a U-turn without accessing the local road network. Thus traffic generated by the median closures along the R44 would not affect the surrounding municipal road network. The proposed conceptual design is illustrated in Figure 4.1.

The proposed upgrade would entail the following:

- Development of a dedicated U-turn bridge, adjacent to and just north of the existing Steynsrust Bridge, with on- and off-ramps within the existing road reserve;
- At the Old Stellenbosch Road east of the R44 (also referred to as the Old Somerset West Road):
  - Providing a deceleration turning lane (north of the triangular splitter island) facilitating left-in access to Old Stellenbosch Road;
  - Providing a deceleration turning lane (south of the triangular splitter island) facilitating access to the on-ramp of the U-turn facility. This lane would include a 120-m long weaving section into which the exit lane from the Old Stellenbosch Road would link. This would allow access either directly onto the on-ramp of the U-turn facility, or, alternatively, to merge with southbound traffic proceeding along the R44 (Broadway Boulevard) towards Somerset West;
  - Associated upgrade of the existing triangular splitter island;
- At Zandberg Road west of the R44:
  - Providing a deceleration turning lane (south of the triangular splitter island) for left-in access to Zandberg Road. This lane would include a 200-m long weaving section into which the off-ramp of the U-turn facility would link; and
  - Providing an entry lane onto the R44 which would include a 60 m acceleration lane before merging with the northbound R44 carriageway.

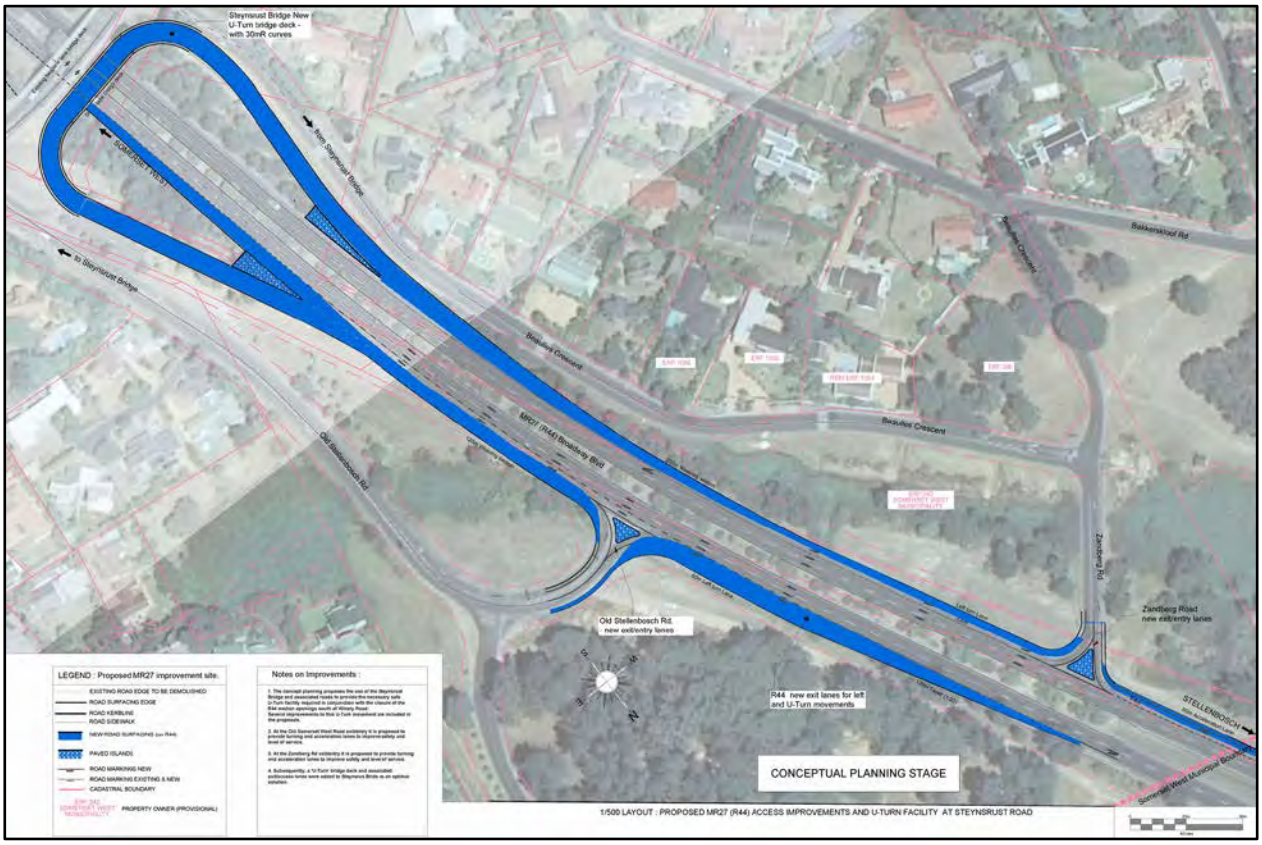


Figure 4.1: Proposed improvements at the Steynsrust Road Interchange (K&T, 2015)

4.2.3 BREDELL ROAD / KLEIN HELDERBERG ROAD

It is proposed to close the existing median openings to Bredell Road and Klein Helderberg Road and to provide left in/left out access to both roads. Improvements at the Bredell Road Intersection would entail the provision of a deceleration turning lane and an acceleration entry lane as well as a triangular splitter island at the exit / entry point (see Figure 4.2).

Figure 4.2: Proposed adjustments at Bredell Road / Klein Helderberg Road (K&T, 2015)

4.2.4 WINERY ROAD INTERCHANGE

Two grade-separated interchange alternatives are being considered for the Winery Road/R44 U-turn facility, namely:

- A grade-separated roundabout interchange – above ground; and
- A grade-separated diamond interchange – below ground

Refer to Figures 4.3 and 4.4 for photographs of the location, which is the same for both alternatives.

4.2.4.1 Grade-separated roundabout – above ground

This proposal is the same as in the Draft BAR, for reasons explained in Chapter 3. The grade-separated roundabout would be located at the existing intersection and alignment of Winery Road with the R44 (see Figure 4.5). The Winery Road vertical alignment would be steepened to tie in with the grade-separated roundabout which would, in turn, be linked to the R44 via on-and off-ramps. Pedestrian walkways and cycling lanes would be included in the ramps and the roundabout. Provision would also be made on all four of the ramps for taxi drop off / pick up embayments.

Figure 4.3: View from the R44 near Bredell Road looking north towards the Winery Road Intersection (MALA, 2014)

Figure 4.4: View from Winery Road towards the R44 Intersection looking east towards Avontuur Estate, with the existing access to the Ken Forrester Wine Estate to the right of Winery Road (August, 2015)

Access to the Ken Forrester Wine Estate would be directly opposite the access road to the smallholdings located to the north of Winery Road. The eastern edge of the roundabout would extend onto the Avontuur Estate property. The Avontuur Estate's existing access would be relocated so as to provide direct private access from the roundabout itself.

It is proposed that the grade-separated roundabout would have 1:2 slope embankments in order to mitigate the potential visual impact. The slopes would be vegetated with appropriate vegetation in order to blend in with the surrounding landscape. Approximately 2.0 ha of land outside the road reserve would have to be obtained from the adjacent landowners.

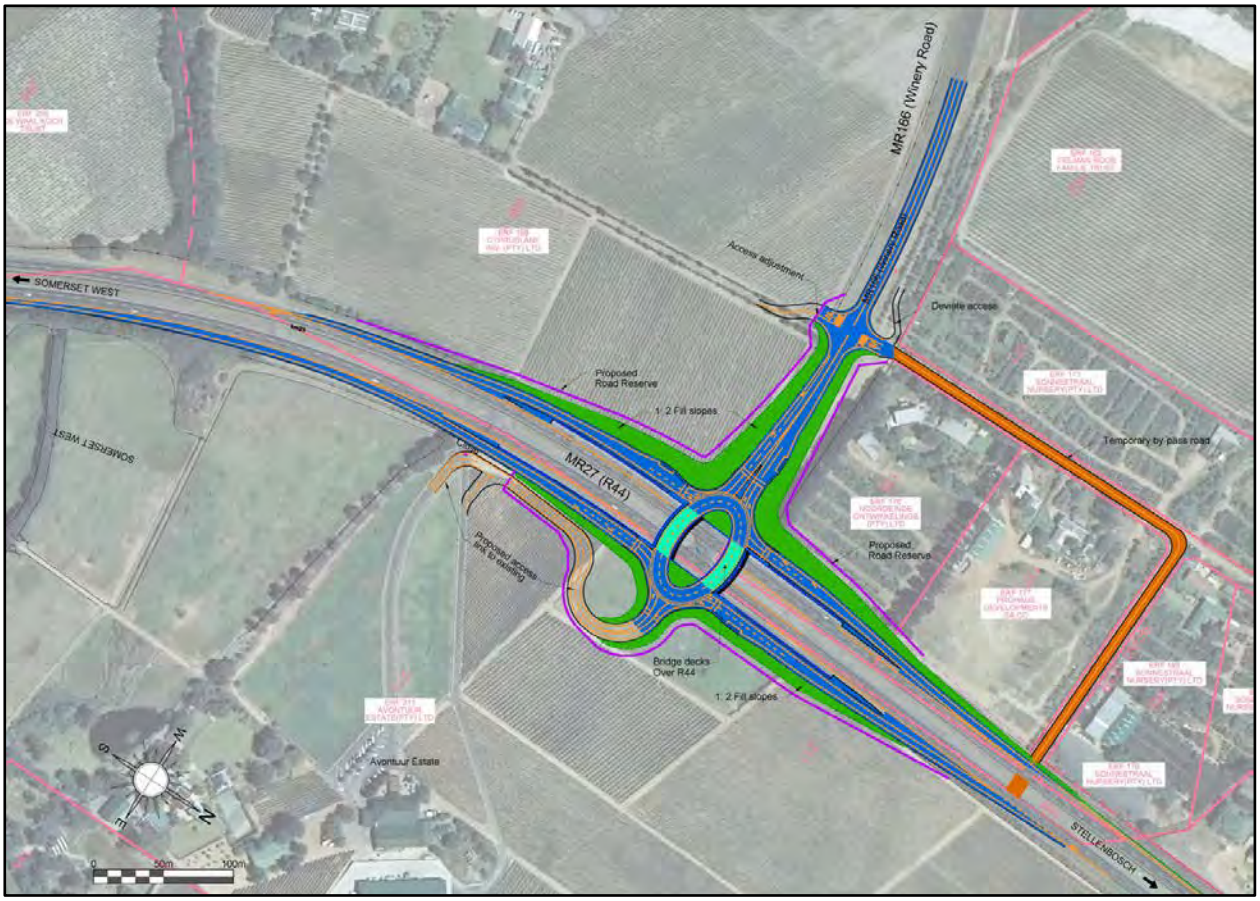


Figure 4.5: Proposed grade-separated roundabout at the Winery Road Intersection with fill slopes (K&T, 2015)

As an alternative to the embankments and to minimise land-take, it would be possible to construct the embankments with a combination of vertical retaining walls and sloped embankments. This option could reduce the total land required for the interchange from private landowners to approximately 1.3 ha. The drawback of vertical retaining walls is that the visual impact of such structures would be higher initially, but could be reduced by vegetation screening that would become more effective with time. The footprint of the interchange using vertical retaining walls is illustrated in Figure 4.6. The detailed figure is included in Appendix C.

As part of the temporary traffic accommodation measures that would be required during the construction phase, it is proposed to upgrade a secondary road which would link Winery Road to a point on the R44 north of Winery Road (this is illustrated in Figures 4.5 and 4.6).

Street lighting would be required in terms of the standard guideline for a grade-separated interchange. This would include lighting on the approach ramps to the roundabout as well as lighting within the roundabout itself – the latter of which would be kept to as low a level as possible whilst complying with the minimum specified standards.

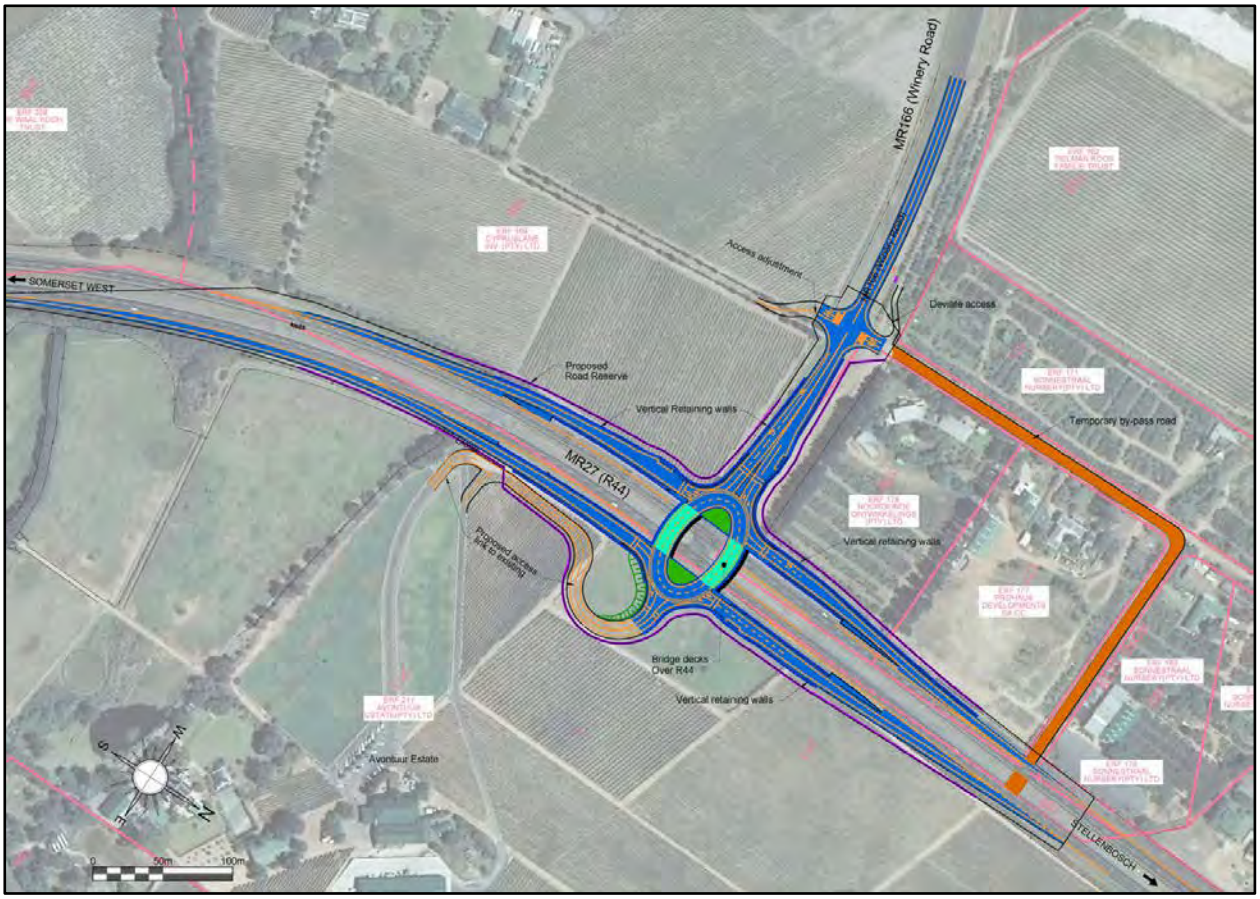


Figure 4.6: Proposed grade separated roundabout at the Winery Road Intersection with vertical retaining walls (K&T, 2015)

4.2.4.2 Grade-separated diamond interchange – below ground

A grade-separated diamond interchange is proposed as a below-ground alternative to a grade-separated roundabout located above ground. This would entail placing Winery Road approximately 7 to 8 m below the existing ground level, i.e. the R44 grade line. Access to the Ken Forrester Wine Estate and the Avontuur Estate property would be similarly aligned as described in Section 4.2.3.1 above for the grade-separated roundabout. The R44 dual carriageway would retain its existing grade line, but would be located on bridge decks passing over the below-ground structure (see Figure 4.7).

Approximately 2.5 ha of land outside the road reserve would have to be obtained from adjacent landowners. Street lighting would be limited to the on- and off-ramps and within the interchange area, which would be below ground. The extent of rock is unknown at this stage and would have a bearing on cost and duration of construction.

The below-ground interchange would have to make provision for an underground stormwater system (a gravity system) to remove stormwater from the lowest point of the interchange. Water may accumulate from groundwater seepage and/or from stormwater. Due to the topography falling to the west, a stormwater drain would be placed in the Winery Road ramps and would emerge (daylight) at the western limit of construction. The stormwater would then continue westwards in a lined side drain of Winery Road.

Vertical retaining walls could also be used as an alternative to ramp embankments. This option could reduce the total land required from private landowners to a similar area as for the above-ground roundabout, i.e. 1.3 ha. The footprint of the interchange using vertical retaining walls would be similar to that illustrated in Figure 4.6 for the above-ground roundabout alternative.

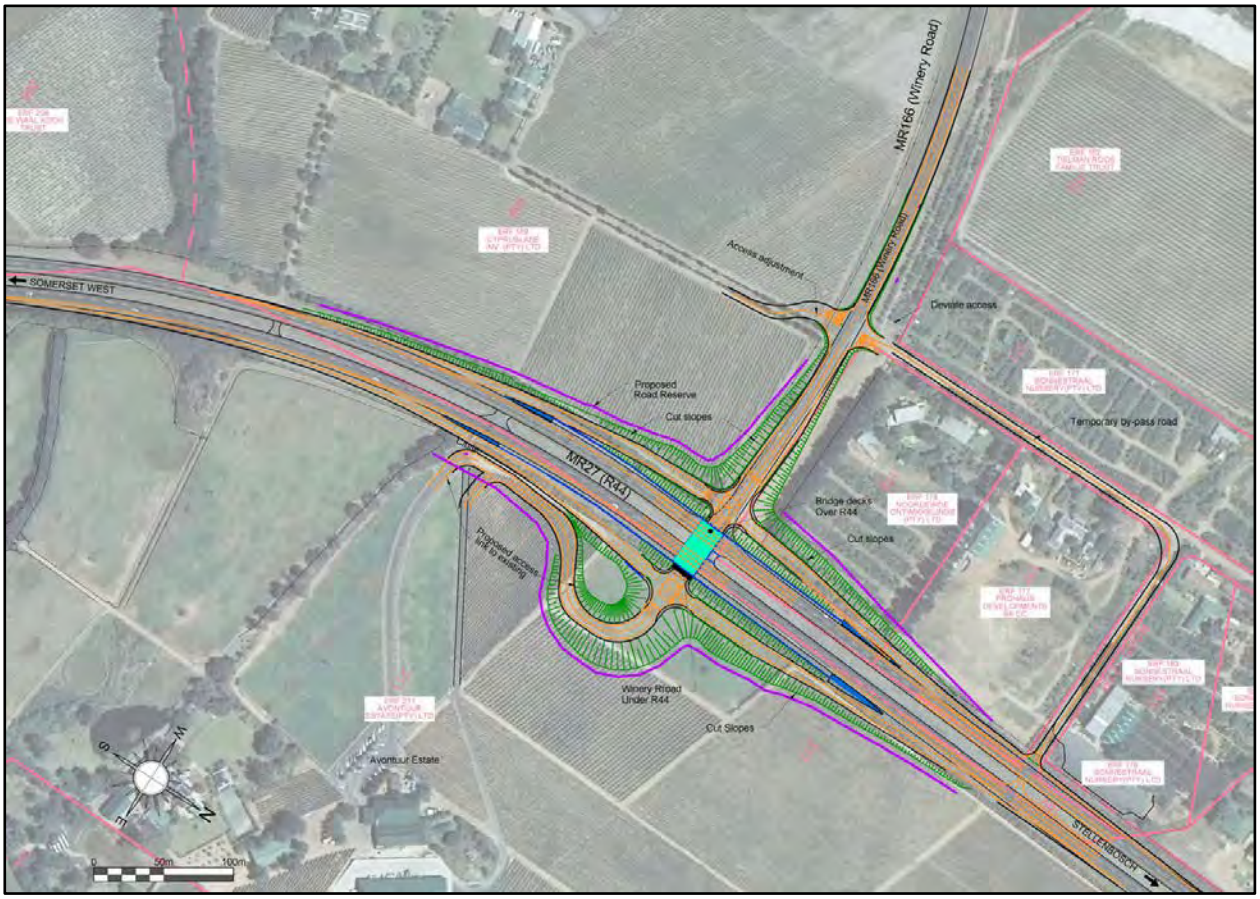


Figure 4.7: Proposed below-ground grade-separated diamond interchange at the Winery Road Intersection with cut slopes (K&T, 2015)

4.2.5 ANNANDALE ROAD INTERCHANGE

Two grade-separated interchange alternatives are also being considered at this intersection with the R44, namely:

- Grade-separated roundabout interchange – above ground; and
- Grade-separated narrow diamond interchange – below ground.

Refer to Figures 4.8 and 4.11 for photographs of the location, which is the same for both alternatives.

4.2.5.1 Grade-separated roundabout – above ground

This proposal is largely the same as in the Draft BAR. The R44 and Annandale Road Intersection is a key intersection on the route providing regional connectivity between the R44 and the R310 into Stellenbosch. Similarly to the Winery Road Intersection, it is proposed to construct a grade-separated roundabout at this location (see Figure 4.12). The roundabout would be off-set to the south of the existing intersection requiring the realignment of Annandale Road from both sides as it approaches the interchange. This alignment has been derived so as to minimise the potential impact on property in all

four quadrants of the intersection whilst simultaneously taking the temporary construction period traffic accommodation practicalities into account. The approximate land acquisition requirement would be 3.3 ha.

Figure 4.8: View of the Annandale Intersection from the R44 looking south towards Somerset West (MALA, 2014)

Figure 4.9: View of the Annandale Intersection from the R44 looking south towards Audacia (August, 2015)

Figure 4.10: View approaching Annandale Intersection looking east from Annandale Road (August, 2015)

Figure 4.11: View of Mooiberge across the Annandale Intersection looking east from Annandale Road (August, 2015)

The interchange would require the realignment of a number of existing access points to surrounding properties. These include:

- A relocation of the existing entrance onto Farm 540 (Zetler's packing plants and the Zetler residence) from Annandale Road;
- A new entrance to the existing servitude access linking the Remaining Extent of Farm 537 (Root 44 Market) to Annandale Road via a relocated access 250 m along Annandale Road taking road access safety considerations into account. This would result in land acquisition and incorporation into the road reserve of a portion of Portion 18 of Farm 537 (Klein Akkerdraai Lodge);

- A relocated access similar to that described above to access Portion 20 of Farm 537 (Mooiberge Padstal) – this access road would be located on Portion 20 of Farm 537;
- A new point of access from the southbound R44 on-ramp onto Portion 20 of Farm 537. This point would also provide for Mooiberge Farmstall traffic to exit directly onto the R44; and
- A new point of access from the southbound R44 off-ramp to the Remaining Extent of Farm 537. This point would also provide for Root 44 Market traffic to exit directly onto the R44. This would reduce the traffic volume using access to Root 44 from Annandale Road (this is a new access not provided in the Draft BAR).

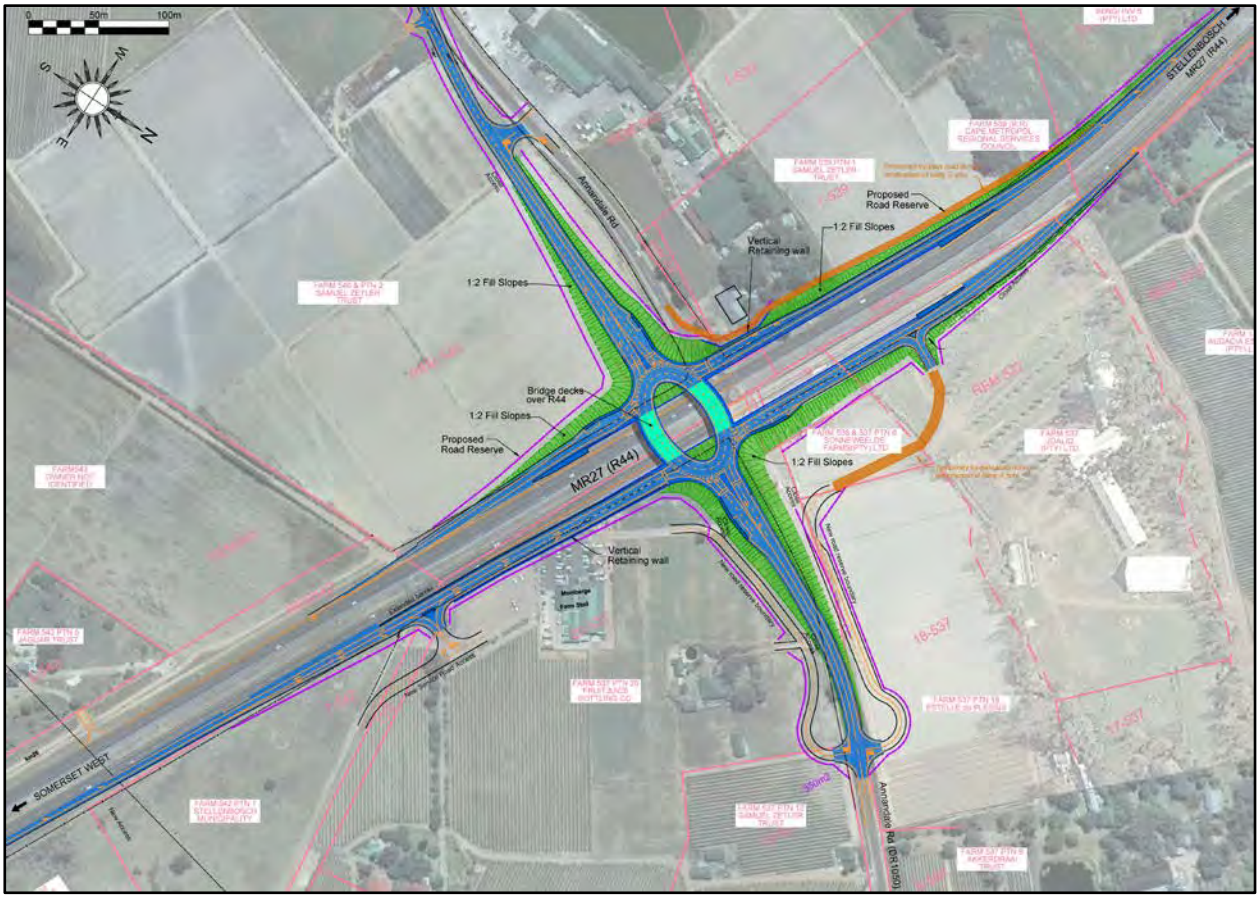


Figure 4.12: Proposed grade-separated roundabout at the Annandale Road Intersection with ramp embankments (K&T, 2015)

Vertical retaining walls could be used as an alternative to ramp embankments (see Figure 4.13). This would reduce the expected interchange land requirement to approximately 2.8 ha. Vertical retaining walls would have a lower impact on the heritage resources at the intersection.

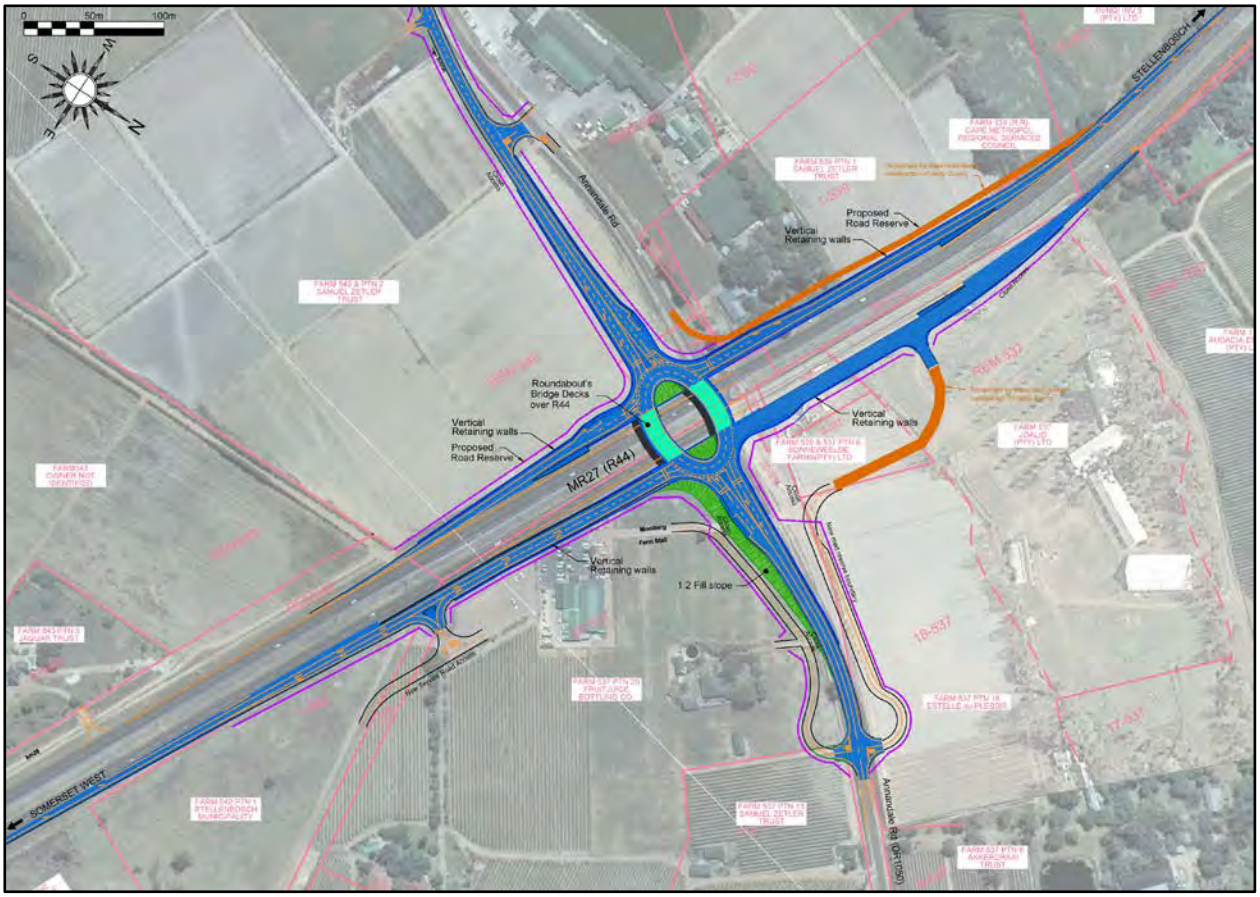


Figure 4.13: Proposed grade-separated roundabout at the Annandale Road Intersection with vertical retaining walls (K&T, September 2015)

4.2.5.2 Grade-separated diamond interchange – below ground

As for Winery Road, a below-ground grade-separated diamond interchange is proposed as an alternative with Annandale Road passing below the R44. Access roads to surrounding properties would be similarly aligned as described in Section 4.2.4.1 above for the grade-separated roundabout. The R44 dual carriageway would retain its existing grade line, but would be located on bridge decks passing over the below-ground structure (see Figure 4.14).

Approximately 3.8 ha of land outside the road reserve would have to be obtained from the adjacent landowners. As for Winery Road, street lighting would be limited to below ground. The extent of rock is unknown at this stage and would have a bearing on cost and duration of construction.

As for Winery Road, an underground stormwater system (a gravity system) would be required to remove stormwater from the lowest point of the below-ground interchange. The stormwater drainage system would be aligned along the R44 to the north as the topography falls in this direction to a low point at a small stream (a tributary of the Bonte River) approximately 220 m north of the interchange.

It would also be possible to construct the embankments with a combination of vertical retaining walls and sloped embankment, which could reduce the total land required from private landowners to approximately 2.5 ha. The footprint of the interchange using vertical retaining walls would be similar to that illustrated in Figure 4.13 for the above-ground roundabout alternative.

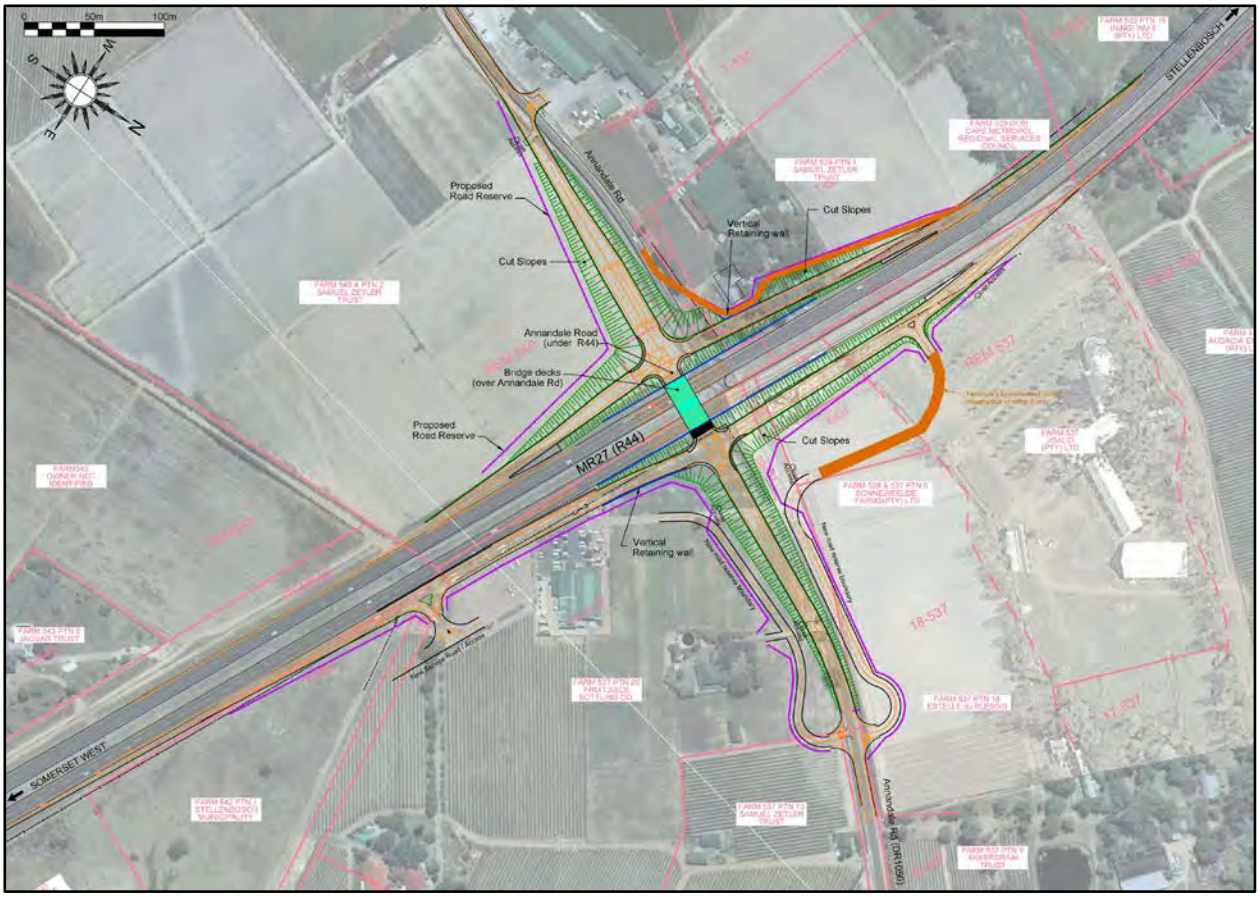


Figure 4.14: Proposed below-ground grade-separated diamond interchange at the Annandale Road Intersection with fill slopes (K&T, 2015)

4.2.6 U-TURN FACILITY NEAR JAMESTOWN CEMETERY OR WEBERSVALLEI ROAD

A U-turn facility would be required to allow vehicles travelling from the south to make a U-turn; (i) in order to access properties located along the eastern side of the R44 between Jamestown Cemetery and Annandale Road and (ii) vehicles departing from properties located along the western side of the R44 north of Annandale Road would require a U-turn facility in order to proceed in a southerly direction.

Three alternatives are assessed and compared in the Revised Final BAR, namely:

- A grade-separated U-turn bridge near Jamestown Cemetery;
- An at-grade teardrop facility near Jamestown Cemetery; and
- An at-grade U-turn movement at the Webersvallei Road signalised intersection.

4.2.6.1 Jamestown Cemetery grade-separated U-turn bridge

This alternative is similar to the Steynsrust Road U-turn facility, namely a dedicated U-turn bridge over the R44 in the form of a horseshoe, with an on- and off-ramp to the R44, which would allow turns in only one direction. It would be located in the vicinity of Jamestown Cemetery. This facility would provide for U-turn movements without conflicting with the movement of traffic on the R44 (see Figure 4.15).

This proposal would require widening of the road reserve by approximately 5 m on each side of the R44 and thus approximately 0.2 ha of land would have to be acquired from an adjacent landowner and the Jamestown Cemetery.

Figure 4.15: Proposed grade-separated U-turn facility near Jamestown Cemetery (K&T, 2015)

4.2.6.2 Jamestown Cemetery at-grade teardrop

This is an at-grade dedicated U-turn teardrop facility alternative which is also located adjacent to Jamestown Cemetery. It would entail the provision of a turning lane located between the two carriageways. In order to accommodate the U-turn facility the northbound carriageway of the R44 would have to be relocated over a distance of approximately 500 m, resulting in an extension of the road reserve boundary approximately 12 m to the north-west. Approximately 0.5 ha of land would have to be acquired for this purpose (see Figure 4.16).

The key disadvantage of this facility is that U-turning traffic would have to slow down to enter the facility while travelling in the fast lane of the northbound carriageway, and exit the teardrop into oncoming traffic using the fast lane of the southbound carriageway. From a technical perspective the option of traffic slowing down and accelerating from / into the fast lane is not supported by DTPW.

4.2.6.3 Webersvallei Road Intersection

The third alternative proposed for the purpose of accommodating U-turning traffic between Annandale Road the Webersvallei Road, is to accommodate such movements at the existing Webersvallei Road Intersection. The upgrading of this signalised intersection forms part of the proposed improvements to ease congestion at the Stellenbosch end of the R44. This would entail widening the road to add turning lanes to both the west and east and providing three through lanes in each direction (see Figure 4.17). These improvements would provide sufficient space to accommodate U-turns of heavy vehicles at the traffic lights.

It should be noted that this alternative is based on existing traffic generated between Annandale and Webersvallei Roads. It does not take into consideration any traffic implications that could potentially occur as a result of changes in land use along the R44 between these roads.

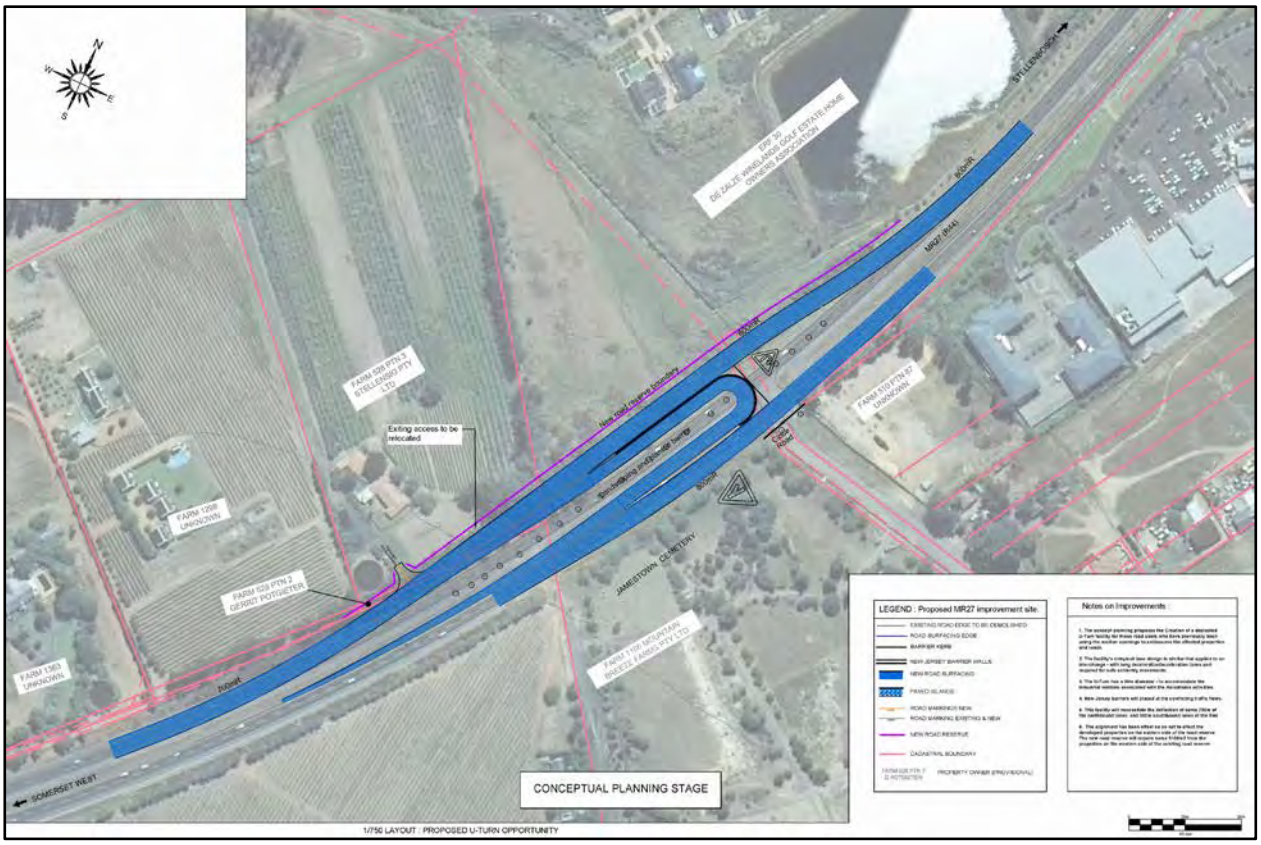


Figure 4.16: Proposed at-grade U-turn facility near Jamestown Cemetery (K&T, 2015)

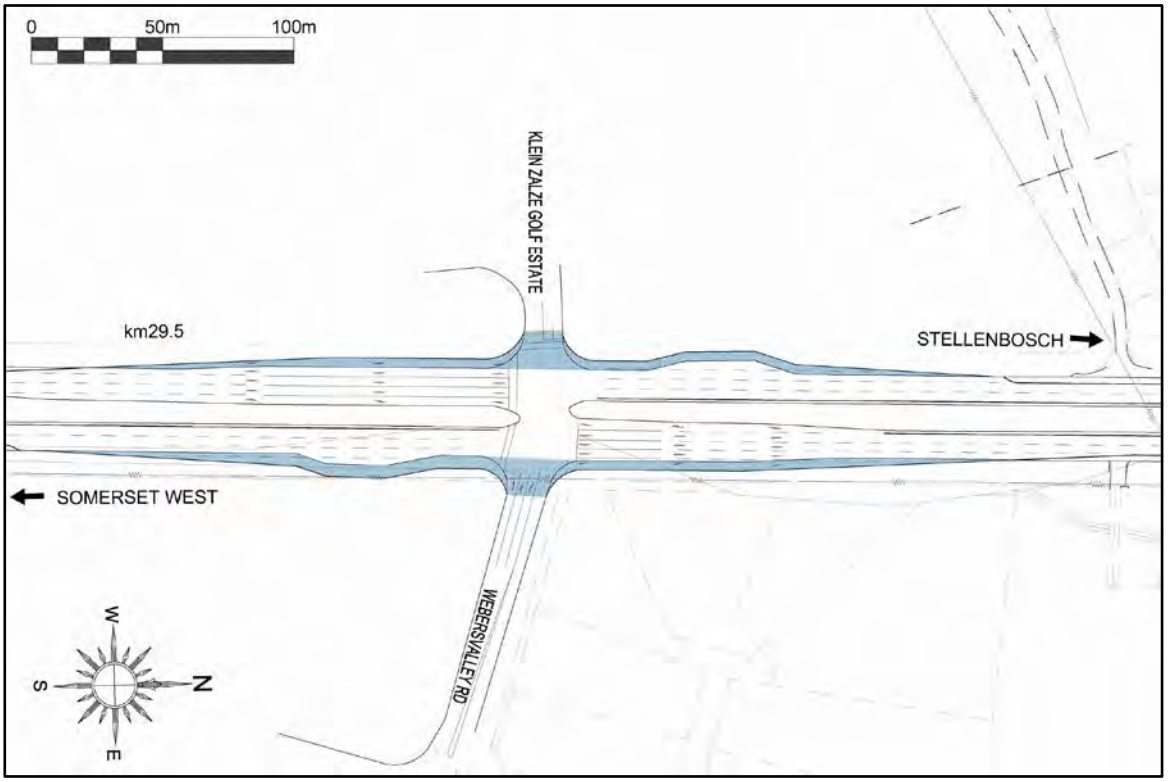


Figure 4.17: Proposed improvements at Webersvallei Road Intersection – shaded area (K&T, 2015)

4.2.7 IMPROVEMENTS TO EXISTING SIGNALISED INTERSECTIONS AT THE APPROACH TO STELLENBOSCH

Existing at-grade signalised intersections within the Stellenbosch Municipality from Webersvallei Road to Van Rheede Street would be improved in order to ease congestion and support the R44 corridor mobility function. The five intersections included in the project scope are Webersvallei Road; Techno Road; Blaauwklippen Road; Trumali Street; and Van Rheede Street. The proposed improvements would entail road widening to provide turning lanes to the west and east as well as three through lanes in each direction to accommodate traffic at each intersection (see Figures 4.18 and 4.19).

In addition, traffic signal timing would be improved. The traffic signals along the route are currently poorly coordinated. Thus it is planned to improve traffic signal timing at the above signalised intersections in conjunction with the Stellenbosch Municipality by coordinating the signals on an area traffic control system along with the rest of the signals in Stellenbosch. This would form part of the Stellenbosch Roads Master Plan which is currently being developed. Such signal timing improvements would assist to reduce congestion and time delays experienced during peak hour traffic.

4.2.8 ADDITIONAL SAFETY MEASURES

4.2.8.1 Implementing average speed over distance (ASOD) control

The closure of median openings and provision of grade-separated U-turn facilities would remove at-grade conflicts between vehicles travelling along the R44 at higher speed and vehicle movements through the median openings. The grade-separated interchanges at Winery and Annandale Roads would allow for free flow of traffic between Somerset West and Webersvallei Road. This would allow for the effective use of average speed over distance (ASOD) control to further improve safety conditions along the route by maintaining a constant speed limit of 100 km/h.

4.2.8.2 Accommodating pedestrian and cycling facilities in the interchange design

Many farmworkers, school children and other pedestrians cross the R44 daily on a somewhat random dispersed pattern along the length of the route with localised concentrations at the Winery Road and Annandale Road Intersections and lesser concentrations at Eikendal Road. Currently, the only moderately safe crossing point between Somerset West and Webersvallei Road is at the Annandale Road Intersection. Large numbers of pedestrians at Winery Road and at Klein Helderberg / Bredell Road have no safe crossing facilities.

In the case of the proposed grade-separated interchanges (whether above- or below-ground), provision would be made to facilitate the movement of pedestrians and cyclists to either side of the R44 as well as to provide specific public transport stops at appropriate positions.

Pedestrian bridges could be considered in future should numbers warrant bridges and as specific pedestrian desire lines become apparent.

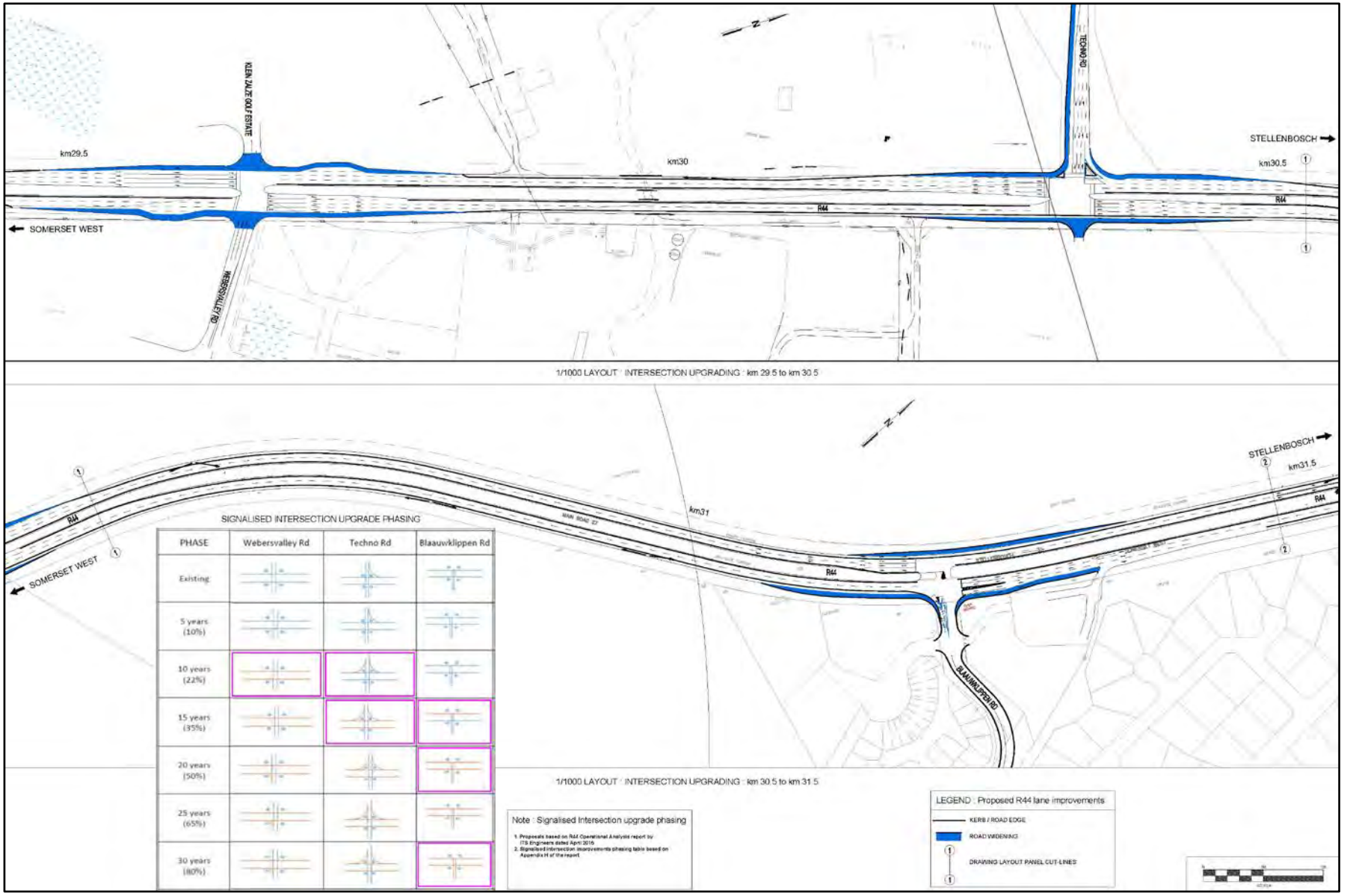


Figure 4.18: Proposed improvements to signalised intersections: Webervallei Road; Techno Road and Blaauwklippen Road (K&T, 2015)

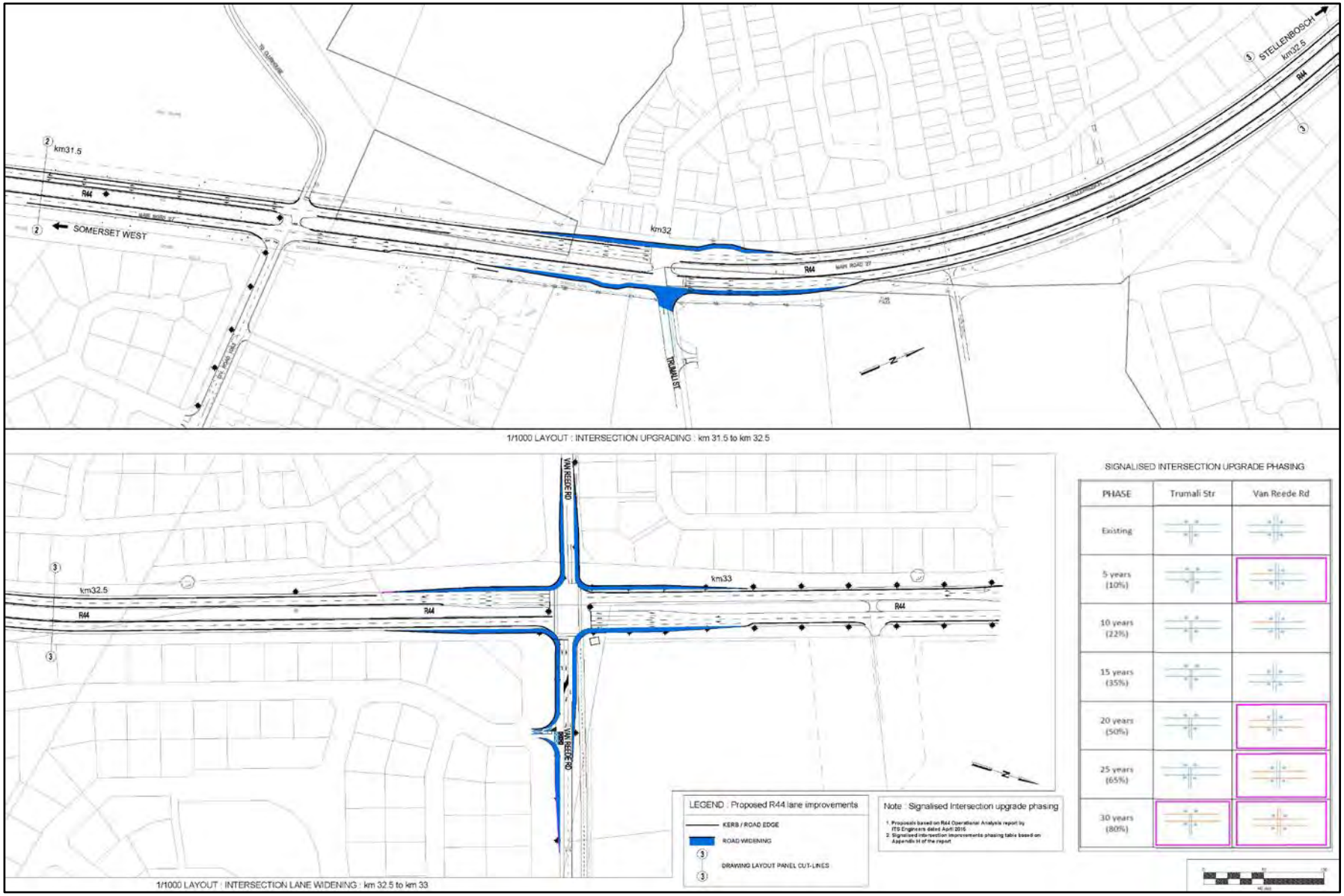


Figure 4.19: Proposed improvements to signalised intersections: Trumali and Van Rheede Streets (K&T, 2015)

4.3 PROJECT COSTS

The costs for the overall project scheme for different combinations of alternatives are provided in Table 4.1. These costs include initial construction and annual maintenance and rehabilitation costs for 30 years based on 2015 prices. The following project components (for which there are no alternatives) are included in all the combinations:

- Closure of median openings;
- Upgrade to the Steynsrust Road Interchange, including the U-turn facility;
- Upgrade to Bredell Road / Klein Helderberg;
- Signal and lane improvements entering Stellenbosch; and
- Speed over distance monitoring.

Table 4.1: Project scheme costs for different combinations of alternatives

U-turn facility at northern end of route section	Interchanges at Winery and Annandale Roads	
	Grade-separated roundabouts	Below-ground interchanges
Webersvallei Road signalised intersection	R 256.7 million	R 354.0 million
At-grade teardrop at Jamestown Cemetery	R 278.6 million	R 375.9 million
U-turn bridge at Jamestown Cemetery	R 292.7 million	R 390.0 million

4.4 NO-GO ALTERNATIVE

The No-Go alternative relates to the option of maintaining the status quo by not improving the R44 between Somerset West and Stellenbosch. Section 3.1 clearly shows the need for improving the safety and mobility of the R44 route. However, should the project not go ahead (No-Go alternative), the following specific implications would arise (both negative and positive):

- No change to historic features at Winery Road and Annandale Road Intersections;
- No negative visual impact on the landscape;
- No change to the quality of the R44 as a scenic route or to the surrounding cultural landscape;
- Adjacent landowners and tourists would have continued direct access to/from the R44 to their homes and businesses;
- Unsafe traffic conditions would remain and furthermore become worse in the future as traffic volumes along the R44 continue to grow;
- Traffic congestion would increase over time and pressure on the local road network would become more problematic than is currently the case;
- Tourism potential may become compromised due to the negative effect of unsafe road conditions for motorised vehicle users, pedestrians and cyclists; and
- Road safety for pedestrians and cyclists would not improve at affected intersections.

It must be noted that should the proposed improvements not go ahead, the DTPW is still within its rights to close the median crossings to improve road safety. However, that would leave the route without the necessary safe U-turn facilities which would likely result in illegal U-turns at unsafe locations and a subsequent increase in accidents.

5. THE AFFECTED ENVIRONMENT

This chapter provides a description of the biophysical and socio-economic environment likely to be affected by the proposed project. Information in this section was derived from the various specialist studies and that sourced by CCA (see Section 2.2.2.1 in this regard).

The affected section of the R44 is located between Somerset West (general location: S33º37'27.13"; E19º28'21.02") and Stellenbosch (general location: S33º39'21.28"; E19º30'10.06") (see Appendix C for photographs of the affected road sections).

5.1 THE BIOPHYSICAL ENVIRONMENT

5.1.1 CLIMATE

The climate is classified as a Mediterranean climate, with dry hot summers and cold wet winters. The lowest rainfall (7 mm) occurs in January / February and the highest (94 mm) in July with 80% of the mean annual precipitation for this area (around 670 mm) received in winter between May and September. The monthly distribution of average maximum temperatures shows that the average midday temperatures for Stellenbosch range from 7°C to 29°C. Prevailing winds are south-easterly during the summer and north-westerly during the winter.

5.1.2 TOPOGRAPHY

The natural topography of the study area is relatively flat, with moderate to low undulating hills interspersed by the tributaries of the Eerste River. The general slope is towards the south and east. Stellenbosch and the Helderberg Mountains border the study area in the east. Four natural landscape types, based on the underlying geology, are found in the study area. These are:

- The sandstone mountain cliffs and peaks of the Stellenbosch Mountain in the north east, Haelkop, Suurberg in centre east and Helderberg in the south east;
- The mountain scree slopes below the cliffs and cultivated surrounding hills (to the north, west and south) comprised of shales and sandstones;
- The cultivated, rolling foothills of granites and associated quaternary soils; and
- The Eerste River and associated tributaries and their alluvial floodplains.

5.1.3 GEOLOGY AND SOILS

The geology can be described as quaternary alluvium derived mostly from Table Mountain sandstones and the Malmesbury Group clays (with some Cape Granite). Along the R44 route, the sections to the north of the Blaauwklippen River are largely underlain by Malmesbury Group shales, while to the south of the river, the Cape Granites of the Stellenbosch-Kuilsriver and Helderberg Plutons occur.

The soils in the very northern section of the R44 route are largely freely drained soils with a low natural fertility and high erodibility potential. Along much of the central region of the route, the soils are shallow, seasonally wet and have a high clay accumulation with imperfect drainage. The southern end of the route is underlain with soils of a restricted soil depth, excessive drainage, a high erodibility and low natural fertility.

5.1.4 VEGETATION

The historical vegetation type that would have covered the study area and surrounds is Swartland Granite Renosterveld. This vegetation type is listed as Critically Endangered due to high levels of habitat transformation across the Western Cape and an exceptionally high number of threatened species associations (Government Gazette, 2011). However, high levels of transformation have occurred in the study area due to the arable land being converted for agricultural purposes, which has eliminated almost all the natural vegetation in the vicinity. Natural vegetation now only occurs as remnant patches, comprising pioneer species, which have either survived due to their weedy habit or through dispersal of seed by birds, wind or other vectors.

No Critical Biodiversity Areas (CBA) has been identified for the portion of the study area that falls within the City of Cape Town municipal boundary. The portion falling within the Stellenbosch Municipality is included in the Stellenbosch – Drakenstein Municipality's CBA plan (Kirkwood et al., 2010). In terms of the area plan several patches of land at the Annandale Road and Winery Road Intersections are designated as critically important in terms of harbouring remnant vegetation. However, after ground-truthing by the vegetation specialist of these areas, this designation is considered erroneous since no conservation worthy patches of vegetation, nor any species of conservation concern, were found. The description of the affected project components are presented below.

5.1.4.1 Steynsrust Road

The affected area comprises an island of vegetated land along Beaulles Crescent. The area is dominated by pine trees and invasive alien species with some patches of natural remnant vegetation present. The slope along Beaulles Crescent is dominated by specimens of *Cliffortia odorata*, *Typha capensis* and *Searsia angustifolia* with scattered individuals of *Passerina cf. vulgaris*, *Pelargonium* sp., *Olea europaea* subsp. *africana*, *Searsia angustifolia*, *Seriphium cinereum*, *Helichrysum* sp., *Hellmuthia membranacea* and *Phylica* sp. A dense band of the endemic shrub *Searsia angustifolia* stretches along the Beaulles Crescent road edge. There are a number of pines and invasive alien species (e.g. *Hakea salicifolia* and *Acacia saligna*) parallel to these shrubs. Additional natural species scattered across the roadside include *Eriocephalus africanus*, *Cliffortia ruscifolia*, *Anthospermum aethiopicum*, and *Oxalis purpurea*.

5.1.4.2 Bredell Road

No vegetation would be affected by the proposed improvements which would occur within the road reserve.

5.1.4.3 Winery Road

Most of the roadside vegetation at Winery Road consist of non-natural vegetation such as kikuyu grass (*Pennisetum clandestinum*) and planted trees such as a hedge of oleander (*Nerium oleander*), juvenile wild olive trees (*Olea europaea* subsp. *africana*), pine trees (*Pinus* sp.), Washington palms (*Washingtonia robusta*), a hedge of mature willow-leaved hakea (*Hakea salicifolia*), an avenue of cypress trees (*Cupressus sempervirens*) and a number of old English oak trees (*Quercus robur*). These species hold little worth in terms of conservation importance and biodiversity. The balance of the private land is cultivated.

A swathe of well-established riverbed grass (*Pennisetum macrourum*) is located along the north-eastern quadrant roadside. This roadside is wet due to several drainage holes feeding the embankment with several individuals of arum lily (*Zantedeschia aethiopica*) present at this point.

5.1.4.4 Annandale Road

Most of the road reserve consists of freshly mowed Kikuyu grass. No natural vegetation is visible besides *Cyperus* cf. *longus*. Numerous exotic trees and shrubs have been planted along the roadside and in the adjacent landowner's gardens. These include Norfolk pines (*Araucaria heterophylla*), English oak (*Quercus robur*), Carob (*Ceratonia siliqua*), Silky oak (*Grevillea robusta*), Seaforthia palm (*Archontophoenix cunninghamiana*), weeping willow *(Salix babylonica*), eastern cottonwood tree (*Populus cf. deltoides*), willow karee (*Searsia angustifolia)* and other garden plants.

Patches of remnant natural vegetation occur within the Kikuyu grass dominated road reserve. The remnant vegetation is not of high conservation value since the species are pioneers; including *Seriphium cinereum*, *Kiggelaria africana*, *Cliffortia ruscifoli*a and *Searsia angustifolia*. There is, however, a noteworthy individual of wild olive (*Olea europaea* subsp. *africana*). This is a mature individual but not ancient and most probably established here naturally after the road was built in the early 1960s.

5.1.4.5 Jamestown Cemetery

The widening of the road reserve at the Jamestown Cemetery (which would be associated with two of the proposed U-turn options in the vicinity of Jamestown) would affect transformed sections of road reserve with patches of pioneer (low conservation value) renosterveld. The private land on the eastern side of the road supports high numbers of mature pines (*Pinus* sp.) and gum (*Eucalyptus* sp.) whereas the eastern side contains rows of Indian laurel (*Ficus nitida*), cotton wood tree (*Populus* cf. *deltoides*) and pin oak (*Quercus palustris*).

5.1.4.6 Webersvallei, Techno, Blaauwklippen, Trumali and Van Rheede Roads/Streets

No natural vegetation would be affected by the proposed improvements which would occur within the road reserve at these intersections.

5.1.4.7 Riparian vegetation

Vegetation within the riparian zones of the streams crossed by the road are in general highly disturbed and contain a number of alien plants such as oak trees (*Quercus robur)*, Port Jackson willows (*Acacia saligna)*, Black Wattle (*Acacia mearnsii)*, poplars (*Populus* sp.), and weeping willows (*Salix babylonica)*. Indigenous trees such as the Wild Olive (*Olea europaea)* do still occur. A small stand of Blue Pea (*Psoralea pinnata)* occurs along a stream near the Annandale Road Intersection. This is a naturally occurring species which is usually confined to wetlands.

5.1.5 FRESHWATER SYSTEMS

The area of interest is located in the Berg Water Management Area and in quaternary catchment G22H. The Bonte River drains westwards under the R44 directly north of the Annandale Road Intersection, while the Moddergat River drains westward directly south of both the Ken Forrester Wine Estate and Avontuur.

Both rivers are seasonal and have been significantly altered by agricultural and urban development. Numerous small earth dams have been built in the area, either to store winter run-off or water from the Theewaterskloof Dam.

The freshwater features of the study area consist of a number of tributaries of the Eerste River of which the Blaauwklippen (Blouklip), Bonte and Moddergat Rivers are the largest. The Eerste River rises in the Jonkershoek Mountains of the Hottentots Holland Mountain Range and discharges into False Bay near Macassar.

Twelve tributaries are crossed by the R44 road within the study area. All the rivers, except one, are south westerly flowing tributaries of the Eerste River. The five watercourses described below may be affected by the proposed intersection improvements. There are no watercourses present at the Bredell or Winery Road Intersections.

5.1.5.1 Steynsrust Road

Minor tributary of the Moddergat River

This is a relatively small watercourse that carries runoff and storm water generated at Steynsrust Road along the western side of the R44. The dominant aquatic (instream) vegetation is the bulrush (*Typha capensis)*, however, most of this section of the stream consists of a concrete channel until its confluence just downstream with the Moddergat River.

The Moddergat River

This section of the Moddergat River has been highly modified by the residential development in Somerset West. Within this section, the watercourse is dominated by wildewingerd (*Cliffortia odorata)*, with clumps of bulrushes (*Typha capensis)*, arum lilies (*Zantedeschi aethiopica)* and the common reed (*Phragmites australis)*. The watercourse is a foothill cobble-bed stream.

5.1.5.2 Annandale Road

A tributary of the Bonte River

This small tributary of the Bonte River has largely been diverted and canalised. Water is diverted to the Bonte River or continues downstream to strawberry fields and a farm dam. Downstream of the R44 the stream consists of an earthen canal which is largely devoid of any instream vegetation. Along the banks are indigenous riverbed grass (*Pennesetum macrourum),* bulrushes (*Typha capensis)* and exotic grasses.

The Bonte River

The Bonte River has also been highly modified by the surrounding agricultural activities and consists of a straightened river channel that is largely devoid of any indigenous plants except for some small patches of sedges (*Cyperus textilis)* and arum lilies (*Zantedeschi aethiopica)*. Exotic grasses and plants such as nasturtium (*Tropaeolum majus)* occur along the stream banks. The watercourse does, however, still contain indigenous fishes, the Cape galaxias (*Galaxias zebratus)*.

5.1.5.3 Jamestown Cemetery

Some riverbed grass (*Pennisetum macrourum*) dominated wetland areas are located immediately to the north of the proposed U-turn facility location and approximately 10 m from the road edge. A stormwater channel is also located immediately adjacent to the R44.

5.1.5.4 Techno Road

A tributary of the Blaauwklippen River is now largely non-existent as a result of a farm dam upstream of Techno Road. There is, however, still some overflow from the dam during winter months which currently flows within a number of eroded channels due to the absence of a well-defined stream channel. Wetland areas are also present south of Techno Road that are associated with the stream.

5.1.5.5 Ecological importance and sensitivity

All of the minor streams are deemed to have a low ecological importance and sensitivity, while the larger Moddergat, Bonte and Blaauwklippen Rivers have a moderate ecological importance and sensitivity. The drainage channels have a marginal ecological importance. In general all the streams in the study area have had their riparian habitat largely to severely modified as a result of the surrounding agricultural and urban activities which have resulted in much of the indigenous riparian plants having been removed and these disturbed areas invaded by alien invasive plants. The instream habitat of these streams is in a better condition (moderately to largely modified), with flow and water quality impacts of upstream activities having the largest impact. No watercourses within the study area are considered Freshwater Ecosystem Priority Areas.

5.1.6 GROUNDWATER SYSTEMS

5.1.6.1 Groundwater Use

The hydrocensus confirmed that all landowners adjacent to the Winery and Annandale Road Intersections are domestic groundwater users. Groundwater is also used in wineries, watering of horses and irrigation of strawberries and gardens. Water abstracted from the rivers and supplied from the Theewaterskloof scheme is used for agricultural activities only. The area is not supplied with water by the Stellenbosch Municipality. Consequently, groundwater is of high value to the property owners, irrespective of how much they use it.

5.1.6.2 Aquifer description

The aquifers between Somerset West and Stellenbosch are secondary in character and owe their water-bearing properties to weathering and fracturing. As a result, they are classed as intergranular and fractured aquifers. Granitic aquifers are heterogeneous, with hydraulic properties varying significantly over short distances. Depth of weathering generally ranges between 20 m and 60 m, suggesting most water strikes are attained at depths shallower than 75 m. Based on the measured data and that sourced from the National Groundwater Archive (NGA), depth to groundwater is unlikely to be deeper than 10 m. It is assumed the direction of groundwater flow mimics topography, with the regional flow direction being westerly to south westerly. Borehole yields are generally low, typically being in the range of 0.1 litre per second (L/s) to 0.5 L/s.

Recharge of granitic aquifers is a complex process dependent on antecedent soil moisture conditions, rainfall (duration and intensity) and geology. Aquifers are recharged by rainfall, with a general acceptance that recharge is in the order of 10% to 15% of the Mean Annual Precipitation (MAP). Recharge is probably ubiquitous in character.

Groundwater quality in the area is good, with the water having a salty (sodium chloride or NaCl) character. Electrical conductivity (EC) ranged between 25 millisiemens/metre (mS/m) and 50 mS/m while the acidity / alkalinity (pH) ranged between 6.1 and 7.4. The groundwater is interpreted to be largely fit for domestic consumption.

5.1.6.3 Aquifer classification and vulnerability

The expected low borehole yields and good groundwater quality suggest the granitic aquifer be classified as a minor aquifer system (Parsons, 1995). However, the dependence on groundwater for domestic supply and the absence of alternative supplies for this purpose warrants a sole source aquifer classification. Such a classification would better reflect the value of the groundwater to the property owners.

Based on a modified DRASTIC method, both Parsons and Conrad (1998) and DWS (2013) showed the granitic aquifer between Somerset West and Stellenbosch to be moderately vulnerable to anthropogenic impacts.

5.1.7 HERITAGE / ARCHAEOLOGY/ PALAEONTOLOGY

5.1.7.1 General

As mentioned elsewhere in this report, the initial HIA has been reviewed and an additional report compiled in order to comply with Section 38(3) of the NHRA in response to the Interim Comment submitted by HWC in May 2016. This section of the Revised Final BAR has subsequently been updated to incorporate relevant cultural heritage information provided in the additional HIA.

The general area is dominated by agriculture with vineyards and some strawberry fields notable in the vicinity of the R44. Horses are also reared on one farm. The initial and additional HIA indicated that the area is highly scenic and, with the presence of many tourist-oriented farm stores and wine tasting rooms (Stellenbosch Wine Routes), the R44 can be regarded as a scenic route that displays the local cultural landscape.

The area has a rich layering of history with many farms going back to the late 1600s. Historical houses, whether farm manor houses or workers' cottages, abound in the landscape. Fransen (2004) lists many of the more notable structures in the region.

Archaeological heritage is little studied in this area but Early Stone Age (ESA) artefacts are well known to occur in a belt along the foot of the mountains stretching from Gordons Bay in the south all the way to Porterville in the north. Numerous commercial surveys have documented such artefacts but only once in recent years, in Gouda, has a sample of this material been recorded (Orton & Flear, 2013). Early on, such artefacts found in Stellenbosch were used to describe what was then known as the "Stellenbosch Industry" of the ESA (Goodwin & Van Riet Lowe, 1929). These artefacts are accommodated within the period now known as the Acheulean.

The National Heritage Resources Act provides for a three tier grading system of national (Grade 1), provincial (Grade II) and local (Grade III) significance, while the HWC system provides a guideline on dividing Grade III resources according to their level of local significance (Grades IIIA, IIIB and IIIC), with

resources of very low significance considered 'ungradeable'.[1] The provisional grading assigned by heritage specialists has been included in the relevant sections below.

5.1.7.2 Archaeology

Stone Age archaeology

Archaeological resources were found in a few places in very limited density. No Stone Age material was found during the survey on Erf 169 (Ken Forrester Wine Estate) (largely due to the surface being vegetated). However, the owner has collected a number of artefacts from the fields through the years, the majority of which were said to have come from the area close to the entrance to the property. On Farm 37/20 and the Remaining Extent of Farm 540 (Zetler property on the south-west corner of the intersection) stone artefacts were located close to the edge of Annandale Road. These were ESA artefacts, although one historical plate fragment was also noted. Along Techno Road a very ephemeral scattering of similar artefacts was noted in the ferruginous gravel. These artefacts include one incompletely flaked radial core on a river cobble and the tip of a hand-axe. A further isolated artefact in the same field also appeared to be a hand-axe tip.

Historical archaeology

The owner of Erf 169 has, over the years, assembled a large collection of ceramic and glass fragments found on the farm. One small ceramic fragment was found on the Remaining Extent of Farm 540 during the ground survey.

Although archaeological resources may be directly impacted, none carry high significance and are thus referred to as 'ungradeable' resources in this particular study.

5.1.7.3 History and buildings

A large number of very old farms occur in this area. The original land grants for most of them date back to the late 1600s. A summary of the "historical" farms adjacent to the Winery and Annandale Road Intersections is provided below.

Winery Road Intersection

The original farm, Zandberg, was granted to Frederik Boot in 1694. Since then the farm was purchased by an early 19th century owner called Scholtz and subsequently dubbed 'Scholtzenhof'. Various portions were subsequently subdivided off the original erf. The original homestead was T-shaped before being turned into an H-shaped house in about 1970. Fransen (2004) considers it likely that the tail of the T was in fact the original house on the farm and may thus date to the late 17th century, a very unusual and significant feature. After a succession of owners, Ken Forrester took ownership of Scholtzenhoff and renamed the farm in 1993.

The Avontuur Estate (now Erf 211) was subdivided off of Scholtzenhof in 1908 (then Annex Scholtzenhof). The Cape Dutch house on this property is H-shaped with the rear wings longer than the front ones.

[1] The NHRA makes provisions for the Grades I to III only while the subdivisions of Grade III into levels A-C are a useful working tool but carry no legal weight.

The Verdruk-my-Niet / Happy Vale farm was an 1824 deduction from Zandberg for Daniel Wouter Malan. A wine cellar, possibly constructed in 1828, is situated just to the east of the far smaller, L-shaped manor house which is dated 1853 (Fransen, 2004). The complex is entirely enclosed by a werf wall and it faces obliquely towards the Winery Road Intersection some 800 m to the north.

Annandale Road Intersection

The original farm, Brakelsdal, was first granted to Jan Wismaar in 1693. In 1846 Michiel Nicolaas Louw took ownership of the property and it is then that the property was listed as "Annandale" on the deed of transfer. A number of subsequent owners made renovations and subdivisions before being purchased by the Zetler family in the early 1900s.

Although the farm stall in the south-eastern quadrant of the Annandale Road Intersection has a date of 1909 shown on its oldest section, the building does not appear on the 1966 aerial photograph. The 1909 date may well date the original farm stall on the property at a different location. It has had two recent additions in 2002 and 2006. Given the building's age of less than 60 years, it is therefore not considered a built environment heritage resource.

The main house on Farm 539/1 lies in the north-west quadrant of the Annandale Road Intersection and has been much altered. The house is likely to have been an outbuilding or worker's cottage when originally constructed but given the extensive modification and addition it is no longer possible to visually determine its original age. The nature of the modifications has rendered the house of very little heritage value in terms of architectural merits. The little value that can be attached to it is mostly archaeological and relates to any buried remains that might be present in and around the house and to an understanding of the construction materials and methods.

The secondary house on Farm 539/1 is also in the north-west quadrant of the Annandale Road Intersection. This house may be greater than 60 years of age, triggering Section 35 of the NHRA, however, it has no special architectural characteristics and thus is of no heritage value as a structure.

The small labourers' cottage on Farm 538 is certainly at least 19th century and seems to have started out as a simple rectangular cottage built of fired clay bricks and mud mortar on a stone foundation. Subsequent additions were made to both the east and west sides of the southern end creating a T-shape. A unique feature of this little house is that it has three hearth and chimney stacks, one original and one on each of the two later (but pre-1925) additions. Although modifications have been made to this cottage, it clearly has substantial amounts of original fabric and the majority is well over 60 years old. Although it is generally in very poor condition, it does have heritage value, primarily for its vernacular architectural characteristics (including its typically organic growth) and the value it imparts to the local cultural landscape. Its context among the strawberry fields and with two accompanying old oak trees adds to this value.

A small outbuilding to the south-east of the cottage is also greater than 60 years of age but has no particular heritage value.

One structure at the Annandale Road Intersection would be directly impacted should the project proceed.

Jamestown Cemetery U-turn location

The smallholdings located west of the R44 do not house any buildings of historical value.

The Jamestown Burial Park (Jamestown Cemetery) is located to the east of the R44, with the area immediately adjacent to the R44 utilised for graves between July 2012 and June 2013. However, these

graves would not be affected by the proposed U-turn facility. It should also be noted that graves younger than 60 years and located within a formal municipal cemetery are not protected under the provisions of the NHRA and are therefore not a heritage issue *per se.*

5.1.7.4 Cultural landscape and scenic route

There are various features on the local landscape that are a result of human intervention. The section of the R44 from Bredell Road to just south of Jamestown is considered to be a significant rural cultural landscape.

The cultural landscape of the study area is described below.

The Eerste River Valley rural cultural landscape

This section of the R44 is located in the wider rural cultural landscape of the Eerste River Valley, which comprises the Eerste River Basin, the Stellenboschberg and Helderberg Foothills. The landscape consists of a collection of formally declared Provincial Heritage Sites, protected biosphere areas, sites that are possibly worthy of Grade I and II heritage status, as well as sites of high local significance. A range of authorities and heritage practitioners have identified this cultural landscape as worthy of formal protection for historic, aesthetic, scenic, architectural, symbolic and social reasons. The landscape is of considerable heritage value in terms of patterns of historical settlement and cultivation dating to the late 17th century, with scenic route conditions and collections of very significant settlements and significant farmsteads. It is highly representative of the Cape Winelands.

The upgrade of the R44 which began in the 1960s bisected the Eerste River Valley into the Mountain Foothills and the Eerste River Basin as two distinct parts. These two regions are held together tenuously through the intersections at Annandale Road and the median openings which link previous networks. The foothills are generally considered a substantially intact rural cultural landscape, which possesses the potential for consideration as being of Grade II or possibly Grade I significance. The Eerste River Basin Area, located to the west of the R44, is considered as generally intact, particularly the areas linked to the interior of this area. The posited grading for the latter area is Grade IIIA. The integrity of the basin area has, however, been compromised along the outer edges as a result of inappropriate development both within and outside of the area.

R44 Scenic Route

Early maps show that roads corresponding to some extent to the R44 route already existed in the 18th and 19th centuries. Many of the early survey diagrams of the farms that line the R44 also indicate that a road along the route of the R44 existed by the 19th century, referred to as the main road. The route which became the R44 was thus part of a network of intersecting paths, tracks and routes.

The origins of the R44 can be traced to a historic map dating to approximately 1890. The original wagon route from Stellenbosch had formalized into a route through to Raithby (Kuiken Valley) and continued along the route now known as Winery Road. The portion of the R44 southwards to Somerset West would at this stage have been a wagon or horse route following established cadastral boundaries between various farms and serving as entrances to them. The underlying network of cadastral boundaries, intersecting paths, tracks, routes and entrances recorded on the 1890 map have been retained in certain areas along the R44 today. By the early 20th century the R44 was a notable main road, which is clearly visible in aerial photographs from 1938.

From a heritage perspective, the R44 is described as a historic route, with significant gateway conditions into the rural farming areas of the foothills and basin and into Stellenbosch itself. However, the upgrade into a dual carriageway in the 1970s, with related urban road geometric design, has turned it into a highly trafficked mobility route whose rural quality is often compromised along its route. The urban-scaled signalized infrastructure of the Annandale Road Intersection, over-scaled tourist uses and related intrusive signage all contribute to a detraction of the qualities of the rural landscape.

The R44 has been identified as a Scenic Route in the Provincial Spatial Development Framework and has been included as an Rural Scenic Drive in the Overlay Zone of the draft Revised Zoning Scheme of the Stellenbosch Municipality (refer to Sections 5.3.1 and 5.3.15). The HIA thus proposes a grading of Grade III Scenic Drive Heritage Resource.

Median openings

The additional HIA identified strong heritage resource indicators in respect of traditional movement routes within the rural cultural landscape. Certain median openings along the R44 formed part of these traditional movement routes, and as such are considered to be significant historic remnants of the network of old movement systems that traversed the Eerste River cultural landscape. These median openings are linked to the history of the landscape and the value of the R44 as an identified scenic route. The median openings are thus regarded as an integral historic component of the R44 and wider highly significant cultural landscape, with heritage significance in their own right. The proposed grading for the median crossings is IIIC.[2]

5.1.8 VISUAL

The study area is a predominantly rural area which is sought after as a way of life by many, as is evident by the numerous housing developments close to Stellenbosch, while it attracts numerous tourists because of its scenery, cultural heritage, wine farms and tourist destinations.

Farmsteads and agricultural buildings are scattered across the rural landscapes, with numerous conversions to tourist orientated businesses such as farmstalls, restaurants and tourist accommodation. Small, historic village settlements, such as Raithby and Jamestown, are found amongst the rural landscape as are commercial facilities such as nurseries. Larger settlements include the towns of Somerset West and Strand in the south and Stellenbosch in the north. Golf Estates and industrial parks are inclusive in the built landscape.

5.1.8.1 Steynsrust Road Interchange

Situated in the north-western suburbs of Somerset West, the intersection lies within an area that is transitional from a suburban to rural landscape. Residential development is within 100 m of the intersection in the south. The suburbs of Helderberg are located to the east and Illaire to the west.

The R44 crosses a ridge at the foot of the Helderberg Mountain, under the Steynsrust Road bridge and continues northwards through a narrow valley, a tributary of the Eerste River. Large exotic trees and low grass provide an open parkland adjacent to the intersection through which the road traverses.

[2] The heritage resources grading system is described in Section 5.1.7.1 above. Grade IIIC indicates the lowest level of local significance in terms of the HWC grading system.

Potential receptors at this interchange are residential areas which are considered high sensitivity receptors. The proposed improvements would be seen by immediate residents. However, the large pine trees, Public Open Space and the high walls and hedges surrounding most adjacent properties would provide screening.

Due to the existing roads, built environment, residential development and large trees which result in the study area being minimally visible in the landscape, the visual sensitivity of the landscape to the proposed interchange improvement is low.

5.1.8.2 Winery Road Intersection

The Winery Road Intersection is situated in the rolling, rural landscape on the slopes of the lower foothills of the Helderberg Mountain.

Large exotic trees are prominent as windrows, avenues and farmstead shade trees. Vineyards, horse paddocks, large trees and retail nurseries form the rural patchwork, stitched by trees and hedges, which surround the intersection. Travelling south outlying residential areas of Somerset West are visible edging the rural landscape. Historic homesteads look across the R44, with views of the neighbouring rural scene and Helderberg and Stellenbosch Mountains with western views of the Peninsula Mountains. These farms adjacent to the R44 / Winery Road Intersection offer wine tasting, restaurant and guest cottage accommodation.

The scenic resources of the Winery Road Intersection area can be described as rural, with vineyards, pastures, paddocks, windbreaks, shaded homesteads and tree lined streams on the gently rolling hills backed by the massive mountains providing a scenic and visual resource that is highly sought after. Receptors within the immediate vicinity of this interchange include:

- Avontuur Estate to the east and Ken Forrester Wine Estate to the south-west, both historic farm settlements, current homesteads and tourist destinations with wine tasting, restaurant (Avontuur) and accommodation (Ken Forrester Wine Estate). These receptors are multi-purpose high sensitivity receptors;
- Smallholdings to the north-west which are predominantly commercial nurseries but have some residential usage, are moderate to high sensitivity receptors;
- Both the R44 and Winery Road are tourist / wine routes. Users thereof are thus high sensitivity receptors; and
- The R44 is also used by approximately 30 000 commuters on a daily basis who are thus moderate sensitivity receptors.

Although the visual receptor sensitivity is moderate to high, the visual environment also includes major roads, such as the R44 which detracts from the rural character rendering the overall visual sensitivity moderate.

5.1.8.3 Annandale Road Intersection

The R44 / Annandale Road Intersection is also set on the Helderberg foothill slopes surrounded by a busy rural node of tourist facilities including wine tasting facilities, the Mooiberge Farmstall, the Audacia tented farm market facility (Root 44), fields of strawberries, homesteads and farm sheds and guest cottage accommodation. Due to its moderately visible position in the landscape, the intersection has a moderate visual sensitivity.

Large trees line the watercourse and provide shade for homesteads, with a plantation of Stone Pine trees covering the slopes of the hills to the north, providing shade for a caravan park. Strawberry fields dominate the immediate surrounds of the intersection with these being seasonally covered by rows of white plastic, a stark sight and source of glare at certain hours of the day. Large scarecrow like caricatures are scattered through a strawberry field and along the fence leading to the Mooiberge Farmstall, which while colourful and reminiscent of 'Playground Fairs' could be construed as visual clutter. Nonetheless, these and the farmstall, provide a remarkable landmark at this intersection.

The following receptors in the immediate vicinity of the proposed Annandale Intersection are rated as high sensitivity receptors:

- Two residential buildings to the north-west on Farm 539, Brakelsdal;
- Historic workers' cottages north-east of the interchange on Farm 538;
- Akkerdraai residential homestead and Guest Lodge on farm 537/18;
- Mooiberge Farmstall with wine tasting and restaurant on Farm 537/18 to south east of the interchange with a small residential cottage to the east;
- Audacia tented 'Root 44 Market' to the north east, which hosts weekend markets; and
- Users of the R44 and Annandale Roads which are scenic, wine and tourist routes.

Workers tending the strawberry fields are rated moderate sensitivity receptors.

The scenic resources of the Annandale Road Intersection area can be described as rural and 'touristic' providing a scene that is highly sought after. However, the R44, a major road with associated traffic lights and high mast lighting, detracts from the rural quality. The overall scenic and visual resources are thus defined as moderate to high.

5.1.8.4 Jamestown Cemetery

This location is on the southern slopes of the Blaauwklip River valley, where the area is characterized by both farmlands and development. Farmlands are visible in the immediate vicinity with views of the Helderberg, Stellenbosch, Jonkershoek and Simonsberg mountains beyond. Nearby surrounding development includes farmsteads, residential areas, tourist/retail facilities and an office park (Stellenbosch Square).

High sensitivity visual receptors would potentially include:

- Jamestown Cemetery immediately to the east; and
- Residents immediately to the west, south-west and north-west including Uitsig and Drie Lande farmsteads, De Zalze Golf Estate (although these residents are predominantly screened by landscaped berms and are orientated to look away from the proposed bridge), Klein Zalze Estate and Stellenbosch Golf Club to the north. Some areas of Jamestown to the north east and Blaauwklip farmsteads/settlements beyond are predominantly screened by the Stellenbosch Square development and tree planting.

5.2 SOCIO-ECONOMIC ENVIRONMENT

This section provides a description of the socio-economic environment. Specifically it provides details of Somerset West and the Stellenbosch Local Municipality area, inclusive of the smaller settlements of Jamestown and Raithby which are situated roughly along the relevant section of the R44. For comparative purposes as well as due to a lack of data at the town level, data is also provided for the

wider sub-region consisting of the City of Cape Town Municipality (CoCT), which includes Somerset West, and the Cape Winelands District Municipality, which includes Stellenbosch.

5.2.1 KEY SECTORS AND ECONOMIC GROWTH

The Gross Value Added (GVA) (as a measure of the value of goods and services produced in the area) for the CoCT is dominated by four sectors: finance and business services (36.1%), manufacturing (16.1%), trade and hospitality (15.6%), as well as community services and general government (15.0%). For the Stellenbosch Local Municipality, the leading contributors to GVA were community services and general government (27.3%), manufacturing (22.4%), finance and business services (20.0%) and trade and hospitality (14.7%).

The revised Stellenbosch IDP (2015/2016) reports that the regional economy within the Cape Winelands District Municipality grew by 3.7% per annum between 2000 and 2013. While this rate is slightly less than the provincial average of 3.9% per annum, it is still significant in light of the fact that the district is home to three of the Province's top ten non-metropolitan local municipalities, namely Stellenbosch, Drakenstein and Langeberg. As the 13th largest municipal economy nationally, Stellenbosch performs the best of these three. This local economy is mainly driven by agriculture and tourism.

The effect of the 2008 global financial crisis on CoCT is clear, resulting in a 1.9% contraction in regional Gross Domestic Product (GDP) growth in 2009. While not growing as strongly as in the period between 2004 and 2007, the economy has recovered in recent years recoding growth of 3.3% and 3.2% in 2010 and 2011, respectively. Similarly, there has also been a sharp decline in economic growth in the Stellenbosch Local Municipality since 2009. Growth rates of 3.3% and 2.9% in 2010 and 2011 are not high as such but indicative of a relatively strong economic recovery thereafter.

5.2.2 DEMOGRAPHICS

The 2011 Census estimated the population of the CoCT at 3.74 million in 2011, having also grown robustly at an average annual rate of 2.57% since 2001. Population density in the City was an average of 1 530 persons per km^2 and the number of households roughly 1.07 million implying an average household size of 3.3 persons per household in 2011. The population of Somerset West was estimated at 55 166.

The population in the Stellenbosch Local Municipality stood at approximately 155 732 with a relatively high annual population growth rate of 2.71 % since 2001. Approximately 35 570 of the residents of the municipality resided in non-urban areas while 2 839 resided in Jamestown and 907 in Raithby. Population density in the municipal area in 2011 was an average of 187 persons per km^2. The number of households in the Municipality was estimated at 43 420, indicating an average household size of 3.3 persons per household (StatsSA, 2013).

5.2.3 EMPLOYMENT

The dominant sector in terms of employment provision for both areas was the community services and general government sector, which provided around 31 % of all employment opportunities in 2011. Within CoCT, finance and business services (23 % of employment) and the wholesale and retail trade (17 % of employment) sectors are prominent. While the manufacturing sector used to be the second largest contributor to employment in the CoCT, this sector has shed a total of 42 000 jobs in the last decade

(CoCT, 2013). Within the Stellenbosch Municipality, the trade and hospitality sector (16 % of employment) and agriculture sector (15 % of employment) are also prominent.
Unemployment in the study area remains a major challenge, as in the rest of the country. Nevertheless, unemployment rates as well as youth unemployment rates are below the provincial and national averages and have fallen since the last Census in 2001.

The unemployment rate for Somerset West in 2011 was 9.2 %, significantly lower than that of CoCT at 31.4 %. At 24.4 % in 2011, the unemployment rate of the Stellenbosch Local Municipality was higher than that of the Cape Winelands District (21 %) as well as the provincial average (21.6 %), but lower than the national average (29.8 %).

5.2.4 INCOME LEVELS AND WELFARE MEASURES

Approximately 31 % of households in the CoCT and 32 % of households in the Cape Winelands District Municipality had incomes below R19 600 per year in 2011. Somerset West had a lower proportion of households in this income bracket of 18 % while the proportion in Stellenbosch Local Municipality was higher at 37 %.

The dependency ratio (the number of people aged below 15 years and above 64 per 100 people aged 15-64 years) provides an additional indicator of the need to generate income in the wider study area. In 2011, the dependency ratio for CoCT was 43.6 while it 38.4 for the Stellenbosch Local Municipality, lower than that of the Cape Winelands District Municipality at 44.9. All these figures are lower than the national average dependency ratio of 52.7 (StatsSA, 2013).

The Human Development Index (HDI) provides a measure of development progress based on the dimensions of life expectancy, literacy and education rate, as well as GDP per capita in purchasing power parity terms. The CoCT's HDI score of 0.74 exceeds the provincial average of 0.71. The Stellenbosch Local Municipality HDI of 0.69 is higher than the overall Cape Winelands District HDI score of 0.65, but lower than the provincial score (Western Cape Provincial Treasury, 2012).

5.3 PLANNING CONTEXT

The study area falls within the planning jurisdiction of the CoCT Helderberg District and the Stellenbosch Local Municipality, which forms part of the Cape Winelands District Municipality. Planning frameworks in relation to the provincial, district and local municipality levels relevant to the proposed project are discussed below.

5.3.1 PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (2014)

The updated Provincial Spatial Development Framework for the Western Cape supports three interrelated spatial planning themes that include the sustainable use of the Western Cape's spatial assets; realising opportunities in the Province's space-economy; and ensuring the establishment and development of integrated and sustainable settlements.

In relation to the first theme, the PSDF highlights the Province's unique agricultural resources, its natural capital in the form of its biodiversity, and its scenic and cultural resources are all regarded as significant spatial assets. These assets provide valuable ecosystem services, drive the success of the region as a leading tourist destination and provide its communities with a rich spatial experience. The PSDF

encourages the sustainable use of the agricultural and biodiversity resources and cautions against wasteful use of arable rural land in the light of the limited potential for agricultural expansion in the Province. In addition, the PSDF supports the safeguarding of significant natural, cultural and productive landscapes. The Cape Winelands is listed as a priority cultural and scenic asset to be protected and preserved in one of the provincial spatial policies linked to this planning theme (Provincial Spatial Policy R5). The R44 is designated a Primary Scenic Route on the Western Cape Province Landscape and Scenic Assets Map compiled as part of the specialist study undertaken for the purposes of reviewing the 2009 PSDF (Winter and Oberholzer, 2013).

In relation to the second theme, the PSDF recognises Government's limited ability to grow the provincial economy. However, it highlights Government's ability to contribute to a thriving economy through providing appropriate regional infrastructure that could lead to the realisation of economic opportunities within specific sectors such as agricultural, agri-tourism and tourism. Provincial Spatial Policy E1 therefore advocates for carefully assessing bulk infrastructure projects to ensure that they serve to connect existing human settlements rather than encourage settlement sprawl. Those projects that aim to shift from private transport to public transport or those that reduce travelling time instead of increasing it should thus receive priority. This policy states that biodiversity, heritage, agricultural resources and scenic landscapes should be considered in assessing bulk infrastructure projects.

The third spatial theme promotes compact and connected human settlements. Road networks can be instrumental in ensuring easy and safe access to economic centres for all and should be designed in a way that will not perpetuate spatial barriers formed by the apartheid regime. One of the provincial spatial policies within this theme (S2) stresses the need to enhance intermodal integration and regional linkages between towns and settlements that also provide for safe public transport connections. The R44 would be considered an important connecting route between settlements in terms of this policy, even though it is not specifically mentioned in this regard in the PSDF.

5.3.2 WESTERN CAPE INFRASTRUCTURE FRAMEWORK (2013)

The Western Cape Infrastructure Framework (WCIF) was produced by the Western Cape Infrastructure Working Group with a view to aligning the planning, delivery and management of infrastructure provided by various stakeholders, including national, provincial and local government; parastatals and the private sector, to the strategic agenda and vision for the province. The WCIF calls for a new approach to infrastructure: "One that satisfies current needs and backlogs, maintains the existing infrastructure, and plans proactively for a desired future outcome that leads to a resilient and inclusive growth *en route* to a vibrant, equitable and low-carbon society".

The framework supports a modal shift from private transport to public transport, in particular rail, as the annual increase of motorised trips is a significant challenge. An average annual growth rate of 2.8 % in motorised trips formed the basis for the projections in this framework. The framework clearly states that infrastructure investment should unlock economic potential at all scales. Such investment should support the towns with significant growth potential identified in the Growth Potential of Towns Study cited in the framework, of which Stellenbosch is one. The proposed improvement of the R44 would contribute to the maintenance of existing infrastructure.

5.3.3 WESTERN CAPE GOVERNMENT: DEPARTMENT OF TRANSPORT AND PUBLIC WORKS STRATEGIC PLAN (2015/16 – 2019/20)

One of the identified strategic outcome-orientated goals of DTPW's strategic plan, Goal 3, aims to "deliver safe, efficient, integrated transport systems in the Western Cape." These systems aim to promote

"economic growth and social connectivity in the Western Cape through partnerships by 31 March 2020" (DTPW, 2015).

The strategic plan acknowledges that spatial planning and infrastructure planning are often undertaken in isolation, a phenomenon that can directly be linked to pedestrian fatalities. It therefore urges that pedestrian management plans should form part of all infrastructure and urban planning development.

The R44 falls within the DTPW's road network which must be maintained and managed. As such, DTPW is proposing to undertake the necessary work to improve the existing road network in terms of safety and LOS.

5.3.4 CITY OF CAPE TOWN SCENIC DRIVE NETWORK MANAGEMENT PLAN (2003)

The Scenic Drive Network Management Plan (SDNMP) was approved in 2003 as a policy aiming to enable the protection and enhancement of Cape Town's unique natural, heritage and cultural landscape. This would promote investment in the tourism industry and job creation. The overall aim and purpose of the SDNMP is " … to identify routes which traverse areas of outstanding scenic quality in the City of Cape Town and to establish a sustainable balance between the conservation of its associated natural and built amenities and the development of its tourism and recreational potential".

The R44/ Beach Road route within the Helderberg area of the City of Cape Town is designated as an S1 route which is a High Priority Route that possesses significant visual quality due to the fact that it functions as a gateway from Stellenbosch to the coast and from the coast to the Winelands.

5.3.5 CITY OF CAPE TOWN INTEGRATED DEVELOPMENT PLAN (2012 – 2017)

The City of Cape Town has outlined the following objectives in its Integrated Development Plan (IDP):

- Create an enabling environment to attract investment that generates economic growth and job creation;
- Provide and maintain economic and social infrastructure to ensure infrastructure-led economic growth and development;
- Promote a sustainable environment through the efficient utilisation of resources;
- Ensure mobility and access through the implementation of an effective public transport system;
- Leverage the City's assets to drive economic growth and sustainable development; and
- Maximise the use of available funding and programmes for training and skills development.

The IDP further stated that "over the next five years, the City will be investing in a number of major infrastructure projects. This includes [the] rehabilitation and reconstruction of metro roads.

Providing a good road-based transport network calls for a well-developed, well-maintained and well-functioning road and street network. The operation and maintenance of this network greatly affect the efficiency of transport of people and goods into and within the city."

Programme 1.2(b) of the IDP relates to the maintenance of infrastructure: "Investment in the maintenance and expansion of essential utilities and services, such as … roads … and transport infrastructure, is fundamental to improve services and quality of life for all citizens as well as to encourage local and foreign investors to invest in other economic infrastructure as well".

The improvements proposed along the R44 forms part of the maintenance of the road-based transport network as it would facilitate economic growth and development.

5.3.6 CITY OF CAPE TOWN SPATIAL DEVELOPMENT FRAMEWORK (2012)

The CoCT SDF sets out, amongst other, the following development principles:

- The public good should prevail over private interests;
- All residents should have equal protection and benefits, and no unfair discrimination should be allowed;
- Encourage local, national and international connectivity;
- Improve urban efficiency, and align planned growth with infrastructure provision; and
- Offer maximum access to the city's opportunities, resources and amenities, and redress spatial imbalances in this regard as far as possible.

The R44 is defined as a tourism / visual gateway which falls under the economic action priority areas. Policy 50 advocates the promotion of accessible, citywide destination places, amongst other the Somerset West Winelands. The policy guideline statement includes: "land use management decisions must protect and enhance existing and potential destination places, including access to these places".

5.3.7 CITY OF CAPE TOWN INTEGRATED TRANSPORT PLAN (2013-2018)

The 2013 Integrated Transport Plan (ITP) update stated the following: "the road network forms an integral part of the greater transportation network. It is the public right of way system by means of which most of the City's transportation needs are met. These needs include the movement of people and goods. People movement includes trips between home and work, educational trips, business trips, as well as recreational trips for social activities. An urban area that is lacking in a good road network will suffer economically and socially. Coupled with land use planning in an intricate dynamic relationship, the road network influences and is influenced by the structure of any major urban area."

The focus of the Transport Infrastructure Strategy is on the provision of new infrastructure for the expansion of the Public Transport System, while maintaining the road network for private cars and freight logistics. It is considered important to ensure that the integrity of the road network, used by general public transport vehicles, private cars and freight vehicles, is well maintained. The strategy is to ensure the structural integrity of the network is maintained without increasing its capacity. Car-based road infrastructure upgrades happen gradually over time by adding additional capacity when demand exceeds what is available. The balance between supply and demand can therefore be restored frequently.

One of the objectives of the CoCT ITP (2013) is "to facilitate a fully integrated and well maintained infrastructure network along with related facilities, and to manage and enable the utilisation of this major asset appropriately and effectively".

5.3.8 CITY OF CAPE TOWN ENVIRONMENTAL MANAGEMENT FRAMEWORK (2012)

Strategy 1 of the CoCT's Helderberg District Plan (consisting of a SDF and an Environmental Management Framework) relates to the reinforcement "of the 'primary accessibility grid': Strengthening the connection to the coast via the R44 / Broadway … as development routes".

The transport infrastructure and route designation indicates Broadway Boulevard (the section of the R44 stretching from Strand to just beyond Steynsrust Road) as one of the routes in the district that should be developed. It stated the following in support of the proposed development:

1. These routes should continue to perform primarily a mobility function. Their role as structuring routes providing improved access and movement continuity between districts and between distant work and living areas should be reinforced.

3. The process of land use intensification along these routes must consider the nature of access roads, additional traffic impacts, and parking requirements.
4. Direct access onto these routes from abutting properties is not supported. Instead, limited access, with a focus on high access nodal points, should be permitted, and where necessary service roads should be developed.
5. Mitigation of the impact of the road's dominant mobility function (including design efforts to slow traffic) may be appropriate at high intensity nodal areas. The route between these nodes should remain primarily mobility orientated through residential areas, with appropriate landscaping and adherence to the boundary walls policy."

The CoCT policy for the section of the R44 from Strand to Steynsrust Road clearly supports a number of the aims of the current proposal for the R44.

5.3.9 CAPE WINELANDS DISTRICT MUNICIPALITY INTEGRATED DEVELOPMENT PLAN (2015/16) AND SPATIAL DEVELOPMENT FRAMEWORK (2009/2010)

The third review of the third generation Cape Winelands District Municipality (CWDM) IDP identifies three key strategic objectives that are strongly influenced and aligned with the provincial and national directive. Strategic Objective 2 is relevant to the proposed project and reads: "Promoting sustainable infrastructure services and transport system which fosters social and economic opportunities" (CWDM IDP, 2015/16).

In order to achieve this objective, the CWDM proposes to increase levels of mobility in the district and focus on sustainable infrastructure delivery especially for rural residents. As the District Municipality does not own any of the public roads in the region, the current District Integrated Transport Plan (DITP) (2011-2017) is largely a reflection of transport planning proposals made by national, provincial and local spheres of government. It does, however, provide insight into current levels of service, which is considered to be reasonable throughout the region.

The long-term vision of the DITP supports a modal shift from private to affordable public transport with a strong focus on the safety and comfort of passengers and pedestrians. It specifically encourages the design/improvement of transport interchanges that would accommodate people and not just vehicles.

The development principles and spatial objectives presented in the latest SDF for the Cape Winelands District Municipality has been incorporated into the current revised IDP. The following objectives are relevant to the proposed project:

- Objective 5 – To promote the concentration and intensification of human and economic activities within the current land footprint and in areas of high accessibility;
- Objective 6 – To promote sustainable resource use and responsible rural development;
- Objective 8 – To foster the inclusion of an economic perspective in land use management and land development; and
- Objective 9 – To improve and conserve the district's natural environment.

In line with the PSDF, the Cape Winelands District Municipality SDF encourages the restriction of future urban development to the existing urban footprints. This would support the integration of land use planning and transport planning insofar as transport demand can be projected spatially. In the case of the R44, the potential development of the settlements of Jamestown and Raithby is of significance. Increasing the safety and LOS of the R44 could result in strengthening the route's foreseen role of connecting compact urban nodes. Careful consideration should be given to the impact on the district's natural environment, i.e. agricultural resources, and cultural landscape.

5.3.10 CAPE WINELANDS DISTRICT MUNICIPALITY ENVIRONMENTAL MANAGEMENT FRAMEWORK (2011)

The CWDM Draft EMF defines scenic / historic routes which should be preserved in the Winelands. It includes the following from the CoCT's Scenic Drive Network Management Plan: "Consideration should be given to the following to enhance the aesthetic appearance of the scenic routes:

- Preservation of natural environment, sense of fit with the character of the area traversed, natural roadside appearance, vegetation cover appropriate to locality;
- Curvilinear horizontal alignments and gently rolling profiles with a minimization of cut and fill and the adoption of curvilinear profiles rather than steep sided slopes and squared shoulders; and
- Use of natural materials for street furniture and roadside walling."

5.3.11 STELLENBOSCH MUNICIPALITY INTEGRATED DEVELOPMENT PLAN (2015/2016)

The broad development goals set by the 2012-2017 Stellenbosch Municipality IDP are echoed in the latest revision dated 2015/2016, with the following five strategic objectives:

- Stellenbosch as the most preferred town for investment and business. Business and investment inflows translate into jobs and prosperity;
- The greenest valley that will not only make Stellenbosch even more attractive for visitors and tourists but also provide a base for new industries;
- Dignified living that will ensure that citizens own their town, take pride in it and have a sense of self-worth and belonging;
- A safer Stellenbosch that will put civic pride and responsibility in place of crime and destructive behaviour; and
- Good governance that implies compliance with and adherence to the policies and procedures that are mandatory and is the hallmark of a well-run municipality.

The revised Stellenbosch IDP recognises road congestion as a major challenge, especially during peak hours, and thus regards a modal shift from private to public transport as a necessity. As a result, the IDP adopts the strategic perspectives of the latest SDF (2013; refer to Section 5.3.12 below) of which the interconnected nodal spatial form and car-free living are directly related to transport. A strategic focus on densification of existing urban areas and the investment in NMT and public transportation is thus noteworthy.

This strategic approach is reflected in the Stellenbosch Municipality's CITP (see Section 5.3.13 below) and the recently established Transport Working Group that is widely represented (i.e. PRASA, CoCT, CWDM, WCG), which is spearheading action to this end. For example, a specialised Transport Plan for the town of Stellenbosch that integrates Local Economic Development initiatives and Land Use Plans into a multi-nodal transport solution is being finalised. It aims to alleviate traffic congestion that would benefit economic productivity of the region, amongst other objectives. Other projects listed in the IDP that indicates the Municipality's commitment to this challenge in the short to medium term include the formulation of an Integrated Public Transport Network, a Stellenbosch Traffic Model and a Traffic Calming Master Plan.

The IDP intends to protect or improve its standing as the 13th largest economy nationally which is largely attributed to its agricultural and tourism industries. An important factor to consider is the region's unique cultural landscape. A Heritage Plan and Strategy is being finalised that aims to provide detailed management guidelines on these resources.

The proposed improvements of the R44 could assist these localised efforts in alleviating traffic congestion through improving traffic flows at key intersections as well as improve safety along a strong mobility link between interconnected nodes (Somerset West, Raithby, Jamestown and Stellenbosch).

The proposed project would to some extent provide support for these objectives insofar as the project is network related and provides necessary infrastructure which will be easy to maintain.

5.3.12 STELLENBOSCH MUNICIPALITY SPATIAL DEVELOPMENT FRAMEWORK (2013)

The latest Stellenbosch Spatial Development Framework (SSDF) was adopted by the Municipality in 2013. The SDF proposes seven strategic development principles that would guide development in the region. Overall, the aim is to maximise the access to economic opportunities to bring about inclusive growth, preserving the distinctive sense of place of the area and to reduce ecological footprints to facilitate future sustainability.

Private motor vehicle usage is a major concern as many residents of outer lying suburbs are entirely reliant on this mode of transport. The SDF aims to curb this trend by encouraging the establishment of car-free living through investment in non-motorised transport (NMT) as well as encouraging the densification of existing "interconnected nodes." However, it is acknowledged that road infrastructure plays a vital role in connecting these nodes. The R44 is highlighted as a "strong structuring road link". The provision of non-motorised transport along all regional roads is furthermore highlighted as a key goal.

The town faces a major infrastructure backlog. Financial constraints prohibit the Municipality from adequately catering for this need. The SSDF thus does not promote the new road link included in the Transport Master Plan, which is proposed to run from the Annandale Intersection of the R44, aligned behind Techno Park, cross the R310 and rejoin the R44 at Kayamandi.

Stellenbosch's exceptionally fertile soil is regarded as one of the key resources needed to create long-term sustainability. The agricultural sector is not only important from a revenue-generating point of view but also because of the substantial contribution it makes to the region's employment statistics. The SDF is subsequently in favour of safeguarding land outside of urban settlements for the use of agriculture, biodiversity conservation, scenic quality and agri-tourism.

Stellenbosch's heritage and the region's sense of place are regarded as major contributors to the region's tourism industry. The SDF identifies a number of principles in response hereto, which include the recommendation to undertake a visual resource management exercise to determine the boundaries of view sheds along main routes.

The SDF identifies a number of new development areas aligned with their vision of creating compact and connected nodes. In addition to 461 ha earmarked for development in Stellenbosch, the SDF earmarks 56 hectares of developable land at the Jamestown / De Zalze node situated approximately 4 km north of the Annandale / R44 intersection. This includes the expansion of Techno Park and a mixed income development on the municipal land in this vicinity (the Stellenbosch Airfield location). The Municipality is also in the process of developing low income housing to the south of Jamestown along the R44 for 570 units; the first phase of 162 units is currently being completed. These future developments could add additional traffic to the R44 and to Winery Road in the case of Raithby, where 20 ha of land have also been earmarked for development. Recognising the existing safety concerns for pedestrians and cyclists attempting to cross the R44, the SDF further calls for assessing ways to improve this situation.

The Stellenbosch Comprehensive Integrated Transport Plan (2011) (see Section 5.3.13 below) considers these densification efforts and supports containing future urban development to existing nodes in order to safeguard the surrounding agricultural areas. It furthermore supports the SDF's strategy to promote and encourage the provision of NMT in order to curtail the escalation of traffic congestion as a result of future urban expansion.

5.3.13 STELLENBOSCH MUNICIPALITY COMPREHENSIVE INTEGRATED TRANSPORT PLAN (2011)

The objectives of the Stellenbosch Municipality's CITP includes "To developed a comprehensive and integrated plan relating to the regulation, provision and management of transport infrastructure (roads, stations and public transport facilities) and for regulating public transport operations and the use of infrastructure by both operator of public transport and private travellers."

The CITP lists the R44 as a major road feeding off the national routes (N1 and N2). It states that there are approximately 56 ha of land which has been identified for development to the western side of the R44. These developments include the municipal land on which the Stellenbosch Airfield is located and land at the entrance to Techno Park. Further development has taken place between the De Zalze Golf Estate and the envisaged Spier development where some of these "developments will have their entrance and access point from the R44, the Annandale Road and not the R310 as the current developments of Spier has at the moment. The impact thereof on future traffic patterns and volumes will have to be measured in time to cater for any new infrastructure that might be needed."

It is thus postulated that the intersection at Annandale Road and the R44 would in the future become busier than it is currently. It is important to plan for future developments in any road infrastructure upgrades.

5.3.14 DRAFT STELLENBOSCH MUNICIPALITY ENVIRONMENTAL MANAGEMENT FRAMEWORK (2014)

The draft Stellenbosch Environmental Management Framework (SEMP) aims to supplement other sectoral policies such as the SDF and the CITP whilst giving effect to national and provincial imperatives (such as bioregional planning) and the Stellenbosch Environmental Vision. The latter reads as follows: "A municipality and communities that recognise the vital importance of their rich natural capital and manage these in a manner that ensures sustainability and fulfils the need of all concerned."

In assessing the agricultural potential of the district, rural land has been classified as either Wilderness, Non-Arable (sub-categories listing low, medium and moderate grazing land) and Arable land (sub-categories include Marginal Potential Arable Land and Moderate Potential Arable Land). The non-urban land along the R44 has been classified as Moderate Potential Arable Land, which contributes significantly to Stellenbosch Municipality producing some of the country's highest yields from agricultural land in terms of income and employment generation. This area has subsequently been earmarked as mainly Intensive Agriculture Spatial Planning Category (SPC) complemented with areas with an Extensive SPC categorisation and interspersed with Urban Areas.

The SEMP places a strong focus on establishing sustainable settlements applicable to those areas assigned as Urban Area SPCs. To this end, densification of existing urban nodes are encouraged, non-motorised transport along major routes (including passenger safety) and the restructuring of road networks to maximise economic activity are supported. Nonetheless, the SEMP upholds that all

development should exude a sense of limits, which specifically relates to the scale and visual impacts of road infrastructure. The SEMP guards against constructing "free-flowing highway networks" that could encourage urban sprawl around these routes. The importance of integrating land use planning (by maintaining strong urban edges to expansion) and transport planning is thus crucial in preventing this outcome.

5.3.15 DRAFT STELLENBOSCH REVISED ZONING SCHEME (2012)

The general purpose of the 2012 revision of the Stellenbosch Zoning Scheme is "… the coordinated and harmonious development of Council's area of jurisdiction, in such a way as will most effectively ensure the achievement of sustainable development and the promotion of the health, safety, order, amenity, convenience and general welfare of the inhabitants of the area to which it applies." The zoning scheme makes provision for establishing overlay zones, as a category of zoning stipulating development rules for a land unit or area, in addition to the underlying zoning. Thus an overlay zone may determine specific development rules relating to *inter alia* environmental and/or conservation protection.

In terms of these provisions, the Revised Zoning Scheme has designated a number of routes within the Stellenbosch municipal area as Scenic Overlay Zones. The R44 south of Jamestown (and selected sections north of Jamestown) has been identified as a Rural Scenic Drive in the Revised Zoning Scheme Overlay Zones.

5.4 LAND USE

5.4.1 GENERAL LAND USE IMPLICATIONS

The land use practice in the vicinity is largely agricultural (vineyards and strawberry farming) but is becoming increasingly residential and the urban areas of Stellenbosch and Somerset West expand towards each other. The suburbs of Paradyskloof and Jamestown as well as the De Zalze Golf Estate and the Techno Park are also located along the R44 route.

Forestry (pine trees) still occurs at Pinewood near Jamestown. Degraded areas are frequent in this area and are often associated with the drainage lines and streams as a result of the spread of invasive alien plants along the river/stream corridors.

Land would be required at the Winery and Annandale Road Intersections for the proposed grade-separated structures. It is anticipated that at Winery Road a vineyard, a horse grazing paddock and a small fallow field would be affected by land acquisition. At the Annandale Road Intersection it is anticipated that strawberry fields, some large trees, a historic building, a vineyard and some business properties (a lodge and a farm stall) would be affected by land acquisition.

Land acquisition that would be required for the proposed above-ground grade-separated roundabouts would be approximately 5.3 ha in total, and approximately 6.3 ha for the proposed below-ground grade-separated interchanges. In the case of the Jamestown Cemetery U-turn facility, approximately 0.2 ha would be required for the proposed grade-separated bridge, and approximately 0.5 ha for an at-grade roundabout.

5.4.2 PROFILE OF AFFECTED LOCAL AGRICULTURE AND COMMERCIAL OPERATIONS

A number of commercial enterprises rely on direct and indirect access to the R44. This has potential implications as a result of the project. In addition, businesses near the Winery and Annandale Road intersections could be affected by loss of land to accommodate new structures and visual impacts associated with new structures. In order to inform the assessment, the following farms and associated businesses that are located at the intersections are profiled in this section:

At Winery Road Intersection:
- Ken Forrester Wine Estate;
- Avontuur Wine Estate and Stud Farm; and
- The business premises on the north western quadrant of the Winery Road Intersection.

At Annandale Road Intersection:
- Mooiberge Farm Stall and restaurant and the associated Zetler farming operation;
- Audacia Wine Estate and the Root 44 Market; and
- Klein Akkerdraai Lodge.

A brief description of business activities at the proposed Jamestown Cemetery U-turn location is also included below.

5.4.2.1 Winery Road Intersection

Ken Forrester Wine Estate

The Ken Forrester Wine Estate farm is roughly 54 ha in extent with roughly 30 ha devoted to vineyards. Wine production uses grapes from the farm and elsewhere to produce roughly 600 000 bottles of wine per year. The estate produces a range of wines but is most well-known for its award winning Chenin Blanc wines. This wine acts as a 'reputation setter' of sorts and relies heavily on the block of vines roughly 4 ha in extent situated between the farmstead and Winery Road. These vines are particularly old and require cultivation with great care.

The estate also has two self-catering cottages that are available for hire to tourists. Permanent staff on the estate total about 22 people including those involved in farming and the other aspects of the business such as administration. Temporary workers are added when needed, particularly at harvest times.

Longer term plans for the estate include relatively significant investment in the main visitor areas. This would include a new car park and tasting facility at the northern end of the farmstead which would result in the general orientation of visitor's facilities to be more north-facing.

Avontuur Wine Estate and Stud Farm

The Avontuur Estate is about 100 hectares in extent with land allocated fairly evenly between vineyards and horse paddocks and other facilities needed for its extensive stud operations focused on thoroughbred race horses. In its winery it produces approximately 125 000 bottles of estate wine per year using grapes from the farm. It receives in excess of 4 000 visitors per month drawn primarily to its wine tastings and a 60-seater restaurant. Permanent staff on the estate total roughly 40 people including those involved in all aspects of farming, the stud operations, restaurant and the other parts of the business. In addition, 25 to 30 casual workers are used when needed such as at harvest times and in peak tourist season.

Business on the north-western corner of Winery Road Intersection

Erf 177 and 178 are located on the north-western corner of the intersection. Erf 177 is owned by Prohaus Developments SA cc and is the premises for M Rent which hires out marquees, tents and associated equipment. Erf 178 is owned by Noordeinde Ontwikkelings where their offices are located as well as those of Tsohle Business Solutions (focused on systems engineering and ICT) and Tatis (customs and tax management solutions). These business premises are located in the western third of both properties closest to the gravel access road off Winery Road and furthest away from the R44. The majority of the remainder of both properties nearer the R44 is open land with lawns much of which is currently hired out to the nearby nurseries for the storage of mature trees.

5.4.2.2 Annandale Road Intersection

The Mooiberge Farm Stall and restaurant and the associated Zetler farming operation

The Mooiberge premises near the Annandale Road Intersection are part of a relatively large business consisting of a farm stall, wine / liquor sales outlet and the Farmer's Kitchen restaurant. The farm stall offers a wide variety of products commonly associated with farm stalls along with a particular emphasis on products derived from strawberries and other refreshments. The stall also serves as a venue where people can come and pick their own strawberries in the surrounding fields. In the wine / liquor outlet, a large variety of wines from the local area and further afield is also on offer. The Farmer's Kitchen restaurant is open during the day time and seats roughly 80 people. The restaurant is also being extended to include a bar area which should accommodate a further 200 people and would also be open in the evenings. Total current staff numbers for the combined operations at Mooiberge are roughly 65 persons.

The wider integrated farming operation covers an area of roughly 550 ha. The current mix of the main crops is strawberries, grapes and sweet corn. Significant value addition takes place at the packing and processing facility to the north of Annandale Road and nearby the Annandale / R44 intersection. A total of roughly 1 000 employees are associated with the entire integrated farming and associated processing operations.

In the case of fresh strawberries, each hectare under cultivation can yield 80 tons per annum which will generally sell for between R35 and R50 per kilogram once washed and packed. Aside from fresh sales, strawberries are also sold frozen, as juice and as pulp. The process of strawberry and berry cultivation and packaging is widely recognised as highly labour intensive when compared with other crops. At Mooiberge, it is estimated that between 10 and 15 workers are needed per hectare of strawberries cultivated if one includes packaging and other value addition activities.

Audacia Wine Estate and the Root 44 Market

Audacia Wine Estate is 32 ha in extent with 20 ha devoted to vineyards. The winery is a relatively small boutique establishment focused on red wine production. In 2013 it produced roughly 20 000 cases of wine and has a permanent staff of seven to which temporary workers are added when needed, particularly at harvest times.

In early 2013 the all-weather Root 44 farmers market was established. This is a large and successful market which operates every weekend and attracts in excess of 5 000 people per day including locals and tourists. It has approximately 150 stalls and makes provision for up to 800 cars. It provides numerous jobs for those operating the market and a number of additional jobs for stall owners and their staff. In addition, the market provides a significant outlet for local produce which may otherwise have had

greater difficulty accessing markets at a reasonable cost. Current estimates are that it has allowed for the generation of some form of income for an estimated 540 people.

Klein Akkerdraai Lodge

Klein Akkerdraai Lodge is situated approximately 300 m to the east of the Annandale Road Intersection with access to the property directly off Annandale Road. It is a relatively small upmarket 'boutique' guest house consisting of four bedrooms in an extensively restored typical Winelands farmhouse with heritage value. It is well established and relies heavily on repeat visitors most of whom are from overseas.

Farming operations on Klein Akkerdraai are outsourced and relatively modest in keeping with the 3.4 ha size of the property. The majority of the property is rented out to the neighbouring Zetler farming operation on which strawberries are cultivated. Part of the rental arrangement includes an agreement that the Zetler's manage the farming of the smaller remaining portion of the farm which is vineyard.

5.3.8.1 Jamestown Cemetery

The key properties in close proximity to the proposed U-turn facility that may be affected are the Jamestown Cemetery east of the R44 and Uitsig Farm (Farm 1298) west of the R44.

Two office parks are located in the area, namely Stellenpark Business Park (partially developed on Farm 510 Portion 87 on the corner of the R44 and the Jamestown Cemetery Road); and Blaauwklip Office Park (adjacent to Stellenpark Business Park along the R44 towards Stellenbosch). The south-eastern corner of the Kleine Zalze Golf Estate is situated approximately 150 m from the proposed U-turn bridge. Stellenbosch Square Mall is located on the corner of Webersvallei Road and the R44.

5.4.3 THE TOURISM CONTEXT

Wine and related attractions and activities are the key tourism drivers in the local area which is part of the Stellenbosch Wine Routes area. It is characterised by high levels of scenic beauty combining often historic vineyards and other rural agricultural scenes with mountain backdrops. The overall Wine Route area is divided into five sub-routes of which two are located over the study area. The majority of the R44 under consideration for upgrading falls within the Helderberg Wine Route area which covers the area from Somerset West to the Annandale Road Intersection. The Stellenbosch Berg Wine Route then covers the area from this intersection to Stellenbosch town. A number of wine farms rely on the R44 for access either directly or indirectly.

6. IMPACT ASSESSMENT

This chapter describes and assesses the significance of the proposed project alternatives on the biophysical and socio-economic environment. It also presents mitigation or optimisation measures that could be used to reduce the significance of any negative impacts or enhance any benefits, respectively.

The first section of this chapter (Section 6.1) assesses the impacts associated with the proposed improvements at specific locations along the route in terms of the potential impacts on:

- Vegetation;
- Freshwater;
- Groundwater;
- Heritage; and
- Visual.

For the Winery and Annandale Road Intersections the assessment considers above-ground grade-separated roundabout and below-ground diamond interchange alternatives. For the Jamestown U-turn facility, three alternatives are considered, namely a grade-separated U-turn bridge; an at-grade teardrop; and, at grade U-turn at the Webersvallei Road signalised intersection.

The second section of this Chapter (Section 6.2) describes the impacts at an overall project scale. Specific issues that are addressed include the following:

- Economic impacts:
  - Economic efficiency of upgrade / cost benefit analysis;
  - Economic feasibility of the project alternatives;
  - Impacts associated with land loss;
  - Impacts on commercial operations associated with visual changes;
  - Impacts on overall tourism potential; and
  - Impacts on local property values.
- Short term construction related impacts:
  - Jobs; and
  - Dust, noise, visual, travel inconvenience / travel delays.
- Impacts of the No-go Alternative.

Where a specific biophysical or socio-economic issue is not applicable to the project scope, these have been omitted from the relevant section.

All impacts are systematically assessed according to pre-defined rating scales as set out in the 'Convention for assigning significance ratings to impacts' (refer to Section 2.2.3.1 and Appendix H2).

Note: impact significance is indicated in **bold lower case** for negative impacts prior to mitigation and in **BOLD UPPER CASE** for negative impacts after mitigation. The same designation is used with the addition of italic letters in brackets for ***(positive)*** impacts.

6.1 ASSESSMENT OF INTERSECTION IMPROVEMENT ASPECTS

6.1.1 STEYNSRUST ROAD U-TURN FACILITY

The natural environment is severely modified at the existing interchange and only a small area outside the existing road reserve would be affected by the proposed new U-turn bridge. It is located within an

essentially modern residential suburb and no historical features occur in the immediate vicinity. It is thus not anticipated that any impacts would be experienced on groundwater and heritage as a result of this project component. Anticipated impacts to vegetation and freshwater and visual features are described below.

6.1.1.1 Vegetation

Impact Description

The proposed development of the Steynsrust Road U-turn bridge would result in a loss of some remnant natural vegetation and non-natural vegetation.

Assessment

The vegetation at Steynsrust Road Interchange is mostly transformed with very little natural remnants remaining. Most of the vegetation in the roadside is planted. The anticipated intensity of the impact would thus be low, of local extent and permanent. The impact significance is therefore deemed to be **LOW** both before and after mitigation (see Table 6.1).

Mitigation

- Rehabilitate the road reserve and road islands using endemic shrub species rather than replacing vegetation with hard-wood species.

Table 6.1: Potential impact of loss of vegetation

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Low	Low
Probability	Definite	Definite
Confidence	High	High
Significance	**Low**	**LOW**
Cumulative impact	Low – no effect on natural vegetation	
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	None	

6.1.1.2 Freshwater

Impact Description

The flow capacity, water quality and freshwater habitats of the watercourses at Steynsrust Road could be affected by the development of the proposed U-turn facility.

Assessment

The Moddergat River and one of its tributaries flow through the Steynsrust Road Interchange. It is anticipated that the proposed access improvements would cause some minor disturbance to the freshwater habitats of the watercourses. However, as both watercourses have been highly modified, with the tributary flowing within a concrete channel through the site, the intensity of the impact is expected to be low, occur locally and be long term. It is thus anticipated that the project would result in an impact of **Low** significance and that with mitigation this would change to **VERY LOW** significance (see Table 6.2).

Mitigation

- New structures should not constrict the flow in the watercourse channels but should aim to improve stormwater management as far as possible.

Table 6.2: Potential impact of disturbance of watercourses

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long term	Long term
Intensity	Low	Very low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low**	**VERY LOW**
Cumulative impact	Low – no cumulative impact is anticipated	
Degree to which impact can be reversed	Partially reversible	
Degree to which impact may cause irreplaceable loss of resources	Medium - Low	
Degree to which impact can be mitigated	Low	

6.1.1.3 Visual impacts

Impact Description

The development of the proposed U-turn facility at Steynsrust Road may change the visual landscape of the surrounding area.

Assessment

The development of this proposed project component would result in the loss of some visual resources thereby affecting sensitive receptors (see Table 6.3).

1. *Increased road area and loss of grass and some trees*. Construction and operation phase activities would result in the removal of some trees and grass, and an increased road surface area associated with the U-turn deck and associated ramps. The impact of the additional visual aspects is thus considered to have a medium intensity, be of local extent and long term duration. The resulting impact would have a **Medium** significance which with mitigation could be reduced to **LOW** significance.
2. *Visibility from sensitive receptors:* Receptors (residents, users of the Steynsrust Bridge system and R44 and of public open space areas) would see the U-turn deck, associated ramps and vehicles. The removal of trees would increase exposure of the existing and new road and bridges to the receptors, whereas the existing road and bridges are currently partially screened. However, as the proposed U-turn deck would be located up against the existing Steynsrust Road bridge this impact would be local, limited to the Zone of Visual Influence (ZVI) and is deemed to be of low intensity resulting in a **LOW** significance impact with and without mitigation.

Mitigation

The following mitigation measures are recommended:

- Limit the extent of disturbance;
- Rehabilitate and revegetate disturbed areas with appropriate vegetation after construction;
- Appoint a Landscape Architect to develop the landscape philosophy, provide detail drawings and specifications for the tender documentation and to monitor implementation; and
- Consult with the City of Cape Town's Spatial Planning and Urban Design Department to obtain input into the proposed landscape plans prior to construction.

Table 6.3: Potential visual impact of the proposed Steynsrust Road U-turn facility*

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long term	Long term
Intensity	Low – Medium	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Low - Medium**	**LOW**
Cumulative impact	Low – Medium due to the existing transformed state with the existing Steynsrust Bridge currently visible to receptors	
Degree to which impact can be reversed	Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Low – Medium	
Degree to which impact can be mitigated	Low – Very low	

* The impact significance listed in this table is an overall combined figure of the visual impacts assessed above.

6.1.2 BREDELL ROAD / KLEIN HELDERBERG ROAD

The proposed safety improvements at Bredell Road would not extend outside the existing road reserve. It is, therefore, not anticipated that any impacts would be experienced on vegetation, freshwater, groundwater, heritage or visual features.

6.1.3 WINERY ROAD

It is not anticipated that the project would have any impact on freshwater features as there are no nearby watercourses at this intersection. Anticipated impacts for vegetation, groundwater, heritage and visual features are described below.

6.1.3.1 Vegetation

Impact Description

The development of the grade-separated roundabout or below-ground interchange would result in the loss of some remnant natural vegetation and non-natural vegetation.

Assessment

Grade-separated roundabout

The affected areas are mostly transformed and contain little natural remnant vegetation. The remnant patches which occur in the road reserve consist of pioneer vegetation and several juvenile wild olive trees. Most of the vegetation adjacent to the road reserve is planted hedges and trees. The loss of minor natural vegetation in the road reserve and non-natural vegetation is thus expected to have a low intensity impact at a local scale and be permanent. The impact would thus have a **LOW** significance both before and after mitigation (see Table 6.4).

Below-ground interchange

This alternative would be slightly narrower on the western side than the grade-separated roundabout, while the footprint would be slightly wider on the eastern side. The footprint extension on the eastern side would impact on transformed farmland and would not result in any loss of natural vegetation. The impact would thus, as above, be of **LOW** significance (see Table 6.4).

Mitigation

The following mitigation measures are recommended:

- Rehabilitate the road reserve and road islands using endemic shrub species rather than replacing vegetation with hard-wood species;
- Replace vegetation removed from the hedge and tree line along Winery Road with similar sized indigenous vegetation; and
- Where possible, relocate or transplant the juvenile wild olive trees.

Table 6.4: Potential impact of loss of vegetation at Winery Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
IMPACT	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Low	Low	Low	Low
Probability	Definite	Definite	Definite	Definite
Confidence	High	High	High	High
Significance	**Low**	**LOW**	**Low**	**LOW**
Cumulative impact	Low		Low	
Degree to which impact can be reversed	Irreversible		Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Low		Low	
Degree to which impact can be mitigated	Very low		Very low	

6.1.3.2 Groundwater

Impact Description

Groundwater users could potentially be impacted by the loss of the borehole on Erf 178 (Noordeinde Ontwikkelings) due to construction blasting (if required) and the potential lowering of the water table due to the excavation associated with the below-ground interchange alternative.

Assessment

Grade-separated roundabout

Impacts on groundwater users associated with this alternative can be divided into two areas of concern:

1. *Damage to or loss of existing boreholes:* The proposed grade-separated roundabout would result in the loss of one borehole (see MG1 in Figure 6.1) at the Winery Road Intersection. The resultant loss of water supplies used for domestic and agricultural purposes would have an impact of high intensity, occur locally and be long term. The impact would therefore have **High** significance to the groundwater users. The supply of a new borehole would reduce the impact to **INSIGNIFICANT** (see Table 6.5).
2. *Blasting:* If blasting is required during the construction phase, it could impact borehole water supply. The other boreholes which are located further than 100 m away from the blasting footprint are considered to have low risk. Three additional boreholes were identified in the vicinity of the Winery Road Intersection, none of which would be closer than 100 m from the proposed roundabout and which would therefore be at low risk of being impacted. Given the dependence of property owners on groundwater for domestic water supply and an absence of alternative source of water, damage to their boreholes could be a permanent high intensity impact, limited to the site. The significance of the impact is thus anticipated to be **High** before mitigation which could reduce to an **INSIGNIFICANT** impact after mitigation (see Table 6.5). It is, however, anticipated that blasting may only be required in small amounts, if at all, in the case of the above-ground alternative.

Figure 6.1: Position of boreholes at the intersection of the R44 with Winery Road in relation to the proposed grade-separated roundabout

Below-ground interchange

This alternative would require excavation to approximately 7 to 8 m below the existing road level. This may result in the continual seepage of groundwater into the excavated areas and interchange. It is planned to discharge the groundwater into a nearby stream by means of a gravity-fed pipeline.

Impacts on groundwater users associated with this alternative can be divided into the following three areas of concern:

1. *Damage to or loss of existing boreholes:* The footprint of the below-ground alternative would be similar to that of the above-ground alternative, but with a slightly larger area. Consequently, the nature, assessment and mitigation measures of this impact would be the same as for the grade-separated roundabout (see Table 6.5).
2. *Blasting:* The nature, assessment and mitigation measures of this impact would also be similar for both alternatives in relation to this area of concern (see Table 6.5). Depending on the underlying geology more blasting may be required than that for the above-ground roundabout.
3. *Lowering of the water table*: Pumping during the construction phase and discharge during the operation phase would result in a localised lowering of the water table. In turn, this could potentially impact the performance of nearby boreholes and the role of groundwater in sustaining the greater environment. However, the extent of any impacts resulting from the abstraction of groundwater would remain at a local scale. The impacts would be of permanent duration because of the need to remove any groundwater that discharges into the excavated areas on an ongoing basis, while the intensity of the impact is expected to be very low. No mitigation is deemed necessary. The significance of the impact has thus been rated as **INSIGNIFICANT** with and without mitigation (see Table 6.6).

Some cumulative impact could be expected, with the impacts caused by the abstraction at the interchanges being superimposed on those from the existing abstraction. However, the cumulative impacts are considered insignificant and would not impact either the performance of existing boreholes or the role of groundwater in the environment. This is because the aquifer response expected from the abstraction of groundwater during both the construction and operation phases is equivalent to that from pumping a single, very low-yielding borehole. The drawdown induced by discharge from the excavated areas would be much less than that caused by abstraction from existing boreholes and would thus have no material impact on the aquifer or existing boreholes.

Table 6.5: Potential impact of the proposed grade-separated roundabout and below-ground interchange alternatives on groundwater

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
IMPACT	**LOSS OF BOREHOLES**		**BLASTING**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	High	Very low	High	Very low
Probability	Definite	Definite	Probable	Probable
Confidence	Medium	High	High	High
Significance	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Cumulative impact	Low – no cumulative impact		Low – no cumulative impact	
Degree to which impact can be reversed	Irreversible		Irreversible	
Degree to which impact may cause irreplaceable loss of resources	High		High	
Degree to which impact can be mitigated	High		High	

Mitigation

The following mitigation measures are recommended:

- Prior to construction replace the borehole that would be destroyed so as to provide a continuous supply of the same volume of water to the affected groundwater user; and
- Monitor the high risk boreholes so that any impacts to borehole performance due to any blasting can be quantified.

Table 6.6: Potential impact of below-ground interchange on groundwater due to potential lowering of the water table as a result of the abstraction of groundwater

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Very low	Very low
Probability	Definite	Definite
Confidence	High	High
Significance	**Insignificant**	**INSIGNIFICANT**
Cumulative impact	Very low – cumulative impact not likely to be of relevance t	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	None	

6.1.3.3 Heritage impacts

a. Archaeological / historical impacts

Impact Description

The proposed project could lead to some disturbance or the loss of archaeological / historical artefacts and changes in the built environment at the Winery Road Intersection.

Assessment

Grade-separated roundabout

Since no archaeological artefacts were uncovered at this intersection, the potential to further uncover such material during construction excavation is small. The impact is thus deemed to be of very low to low intensity, local extent and permanent duration. It is thus anticipated that the impact would be of **VERY LOW** significance both before and after mitigation (see Table 6.7).

Below-ground interchange

The disturbance footprint of the below-ground alternative would be largely the same as for the above-ground alternative. The archaeological impact would thus be the same as for the above-ground alternative, namely of **VERY LOW** significance both before and after mitigation (see Table 6.7).

It should be noted that no heritage impact in terms of the built environment is anticipated as a result of either alternative.

Mitigation

- Ensure that the project footprint is kept to a minimum;

Table 6.7: Potential archaeological / historical impacts at Winery Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Very low - Low	Very low - Low	Very low - Low	Very low - Low
Probability	Probable	Probable	Probable	Probable
Confidence	High	High	High	High
Significance	**Very low**	**VERY LOW**	**Very low**	**VERY LOW**
Cumulative impact	None		None	
Degree to which impact can be reversed	Irreversible		Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Medium		Medium	
Degree to which impact can be mitigated	Very low		Very low	

b. Cultural landscape impacts:

Impact Description

The proposed project would result in changes in the cultural landscape and the R44 scenic drive at the Winery Road Intersection.

Assessment

Grade-separated roundabout

The cultural heritage specialist study provided a description and discussion of the potential impact of the proposed grade-separated roundabouts that apply to both Winery Road and Annandale Road. The study states that they would have a considerable impact on the landscape, immediate surrounds and overall heritage resources on various levels, namely:

- The proposed roundabouts are not in line with the scenic drive recommendations or with any of the heritage resource indicators proposed in the additional HIA report. (Please note that the additional HIA provides heritage indicators, in line with established practice. Such indicators serve as informants for design proposals that are developed within the context of significant heritage resources. The HIA thus makes a number of recommendations regarding heritage resources indicators, including recommendations regarding the design approach to scenic drives – refer to Section 6.2.2 for more detail in this regard).
- The proposed roundabouts present a model which is considered at fundamental odds with the identified rural cultural landscape. It is regarded as a movement system which is imposed onto the landscape, not one which responds to it.
- The grade-separated roundabout solution does not respond to the sense of place.
- The footprint would effectively impact on a wider area and identified heritage resources around the immediate periphery of the footprint.
- In purely visual terms, the above-ground grade-separated alternative would have the greater impact, in terms of the physicality of the structures imposed on the landscape, as well as in material terms, in that the concrete structures as well as the considerable amount of cut and fill would not be in line with the scenic drive recommendations proposed in the additional HIA report.
- The visual linkages to the broader landscape, particularly when viewed from Winery Road looking toward the R44 and mountains, would be heavily compromised leading to an almost complete separation of the various elements that make up the wider landscape.
- The cultural and rural sense of place of the region as a totality would be compromised which the study regards as a highly negative impact on the identified heritage resources.

For the R44/Winery Road Intersection (see Figures 6.2 and 6.3), the cultural heritage specialist study states that the potential footprint would be imposed onto the established cultural landscape and that no amount of visual screening would be able to mitigate this intrusion onto an historic pattern.

The cultural heritage specialist study concluded that the potential cultural heritage impact of the grade-separated roundabout would be a permanent localised impact of high intensity. The impact significance would be **HIGH** with and without mitigation (see Table 6.8).

Figure 6.2: **Visual simulations of proposed grade-separated alternatives at the R44/Winery Road Intersection, showing the view looking north – composite image comparing an existing view (top image) with photomontages of the proposed above-ground roundabout (middle image) and the proposed below-ground interchange (bottom image) (Think3dlab, 2016).**

Figure 6.3: **Visual simulation of proposed grade-separated alternatives at the R44/Winery Road Intersection, showing the view looking west– composite image comparing an existing view (top image) with photomontages of the proposed above-ground roundabout (middle image) and the proposed below-ground interchange (bottom image) (Think3dlab, 2016).**

Below-ground interchange

The cultural heritage specialist study indicated that the proposed below-ground interchanges would on one level be a potentially less intrusive option than the above-ground alternative in that they would visually maintain a degree of continuity with the surrounding cultural landscape. However, the study sees

the below-ground alternatives as still representing a fundamental intrusion onto the established historic pattern, especially when viewed from Winery Road, which underpins the heritage significance of the wider rural cultural landscape, on a number of levels, namely:

- The footprint of the proposed structures would affect a considerable area at both locations, dependent on whether constructed with fill slopes or vertical retaining walls.
- They would not be in line with scenic drive recommendations and heritage resource indicators proposed in the additional HIA report.
- These are regarded as large, urban morphology structures imposed into a rural landscape which would alter the topography of the site to suit, rather than respond to it and existing geometries.

Due to the assessed intrusion of the structure into the landscape, the impact of the below-ground interchange (see Figures 6.2 and 6.3) is still seen as being of high intensity. The impact significance would be **HIGH** with and without mitigation (see Table 6.8).

Mitigation

The specialist study indicated that the overall impact on the rural cultural landscape and scenic drive cannot be mitigated for either of these alternatives.

Table 6.8: Potential impacts on the cultural landscape and the R44 scenic drive at Winery Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	High	High	High	High
Probability	Definite	Definite	High	High
Confidence	High	High	High	High
Significance	**High**	**HIGH**	**High**	**HIGH**
Cumulative impact	High. Proposal would impact on entire rural cultural landscape.			
Degree to which impact can be reversed	Irreversible		Irreversible	
Degree to which impact may cause irreplaceable loss of resources	High		High	
Degree to which impact can be mitigated	None		None	

6.1.3.4 Visual impacts

Impact Description

Visual impacts that could result from the proposed project include a change in the rural landscape character resulting from the visual intrusion of the physical structures, associated lighting infrastructure and light pollution.

Assessment

Grade-separated roundabout

The proposed grade-separated roundabout deck level would be approximately 7 - 8 m above the existing carriageway level with associated fill slopes or retaining walls extending beyond the current road reserve(see Figures 4.3. and 4.4 in Chapter 4). This alternative would result in the loss of some visual resources thereby affecting sensitive receptors such as Avontuur, the Ken Forrester Wine Estate and the Happy Vale homestead. It would also be illuminated at night resulting in some light pollution. A change in landuse character from rural to urban would to some extent be experienced. All visual impacts are

anticipated to occur locally within the Zone of Visual Influence (ZVI) and have a long term or permanent duration (see Table 6.9).

1. *Change in rural landscape character:* The existing road connectivity at the intersection respects the rural character of the area. The proposed grade-separated roundabout would be of a more highway nature resulting in the interchange being less rural in nature. The impact on rural landscape character is thus considered to have a high intensity, local extent and would be permanent. The resulting impact would have a **High** significance which with mitigation could be reduced to a **MEDIUM** significance.
2. *Light Pollution:* The proposed grade-separated interchange would require street lighting which could result in light pollution to receptors within the ZVI leading to some loss of night darkness, appreciated in a rural landscape. The intensity of this impact is considered to be medium to high with local extent and long term duration. This would result in a **Medium** to **High** impact significance which with mitigation could be reduced to **MEDIUM** significance.
3. *Visibility from sensitive receptors:* Receptors (surrounding farmers, smallholdings, etc.) would see the elevated roundabout, vehicles on the ramps, night lighting and new access roads within their largely unobstructed view field. The interchange would not block views of the surrounding rural landscape and mountains, but would partially intrude on these views. This is deemed to be an impact of high intensity resulting in a **High** significance impact which with mitigation could be reduced to **MEDIUM** significance
4. *Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route:* The proposed roundabout would be visible for a radius of approximately 2.5 km within the ZVI. Views of adjacent rural landscape, particularly to the south-west, may be partially obscured. This impact is deemed to have medium intensity resulting in an impact of **Medium** significance and with mitigation of **LOW to MEDIUM**.

Visual simulations of the views are provided in Figures 6.4 to 6.7.

However, the impacts would be restricted very locally to users of the R44 and the users of the interchange itself and be only partially visible to sensitive visual receptors (adjacent landowners of Avontuur, Ken Forrester Vineyards and Happy Vale) as the existing R44 road and traffic is currently partially obscured to them. All visual impacts are anticipated to occur locally and have a long-term duration (see Table 6.9). From a visual sensitivity perspective, this alternative is preferred to the grade-separated roundabout.

1. *Change in rural landscape character:* The below-ground interchange would result in a change in the character from rural to urban. The impact is considered to have a low intensity at the local level, with a significance rating of **LOW** with and without mitigation.
2. *Light Pollution:* The intensity of this impact is considered to be low, of local extent, limited to the ZVI, and long term duration. This would result in a **Low** impact significance which could be reduced to **VERY LOW** significance with mitigation.
3. *Visibility from sensitive receptors:* The proposed interchange would be visible to users of the interchange and the R44 and partially visible to the adjacent landowners (Avontuur, Ken Forrester Vineyards and Happy Vale). This impact would be of low intensity resulting in a **LOW** significance impact with or without mitigation.
4. *Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route:* As views of the proposed interchange would be restricted to its immediate surroundings, this impact is deemed to have a low to medium intensity resulting in an impact of **Low to Medium** significance and with mitigation of **LOW**.

Figure 6.4: **Current view west from Avontuur restaurant and wine tasting terrace towards the R44 Intersection, approximately 260 m away (MALA, 2014)**

Figure 6.5: **Visual simulation of the proposed grade-separated roundabout looking west from Avontuur restaurant and wine tasting terrace, approximately 260 m away (MALA, 2014)**

Figure 6.6: **Current view north-east from Ken Forrester Vineyards wine tasting area towards the R44 Intersection, approximately 350 m away (MALA, 2014)**

Figure 6.7: **Visual simulation of the proposed grade-separated roundabout looking north east from Ken Forrester Vineyards wine tasting area, approximately 350 m away (MALA, 2014)**

Mitigation

The following mitigation measures are recommended:

- Use 'low spill' light which directs light downward;
- Cover associated infrastructure such as electrical kiosks with rural type coverings or where feasible, bury them;

- Plant vegetation on the fill slopes / embankments or in front of the vertical retaining walls to screen the interchange from sensitive receptors;
- Landscape cut embankments and disturbed areas in appropriate ways to blend with the rural nature;
- For the below-ground interchange: Use exposed aggregate finish to provide a more natural aesthetic; and
- Screen the lights at the intersection from the surrounding landscape through tree planting of a rural nature where possible.

Table 6.9: Potential visual impact at Winery Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local – limited to ZVI	Local – limited to ZVI	Local	Local
Duration	Long term	Long term	Long term	Long term
Intensity	Medium – High	Low – Medium	Low – Medium	Very low - Low
Probability	Definite	Definite	Probable	Probable
Confidence	High	High	High	High
Significance*	**Medium – High**	**LOW – MEDIUM MEDIUM**	**Low – Medium**	**VERY LOW – LOW**
Cumulative impact	Low		Low	
Degree to which impact can be reversed	Irreversible - Partially reversible		Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Low		Low	
Degree to which impact can be mitigated	Low		Low	

* The impact significance listed in this table is an overall combined figure of the impacts assessed above.

6.1.4 ANNANDALE ROAD

6.1.4.1 Vegetation

Impact Description

The development of the grade-separated roundabout or below-ground interchange would result in a loss of some natural vegetation and non-natural vegetation.

Assessment

Grade-separated roundabout

The affected areas are mostly transformed and contain very little to no natural vegetation. The natural vegetation includes pioneer species and a mature wild olive tree. Most of the vegetation in the roadside is planted hedges and trees. The loss of some natural vegetation and non-natural vegetation is thus expected to have a low intensity at a local scale and be of a permanent duration. The impact would thus have a **LOW** significance both before and after mitigation (see Table 6.10).

Below-ground interchange

This alternative would have a slightly wider footprint on all sides than the grade-separated roundabout, in particular the south-eastern side of the intersection. However, the footprint extension would impact on transformed farmland. The impact would thus be of **LOW** significance as in the case of the grade-separated roundabout alternative.

Mitigation

The following mitigation measures are recommended:

- Rehabilitate the road reserve and road islands using endemic shrub species rather than replacing vegetation with hard-wood species;
- Replace trees with similar size indigenous vegetation to retain the screening function currently provided; and
- Where possible, relocate, transplant or replace the mature wild olive tree.

Table 6.10: Potential impact of loss of vegetation at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
IMPACT	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Low	Low	Low	Low
Probability	Definite	Definite	Definite	Definite
Confidence	High	High	High	High
Significance	**Low**	**LOW**	**Low**	**LOW**
Cumulative impact	Low		Low	
Degree to which impact can be reversed	Irreversible		Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Low		Low	
Degree to which impact can be mitigated	Very low		Very low	

6.1.4.2 Freshwater

Impact Description

The flow capacity, water quality and freshwater habitats of the watercourses at Annandale Road could be affected by the proposed project.

Assessment

Grade-separated roundabout

The Bonte River and one of its tributaries flow to the north of the Annandale Road Intersection. It is anticipated that the on- and off-ramps to the north of the proposed grade-separated roundabout would cause some disturbance of the watercourses and impedance or diversion of the flow. However, as both watercourses have been highly modified, with the tributary flowing within a concrete channel through the site, the intensity of the impact is expected to be low, occur locally and be permanent. It is thus anticipated that the project would result in an impact of **Low** significance and with mitigation this could change to **VERY LOW to LOW** significance (see Table 6.11).

Below-ground interchange

The below-ground interchange would have a similar impact on the Bonte River and its tributary as the grade-separated roundabout – **VERY LOW to LOW** with mitigation.

Mitigation

- Any new structures should aim to improve stormwater management as far as possible;
- Control invasive alien vegetation within the road reserve; and
- Rehabilitate disturbed areas within the freshwater features after construction.

Table 6.11: Potential impact on watercourses at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
IMPACT	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Low	Low – very low	Low	Low – very low
Probability	Definite	Definite	Definite	Definite
Confidence	High	High	High	High
Significance	**Low**	**VERY LOW – LOW**	**Low**	**VERY LOW – LOW**
Cumulative impact	Low		Low	
Degree to which impact can be reversed	Partially reversible		Partially reversible	
Degree to which impact may cause irreplaceable loss of resources	Medium - Low		Medium - Low	
Degree to which impact can be mitigated	Low		Low	

6.1.4.3 Groundwater

Impact Description

The proposed project could affect groundwater users due to the loss of boreholes in the vicinity of the intersection and, if required, due to construction blasting.

Assessment

Grade-separated roundabout

Impacts on groundwater users can be divided into two areas of concern:

1. *Damage to or loss of existing boreholes:* The proposed grade-separated roundabout would result in the loss of four boreholes (depicted as DW1, DW5, AF1 and AF2 in specialist report) at this intersection (see Figure 6.8). The resultant loss of water supply from these particular boreholes used for domestic and agricultural purposes would be of high intensity, local extent and long term duration. The impact would thus have **High** significance to the groundwater users. The supply of new replacement boreholes would reduce the significance of the impact to **INSIGNIFICANT** (see Table 6.12).
2. *Blasting:* If blasting is required during the construction phase it could impact borehole water supply. The boreholes located within 30 m from the blasting area are considered to be at high risk of damage. Five boreholes are situated within 30 m of this proposed grade-separated roundabout. Given the dependence of property owners on groundwater for domestic water supply and an absence of an alternative source of water, damage to their boreholes would be a permanent high intensity impact which is limited to the site. The impact would thus have **High** significance to the groundwater users. The supply of new boreholes would reduce the significance of the impact to **INSIGNIFICANT** (see Table 6.12). It is, however, considered very unlikely that blasting for the proposed project would occur in the case of the above-ground alternative.

Figure 6.8: Position of boreholes at the intersection of the R44 with Annandale Road in relation to the proposed grade-separated roundabout

Below-ground interchange

This alternative would also require excavation approximately 7 - 8 m below the existing road level, which may result in the continual seepage of groundwater into the excavated areas and interchange. The groundwater would be gravity fed into a nearby stream via pipeline.

Impacts on groundwater users associated with this alternative can be divided into the following three areas of concern:

1. *Damage to or loss of existing boreholes:* The footprint of the below-ground alternative would be slightly larger than the above-ground alternative. However, the nature, assessment and mitigation measures of this impact would be the same for both alternatives (see Table 6.12).
2. *Blasting:* The nature, assessment and mitigation measures of this impact would also be similar to that for the grade-separated roundabout in relation to this area of concern (see Table 6.12).
3. *Lowering of the water table*: Groundwater seepage that would be pumped during construction and gravity discharged during operation would result in a localised lowering of the water table. In turn, this could potentially impact the performance of nearby boreholes and the role of groundwater in sustaining the greater environment. However, the extent of any impacts resulting from the abstraction of groundwater would remain at a local scale. The impacts would be of permanent duration because of the need to remove any groundwater that discharges into the excavated areas on an ongoing basis, while the intensity of the impact is expected to be very low. No mitigation is deemed necessary. The significance of the impact has thus been rated as **INSIGNIFICANT** with and without mitigation (see Table 6.13).

Some cumulative impact could be expected as a result of impacts of the abstraction at the interchanges being superimposed on those from the existing abstraction. However, the cumulative impacts are considered insignificant and would not impact either the performance of existing boreholes or the role of groundwater in the environment for the same reasons as described in relation to the proposed interchange at Winery Road (see Section 6.1.3.2).

Mitigation

The following mitigation measures are recommended:

- Prior to construction, replace the boreholes that would be destroyed so as to provide a continuous supply of the same volume of water to the affected groundwater users;
- Monitor the high risk boreholes so that any impacts to borehole performance due to any blasting can be quantified; and
- Use a retaining wall rather than a fill slope to reduce the risk of loss of any boreholes where possible or feasible (potentially boreholes DW1 and MB1 in Figure 6.8).

Table 6.12: Potential impact of both the proposed grade-separated roundabout and below-ground interchange on groundwater at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
IMPACT	**LOSS OF BOREHOLES**		**BLASTING**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	High	Very low	High	Very low
Probability	Definite	Definite	Improbable	Improbable
Confidence	Medium	High	High	High
Significance	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Cumulative impact	Low – no cumulative impact		Low – no cumulative impact	
Degree to which impact can be reversed	Irreversible		Irreversible	
Degree to which impact may cause	High		High	

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
IMPACT	**LOSS OF BOREHOLES**		**BLASTING**	
irreplaceable loss of resources				
Degree to which impact can be mitigated	High		High	

Table 6.13: Potential impact of below-ground interchange on groundwater due to potential lowering of the water table as a result of groundwater seepage at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Very low	Very low
Probability	Definite	Definite
Confidence	High	High
Significance	**Insignificant**	**INSIGNIFICANT**
Cumulative impact	Very low – cumulative impact not likely to be of relevance	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	None	

6.1.4.4 Heritage impacts

a. Archaeological / historical impacts:

Impact Description

The proposed project could lead to some disturbance or the loss of archaeological / historical artefacts and built environment resources at the Annandale Road Intersection.

Assessment

Grade-separated roundabout

1. *Archaeological / historical artefacts:* No archaeological artefacts were observed. However, a historical artefact was discovered and some are expected to be associated with buried material at the labourer's cottage. The impact on historical resources is therefore deemed to be of medium intensity, local extent and permanent duration. It is thus anticipated that the impact would be of **Medium** significance. With mitigation the significance of the impact is expected to be **VERY LOW** (see Table 6.14).
2. *Built environment:* The labourer's cottage, a building of historic significance, would be lost entirely. Other built structures of heritage significance occurring in close proximity to the footprint of the proposed grade-separated roundabout would also be affected in terms of contextual impacts. The loss of the cottage and the sensitivity of the other structures results in an anticipated impact on the built environment of high significance, at a local level and would be permanent. The impact would thus have a **High** significance before mitigation and a **MEDIUM to HIGH** significance after mitigation (see Table 6.15).

Below-ground interchange

1. *Archaeological / historical artefacts:* As the disturbance footprint of the below-ground alternative would be largely the same as for the grade-separated roundabout, the impacts on archaeology and historical artefacts would be the same for both alternatives. The impact rating would thus be of

Medium significance before mitigation and **VERY LOW** significance with mitigation measures (see Table 6.14).

2. *Built environment:* The anticipated impact on cultural history in terms of the built environment would also be the same for both alternatives due to the similar extent of the disturbance footprint in both cases. The impact would thus have a **High** significance before mitigation and a **MEDIUM to HIGH** significance after mitigation (see Table 6.15).

Mitigation

The following mitigation measures are recommended:

- Ensure that the project footprint is kept to a minimum;
- Undertake archaeological test excavations to look for historical dumps and/or earlier foundations near the labourer's cottage; and
- Undertake plaster sampling and a detailed recording of the above-ground characteristics and features of the labourer's cottage.

Table 6.14: Potential archaeological / historical impacts at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Medium	Very low	Medium	Very low
Probability	Definite	Definite	Definite	Definite
Confidence	High	High	High	High
Significance	**Medium**	**VERY LOW**	**Medium**	**VERY LOW**
Cumulative impact	Very low since archaeological resources generally occur in very low densities in the area.			
Degree to which impact can be reversed	Irreversible			
Degree to which impact may cause irreplaceable loss of resources	High		High	
Degree to which impact can be mitigated	Medium		Medium	

Table 6.15: Potential impacts on the built environment at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	High	Medium – High	High	Medium – High
Probability	Definite	Definite	Definite	Definite
Confidence	High	High	High	High
Significance	**High**	**MEDIUM – HIGH**	**High**	**MEDIUM – HIGH**
Cumulative impact	Low – structures of a similar size and nature do not occur in the landscape so cumulative impacts to the landscape do not apply but at least one other heritage structure is known to have been lost at the Annandale Intersection when the R44 was built.			
Degree to which impact can be reversed	Irreversible			
Degree to which impact may cause irreplaceable loss of resources	High		High	
Degree to which impact can be mitigated	Very Low		Very low	

b. Cultural landscape impacts:

Impact Description

The proposed project would lead to changes in the cultural landscape and the R44 scenic drive at the Annandale Road Intersection.

Assessment

Grade-separated roundabout:

The cultural heritage specialist study's description and discussion of the potential impact of the proposed grade-separated roundabouts provided in relation to Winery Road is similarly applied to Annandale Road – refer to Section 6.1.3.4(b) for details in this regard.

The cultural heritage study of the R44/Annandale Road Intersection (see Figures 6.9 and 6.10), like that of Winery Road, finds that the potential footprint would be imposed onto the established cultural landscape and that no amount of visual screening would be able to mitigate the intrusion onto the underlying historic pattern.

The study assesses the potential impact to be of local extent, permanent duration and high intensity. The impact significance would be **HIGH** both before and after mitigation (see Table 6.16).

Below-ground interchange:

Similarly, the cultural heritage study's description and discussion of the potential impact of the proposed below-ground interchanges provided in relation to Winery Road can be applied to Annandale Road – refer to Section 6.1.3.4(b) for details in this regard.

A degree of visual continuity would be achieved with the below-ground option. However, the study argues that this alternative would still represent a fundamental intrusion onto the historic pattern and would not be in line with the scenic route recommendations and heritage resource indicators proposed by the HIA study.

The cultural heritage specialist study assigns the same impact ratings to the below-ground interchange as to the grade-separated roundabout, i.e. of local extent, permanent duration and high intensity. The impact significance would thus be **HIGH** both before and after mitigation (see Table 6.16).

Mitigation

The study indicated that the overall impact on the rural cultural landscape and scenic drive cannot be mitigated for either of these alternatives.

Figure 6.9: **Visual simulations of proposed grade-separated alternatives at the R44/Annandale Road Intersection, showing the view looking north – composite image comparing an existing view (top image) with photomontages of the proposed above-ground roundabout (middle image) and the proposed below-ground interchange (bottom image) (Think3dlab, 2016).**

Figure 6.10: **Visual simulations of proposed grade-separated alternatives at the R44/Annandale Road Intersection, showing the view looking west – composite image comparing an existing view (top image) with photomontages of the proposed above-ground roundabout (middle image) and the proposed below-ground interchange (bottom image) (Think3dlab, 2016).**

Table 6.16: Potential impacts on the cultural landscape and the R44 scenic drive at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	High	High	High	High
Probability	Definite	Definite	High	High
Confidence	High	High	High	High
Significance	**High**	**HIGH**	High	**HIGH**
Cumulative impact	High – proposal will impact on entire rural cultural landscape.			
Degree to which impact can be reversed	Irreversible			
Degree to which impact may cause irreplaceable loss of resources	High		High	
Degree to which impact can be mitigated	None		None	

6.1.4.5 Visual impacts

Impact Description

Visual impacts that could result from the proposed project include a change in the semi-rural landscape character resulting from the visual intrusion of the physical structures, associated lighting infrastructure and light pollution and loss of visual resources.

Assessment

Grade-separated roundabout

The proposed grade-separated roundabout deck level would be approximately 7 - 8 m above the existing carriageway level with associated fill slopes or retaining walls extending beyond the current road reserve (see Figures 4.6. and 4.7 in Chapter 4). This alternative would result in the loss of some visual resources thereby affecting sensitive receptors such as the Mooiberge Farmstall, the Audacia Tented Root 44 Market, the Klein Akkerdraai Guest Lodge and residents in the immediately surrounding area. It must, however, be noted that the area has already lost some of its rural character because of the presence of facilities associated with the strawberry industry, the existing signalised intersection and the R44 roadway. All visual impacts are anticipated to occur locally within the ZVI and have a long term or permanent duration (see Table 6.17).

1. *Change in landscape character:* The current intersection is signalized and is located adjacent to rural tourist / commercial components (Mooiberge Farmstall and Root 44 Market) and rural industrial components (strawberry packing sheds and plastic tunnels). The proposed grade-separated roundabout has the potential to further change the already partially transformed semi-rural character of the area immediately surrounding the intersection as it would be of a more highway nature. The impact on the semi-rural landscape character is thus considered to have a medium to high intensity of local extent and long term duration. The resulting impact is deemed to have a **Medium** significance which with mitigation could be reduced to a **LOW** to **MEDIUM** significance.
2. *Light pollution:* The proposed grade-separated interchange would require the same or less lighting than the status quo. It is thus anticipated that there would be no change or a minor improvement to the existing situation.
3. *Loss of visual resource:* The historic cottage, building remnant on Farm 538 and the associated oak trees would be lost. The anticipated intensity of this impact would be medium, of local extent and

permanent duration. It is deemed that this impact would be of **MEDIUM** significance with and without mitigation.

4. *Loss of view:* The proposed elevated roundabout would result in the loss of trees, a portion of the garden, an entrance gate and views from the immediately adjacent residential houses as they would be situated less than 50 m from a 5 m fill embankment or retaining wall of the proposed roundabout. This impact is thus deemed to have a medium intensity with local extent and long term duration. This would result in an impact of **MEDIUM** significance both before and after mitigation.
5. *Visibility from sensitive receptors:* There are a number of further sensitive receptors in the ZVI of this proposed grade-separated roundabout interchange, all within 150 m of the proposed roundabout. These receptors would all experience a change in their visual environment as a result of the proposed grade-separated interchange, ramps and access roads being visible from their properties, in some instances on their properties, bringing traffic closer to them than before. The impact is thus considered to have a medium intensity of local extent and be long term. The resultant impact significance is deemed to be **Medium** which with mitigation could be reduced to **LOW** to **MEDIUM** (see Figures 6.11 to 6.14 below).
6. *Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route:* The proposed roundabout would be visible for a radius of approximately 2 km within the ZVI. Views of adjacent rural landscape, including views of the Mooiberge Farmstall and adjacent strawberry fields would be partially obscured. This impact is deemed to have low to medium intensity, local extent and long term duration. It is thus anticipated that this impact would have a significance of **Low to Medium** which with mitigation could be reduced to **LOW**.

Visual simulations of the views are provided in Figures 6.11 to 6.14.

Below-ground interchange

The proposed interchange would be approximately 7 – 8 m below the existing carriageway level. Lighting would be limited to the retaining walls of the on- and off- ramps. Much of the existing high level lighting would be removed. The loss of scenic resources in the form of the historic cottage on Farm 538 (north-east of the intersection) and the entrance to the farmstead (north-west of the intersection) would be common to both alternatives. However, the visual impact of the interchange structures as such would be restricted very locally to users of the R44 and sensitive visual receptors. All visual impacts are anticipated to occur locally and have a long term duration (see Table 6.17). From a visual sensitivity perspective, this is the preferred alternative.

1. *Change in landscape character:* The below-ground interchange would result in a change in the character due to the implementation of a configuration common to many South African freeways, but unusual to the cultural semi-rural landscape. It would thus intrude visually to some extent. The impact is considered to have a low intensity at the local level, with a significance rating of **LOW** with and without mitigation.
2. *Light pollution:* No light pollution is expected to result from the development of the proposed below-ground interchange as less lighting than the existing situation would be required and it would largely be located below ground.
3. *Loss of visual resource:* The cut slopes of the north-eastern ramp would result in the loss of the cottage and building remnant of Farm 538, Brakkesdal. This would, in turn, result in the loss of a visual and scenic resource. Similarly the entrance to the farmstead on the north-west quadrant and much of the garden would be lost. However, the remaining resources, e.g. strawberry fields and Mooiberge Farmstall, would not be diminished by this proposal thus the overall semi-rural visual resource would remain. The intensity of this impact is considered to be low to medium, of local extent and permanent. This would result in an impact of **LOW to MEDIUM** significance with and without mitigation.
4. *Loss of view:* The development of this alternative would not be associated with loss of views due to its location below ground.

5. *Visibility from sensitive receptors:* Some aspects of the interchange would visually intrude and the sense of place would change. This impact is anticipated due to the proximity of the structure to local receptors, e.g. residents from adjacent smallholdings and farms, as well as the loss of some ground and trees. The impact would be of low intensity, local extent and long-term duration. The significance of the impact would thus be **LOW** with and without mitigation.

Figure 6.11: View from Klein Akkerdraai Lodge south-west towards the R44 Intersection as currently seen, approximately 360 m away (MALA, 2014)

Figure 6.12: Visual simulation of the proposed grade-separated roundabout south-west from Klein Akkerdraai Lodge, approximately 360 m away (MALA, 2014)

Figure 6.13: **View from Mooiberge Restaurant north-west towards the R44 interchange as currently seen, approximately 160 m away (MALA, 2014)**

Figure 6.14: **Visual simulation of the proposed grade-separated roundabout looking north west from the Mooiberge Farmstall restaurant deck, approximately 160 m away (MALA, 2014)**

6. *Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route:* Views of the interchange would be restricted to the immediate surroundings while views of the adjacent semi-rural landscape, including views of the Mooiberge Farmstall and adjacent strawberry fields, would not be affected. The impact is considered to be of low to medium intensity, local extent and long-term duration, thus the impact significance would be **Low to Medium** before mitigation, which could be reduced to **LOW** with mitigation.

Mitigation

The following mitigation measures are recommended:

- Use 'low spill' light which directs light downward;
- Landscape and revegetate cut embankments and disturbed areas such that they blend in with the rural nature of the surrounds;
- Screen the light spill and the structures from the surrounding landscape through tree planting of a rural nature, where possible;
- Reduce the extent of the cut/fill slopes by the use of retaining walls, especially in the north-western quadrant;
- Provide a planted berm adjacent to the new access road on the Klein Akkerdraai property to serve as a visual and noise screen; and
- For the below-ground interchange: Use exposed aggregate finish to provide a more natural aesthetic.

Table 6.17: Potential visual impact at Annandale Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Long term	Long term	Long term	Long term
Intensity	Low - Medium	Low - Medium	Low - Medium	Low
Probability	Highly probable	Highly probable	Highly probable	Highly probable
Confidence	High	High	High	High
Significance*	**Low – Medium**	**LOW - MEDIUM**	**Low – Medium**	**LOW**
Cumulative impact	Low		Low – medium	
Degree to which impact can be reversed	Irreversible – Fully reversible, depending on the impact		Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Medium		Low - Medium	
Degree to which impact can be mitigated	Very low - Low		Low	

* The impact significance listed in this table is an overall combined assessment figure of the impacts considered above.

6.1.5 JAMESTOWN U-TURN FACILITY

It is not anticipated that the proposed alternative at this location would have any impact on groundwater as no boreholes were identified in close proximity to the area earmarked for the U-turn facility. Anticipated impacts for vegetation, freshwater, heritage and visual features are described below

6.1.5.1 Vegetation

Impact Description

The development of the grade-separated U-turn bridge or at-grade teardrop along the R44 near the Jamestown Cemetery area would result in the loss of some remnant natural vegetation and non-natural vegetation.

Assessment

Grade-separated U-turn bridge:

The road reserve would have to be widened by approximately 5.5 m on both sides to accommodate the proposed bridge structure. This would include transformed sections of road reserve with patches of pioneer renosterveld of low conservation value. The private land on both sides of the R44 supports high numbers of mature trees, with pines (*Pinus* sp.) and gum trees (*Eucalyptus* sp.) on the western side and rows of Indian laurel (*Ficus nitida*), cotton wood tree (*Populus* cf. *deltoides*) and pin oak (*Quercus palustris*) on the eastern side. The loss of minor natural vegetation in the road reserve and non-natural vegetation would have a low intensity at a local scale and be permanent. The impact would thus have a **LOW** significance both before and after mitigation (see Table 6.18).

At-grade teardrop:

The at-grade teardrop would also require the widening of the road reserve on both sides, but in this case approximately 12 m widening would be required on the western side. The impact intensity would be low to medium, but the overall significance would be **LOW** as for the grade-separated alternative (see Table 6.18).

Webersvallei Road Intersection:

The proposed improvements at the existing intersection would be limited to the existing road reserve, which would entail **NO** impact on natural vegetation.

Table 6.18: Potential impact on vegetation of the proposed U-turn facilities near Jamestown Cemetery / Webersvallei Road Intersection

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP**		**WEBERSVALLEI ROAD INTERSECTION**	
Extent	Local	Local	Local	Local	N/A	N/A
Duration	Permanent	Permanent	Permanent	Permanent		
Intensity	Low	Low	Low- Medium	Low -medium		
Probability	Definite	Definite	Definite	Definite		
Confidence	High	High	High	High		
Significance	**Low**	**LOW**	**Low**	**LOW**	**N/A**	**N/A**
Cumulative impact	Low		Low		N/A	
Degree to which impact can be reversed	Irreversible		Irreversible		N/A	
Degree to which impact may cause irreplaceable loss of resources	Low		Low		N/A	
Degree to which impact can be mitigated	Very Low		Very Low		N/A	

Mitigation

- Rehabilitate the road reserve and road islands using endemic shrub species rather than replacing vegetation with hard-wood species.

6.1.5.2 Freshwater

Impact Description

The flow capacity, water quality and freshwater habitats of watercourses could be affected by the development of the proposed U-turn facility.

Assessment

Grade-separated U-turn bridge:

Wetland areas, dominated by riverbed grass (*Pennisetum macrourum*), are located approximately 10 m from the road edge immediately to the north of the proposed U-turn bridge location. There is also a stormwater channel located adjacent to the R44. Provided the proposed U-turn bridge does not extend northwards into the wetland area, the potential impact of this proposed works on the surrounding freshwater features would be of **VERY LOW** significance and would be likely to occur only during the construction phase (see Table 6.19).

At-grade teardrop:

The at-grade teardrop would extend into the wetland area north-west of the R44 as the physical footprint of this structure would be larger than that of the U-turn bridge. This would result in a permanent impact, which would be of local extent and is considered to have a medium intensity. The significance of the impact has thus been rated as **MEDIUM** with and without mitigation (see Table 6.19).

Webersvallei Road Intersection:

Stormwater channels are located along the R44 and the roads feeding into the R44 at this location. No other freshwater features are present. The significance of the potential impacts of the proposed improvements on freshwater features would thus be **VERY LOW** (see Table 6.19) and would likely occur only during the construction phase, if there is flow in the stormwater channels.

Table 6.19: Potential impact of the proposed U-turn facilities at Jamestown Cemetery / Webersvallei Road Intersection on freshwater features

CRITERIA	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION
ALTERNATIVE	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP**		**WEBERSVALLEI ROAD INTERSECTION**	
Extent	Local	Local	Local	Local	Local	Local
Duration	Short term	Short term	Permanent	Permanent	Short term	Short term
Intensity	Low	Low	Medium	Medium	Low	Low
Probability	Probable	Probable	Definite	Definite	Probable	Probable
Confidence	High	High	High	High	High	High
Significance	**Very low**	**VERY LOW**	**Medium**	**MEDIUM**	**Very low**	**VERY LOW**
Cumulative impact	N/A		Low		N/A	
Degree to which impact can be reversed	Fully reversible		Irreversible		Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	Low		Medium		Low	
Degree to which impact can be mitigated	Low		None		Low	

Mitigation

- The structure should avoid or minimise any impact on freshwater features and avoid affecting the flow of watercourse channels.

6.1.5.3 Heritage impacts

Impact Description

The proposed project could lead to some disturbance or the loss of archaeological / historical artefacts and changes in the built environment and cultural landscape in the vicinity of the proposed Jamestown U-turn facility.

Assessment

Grade-separated U-turn bridge:

1. *Archaeological / historical impacts:* The only impacts likely to occur would relate to isolated stone artefacts, most probably from the Early Stone Age, which commonly occur in very low densities in agricultural lands in the area. The expected impacts would thus be of **VERY LOW** significance before and after mitigation (see Table 6.20).
2. *Cultural heritage impacts:* The proposed U-turn bridge would introduce impacts to the cultural landscape due to the concrete structure located above the roadway that would be prominently visible by road users travelling in either direction. Widening of the road reserve on both sides of the R44 would result in the loss of part of the large gum trees line located to the west of the R44. These trees are considered a heritage resource of moderate significance as they contribute meaningfully to the rural nature of the cultural landscape.

   The main impacts expected are impacts to users of the R44 who would have their views of the surrounding landscape partially obstructed. The impact would be largely localised as it would be of high significance from relatively close range, but would decrease with distance. Views from the west and east would also be partially obstructed, largely due to the retaining walls that would support the ramps, but because of the large number of trees in the landscape these views are likely to only experience impacts of low-medium significance. With planting of new trees around the bridge the intensity of the impacts, and hence the overall significance, would be reduced.

   This alternative would have a medium - high intensity, local site-specific extent and permanent impact on the cultural landscape. The impact significance would thus be **Medium to High** before mitigation, which would decrease to **MEDIUM** after mitigation (see Table 6.21).

At-grade teardrop:

1. *Archaeological / historical impacts:* The expected archaeological impact would, despite its larger footprint, be similar to that of the above-ground alternative, namely **VERY LOW** significance both before and after mitigation (see Table 6.20).
2. *Cultural heritage impacts:* The at-grade alternative would result in a much lower intensity impact on the local cultural landscape than the U-turn bridge alternative as it would be at-grade and would not impose into the cultural landscape. However, more trees would be lost due to the larger physical footprint of the structure which would require additional widening of the road reserve on the western side of the R44. The resulting localised permanent impact is consider to have a low - medium intensity, thus the significance of the impact is considered to be **LOW - MEDIUM** with and without mitigation (see Table 6.21).

Webersvallei Road Intersection:

Given the localised nature and limited scale of the proposed improvements at this existing intersection, it is not anticipated that there would be any impact on heritage resources.

Mitigation

- Keep the disturbance footprint to a minimum;
- Plant appropriate trees around the retaining walls to screen the structures;
- Use columns were feasible to reduce the length of walling; and
- Use surface textures and colours on the concrete that are sympathetic to the landscape.

Table 6.20: Potential archaeological / historical impacts of the proposed U-turn facilities at Jamestown Cemetery / Webersvallei Road Intersection

CRITERIA	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION
ALTERNATIVE	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP**		**WEBERSVALLEI ROAD INTERSECTION**	
Extent	Local	Local	Local	Local	N/A	N/A
Duration	Permanent	Permanent	Permanent	Permanent		
Intensity	Very low	Very low	Very low	Very low		
Probability	Improbable	Improbable	Improbable	Improbable		
Confidence	High	High	High	High		
Significance	**Very low**	**VERY LOW**	**Very low**	**VERY LOW**	N/A	N/A
Cumulative impact	Very low since archaeological resources generally occur in very low densities in the area.				N/A	
Degree to which impact can be reversed	Irreversible		Irreversible		N/A	
Degree to which impact may cause irreplaceable loss of resources	High		High		N/A	
Degree to which impact can be mitigated	Very low		Very low		N/A	

Table 6.21: Potential cultural heritage impacts of the proposed U-turn facilities at Jamestown Cemetery / Webersvallei Road Intersection

CRITERIA	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION
ALTERNATIVE	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP**		**WEBERSVALLEI ROAD INTERSECTION**	
Extent	Local	Local	Local	Local	N/A	N/A
Duration	Permanent	Permanent	Permanent	Permanent		
Intensity	Medium – High	Medium	Low – Medium	Low		
Probability	Definite	Definite	Definite	Definite		
Confidence	High	High	High	High		
Significance	**Medium – High**	**MEDIUM**	**Low – Medium**	**LOW - MEDIUM**	N/A	N/A
Cumulative impact	Low				N/A	
Degree to which impact can be reversed	Irreversible		Irreversible		N/A	
Degree to which impact may cause irreplaceable loss of resources	High		Low - Medium		N/A	
Degree to which impact can be mitigated	Low		Very low		N/A	

6.1.5.4 Visual impacts

Impact Description

The development of the proposed U-turn facility at the Stellenbosch end of the upgrade road section may change the visual landscape of the surrounding area.

Assessment

Grade-separated U-turn bridge:

The development of this proposed project component would result in the loss of some visual resources thereby affecting sensitive receptors (see Table 6.22).

1. *Change in semi-rural landscape character:* The proposed U-turn bridge would result in a change in the character from semi-urban to urban as a grade-separated bridge is a feature common to freeways. The impact on visual aspects is thus considered to have a medium - high intensity, local extent and long-term duration. The resulting impact would have a **Medium to High** significance before mitigation which could be reduced to **MEDIUM** significance after mitigation.
2. *Visibility from sensitive receptors and R44 users:* Users of the R44 and local visual receptors (adjacent residents, golfers, Jamestown Cemetery and Stellenbosch Square, etc.) would see the U-turn deck, associated ramps and vehicles (see Figures 6.15 to 6.17). The removal of some of the mature trees to the west of the proposed structure would increase exposure of the existing road and new bridge structure to the receptors. Adjacent residents, especially Uitsig Farm, would also see the ramp retaining wall, which could be up to 10 m high on the western side. This impact would be local, limited to the Zone of Visual Influence (ZVI), of long-term duration and is deemed to be of low intensity resulting in a **Medium** significance impact before mitigation, which could be reduced to **LOW** significance after mitigation.

At-grade teardrop:

The at-grade alternative would have a larger physical footprint than the U-turn bridge structure, which would result in the loss of more trees to both sides of the road. However, as the visual impact (which includes both rural landscape and visibility from receptors) would be largely limited to the teardrop structure at ground level road, it is deemed to have a low to medium intensity, local extent and long term duration. Thus the significance of the impact is considered to be **Low to Medium** before mitigation, which could be improved to **LOW** with the implementation of the recommended mitigation measures (see Table 6.22).

Webersvallei Road Intersection:

No visual impacts would result from this alternative as the proposed improvements would be limited in extent and located within the existing road reserve. The nature of the existing intersection would not change (see Table 6.22).

Mitigation

- Landscape fill embankments, walls and disturbed areas in appropriate way to blend with the semi-rural nature of the landscape;
- For the grade separated U-turn bridge:
  - Use exposed aggregate finish on ramp retaining walls to provide a more natural aesthetic;
  - Appoint an arborist to manage root and crown pruning of trees;
  - Replant lost trees and plant new trees to screen the elevated structure from the surrounding landscape.

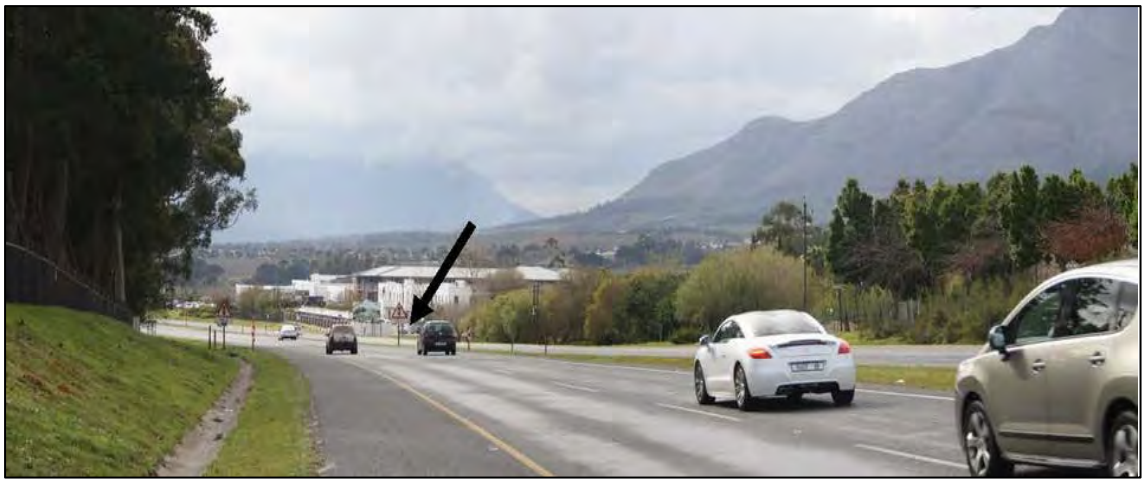


Figure 6.15 **View towards the proposed location of grade-separated U-turn bridge (indicated by the black arrow) as currently seen when travelling north on the R44 towards Stellenbosch (MALA, 2015)**

Figure 6.16 **Visual simulation of the proposed grade-separated U-turn bridge as seen when travelling north on the R44 towards Stellenbosch (MALA, 2015)**

Figure 6.17 **Visual simulation of the proposed grade-separated U-turn bridge as seen when travelling south on the R44 towards Somerset West (MALA, 2015)**

Table 6.22: Potential visual impacts of the proposed U-turn facility near Jamestown Cemetery / Webersvallei Intersection

CRITERIA	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION
ALTERNATIVE	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP**		**WEBERSVALLEI ROAD INTERSECTION**	
Extent	Local	Local	Local	Local	N/A	N/A
Duration	Long-term	Long-term	Long-term	Long-term		
Intensity	Medium – High	Low – Medium	Medium	Low		
Probability	Definite	Definite	Definite	Definite		
Confidence	High	High	High	High		
Significance*	**Medium to High**	**LOW TO MEDIUM**	**Medium**	**LOW**	**N/A**	**N/A**
Cumulative impact	Medium		Low		N/A	
Degree to which impact can be reversed	Irreversible		Irreversible		N/A	
Degree to which impact may cause irreplaceable loss of resources	Medium		Medium		N/A	
Degree to which impact can be mitigated	Low - medium		Low		N/A	

* The impact significance listed in this table is an overall combined figure of the visual impacts assessed above.

6.1.6 IMPROVEMENTS TO EXISTING SIGNALISED INTERSECTIONS

The proposed intersection improvements would remain largely within the existing road reserve in the case of all five existing signalised intersections included in the proposed project. The natural environment at these intersections is severely modified and it is thus anticipated that there would be no impact of any significance on vegetation, groundwater, heritage or visual aspects. The anticipated impact on freshwater is described below as one stream passes in close proximity to the Techno Road Intersection. No significant impacts are anticipated at any of the other intersections as freshwater features are not located in near proximity.

6.1.6.1 Freshwater

Impact Description

The flow capacity, water quality and freshwater habitats of the river at Techno Road could be affected by the proposed improvements at this interchange.

Assessment

A largely non-existent tributary of the Blaauwklippen River is located to the west and north of Techno Road. Due to the fact that the stream / drainage channel has already been modified with only remnants of the system remaining, the impact of the proposed activities would be of low intensity, occur locally and be long term. The resultant impact significance is thus anticipated to be **LOW** before mitigation. It is anticipated that with mitigation the proposed changes at this intersection could provide for a potential improvement on the existing freshwater situation. However, the improvements would need to take into account the proposed developments south of Techno Road. Impact significance after mitigation is thus deemed to be **INSIGNIFICANT** (see Table 6.23).

Mitigation

The following mitigation measures are recommended:

- New structures should not constrict the flow in the watercourse channels but should aim to improve stormwater management as far as possible; and

- Overflow from the upstream dam flows along the Techno Road and into the stormwater drains which results in erosion of the road edges. It is recommended that this informal stream be accommodated within the upgrade activities.

Table 6.23: Potential impact of disturbance of the Blaauwklippen River

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long term	Long term
Intensity	Low	Very low
Probability	Probable	Probable
Confidence	Medium - High	Medium - High
Significance	**Low**	**INSIGNIFICANT**
Cumulative impact	Low	
Degree to which impact can be reversed	Partially reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Low	

6.2 ASSESSMENT OF PROJECT SCALE IMPACTS

6.2.1 ECONOMIC

A number of economic issues relating to the proposed R44 road improvement project were identified during the initial phase of the Basic Assessment process. This section addresses these issues and where appropriate assessment of impacts is undertaken. The specialist report is provided in full in Appendix E6.

6.2.1.1 Economic efficiency of upgrade / Cost-benefit analysis

Methodology

A detailed description of the methodology used in the economic study is provided in Chapter 3. A further brief summary is provided here.

The methodology that the economic specialists used to assess the economic efficiency of the proposed upgrades was an economic Cost Benefit Analysis (CBA). A CBA assumes, with some important caveats, that what is demonstrably good for the economy as a whole is a reasonable approximation of what would be good for the majority of the people living and working in that area.

CBA is a means of taking all the direct costs and all the direct benefits of a proposed project and comparing these. It is the conventional method that is used in project appraisal. The outcome of this analysis is the reporting of a net present value (NPV), a benefit cost ratio (BCR) and an internal rate of return (IRR). This provides both a financial and an economic CBA. The difference between the financial and economic results is that the financial analysis looks at monetary costs and benefits of the alternatives while the economic analysis includes the costs to society.

A high BCR is usually a good indicator that it would be possible to raise finance to implement a project. In the case of a private sector investment a good BCR would be part of the business case to funders. If it is a public infrastructure project, a high BCR should give confidence that it is worth funding the project directly from the Treasury.

If the evaluated benefits of a project are indeed greater than the overall project costs then the BCR would be greater than 1. A BCR greater than 1 indicates that the completed project would constitute an economic asset; a BCR less than 1 implies that the project would be an economic liability. The higher the BCR the less risk there is that the proposed investment could turn out to be less than viable economically. Low BCR's, even if greater than 1, provide a warning that a project could be risky and may turn out to become an economic liability instead of an asset.

The economic analysis focused purely on direct costs and benefits and did not take any indirect costs and benefits into account. Indirect costs and benefits would include those costs and benefits resulting from multiplier effects. For example, the upgrading of a road would have spin off effects for the construction industry and the building materials supply industries. These, in turn, would have backward linkages with other commodity suppliers and retail industries. A cost that could not be quantified is the visual impact of the above-ground grade-separated roundabouts.

Alternatives assessed

As indicated in Chapter 3 there was considerable opposition to the preferred alternative of grade-separated roundabouts. As a result further alternative solutions were developed and a traffic specialist was appointed to investigate these proposed solutions. The economic analysis was subsequently undertaken on four alternatives that were considered viable in the traffic analysis model. Two of these alternatives were subsequently dropped from further consideration for the reasons indicated in Chapter 3.

The two alternatives that were considered included a combination of above- and below-ground interchanges, U-turn facilities, lane widening and improvements to intersection signals at the Stellenbosch end of the project. As described earlier, these include:

Alternative 2: Two above-ground, grade-separated roundabouts at the Annandale and Winery Road Intersections, with grade-separated U-turn bridges at Steynsrust and near the Jamestown Cemetery. This would also include additional through lanes at the intersections into Stellenbosch. There would also be changes to the timing and phases of the signals entering Stellenbosch.

Alternative 4: Two below-ground diamond interchanges at the Annandale and Winery Road Intersections, grade-separated U-turns bridges at Steynsrust and near the Jamestown Cemetery and again with the lane additions and signal improvements into Stellenbosch. This assumes 30% underground rock at each intersection.

Results of the cost benefit analysis

The results of the cost benefit analysis for the two proposed alternatives are shown in Table 6.24. The table includes the present value (PV) of all the costs as well as the benefits, NPV, the BCR and the IRR for each alternative.

Alternative 2

Total costs have a PV of R 373 m and benefits a PV of R 754 m. Thus the NPV is 381. The BCR is 2.02 and the IRR 18%. This alternative is economically robust and the most efficient of the two alternatives that are being considered further.

Alternative 4

Total costs have a PV of R 454 m and benefits a PV of R 754 m. The NPV is 300. The BCR is 1.66 and the IRR 14%. This alternative is economically efficient, but not as efficient as Alternative 2. However, it does address the issue of visual impact which has not been considered in the assessment of economic efficiency.

Table 6.24: Results of the Cost Benefit Analysis for Alternatives 2 and 4 (grade–separated U-turn)

Present Value of Costs and Benefits, Rm, 2013 Prices (grade-separated U-turn)	Alternative 2 Two GSRs Above Ground Plus Lane & Signal Improvement	Alternative 4 Two Diamonds Below Ground Plus Lane & Signal Improvements 30% Rock
Costs		
Initial Capital Costs	207.7	276.8
Land Acquisition	6.1	6.1
Maintenance Costs	9.3	11.0
Professional Fees	32.9	43.6
Additional Travel	116.8	116.8
Total Costs	**372.8**	**454.2**
Benefits		
Time Savings	442.0	442.0
Accident Savings	295.8	295.8
Reduced Emissions	16.0	16.0
Total Benefits	**753.8**	**753.8**
NPV	381.0	299.6
BCR	2.02	1.66
IRR	18%	14%

The above findings only considered the cost of a grade-separated facility near the Jamestown Cemetery. Thus it was also necessary to assess the implications of the other proposed alternatives for providing for U-turn facilities at the Stellenbosch end of the project. The results of this analysis are provided in Table 6.25 below.

The U-turn movement at the Webersvallei Road traffic signals is the most efficient of the three alternatives with a BCR of 2.17, further:

- Construction costs, maintenance costs and professional fees are lower;
- This is offset by increased traveling time for people who need to drive further to make a U-turn at Webersvallei Road ; and
- There would be the potential for fewer accidents near the Jamestown Cemetery but more at the Webersvallei Road Intersection. There would be fewer accidents overall and the benefits would be marginally higher.

Table 6.25: Comparison of Jamestown Cemetery / Webersvallei U-turn options (for Alternative 2 scenario)

Present Value of Costs and Benefits, Rm, 2013 Prices	Grade Separated Jamestown	At Grade Jamestown	At Grade Webersvallei
Costs			
Initial Capital Costs	207.7	197.8	182.2
Land Acquisition	6.1	6.1	6.1
Maintenance Costs	9.3	8.8	8.2
Professional Fees	32.9	31.3	28.8
Additional Travel	116.8	116.8	121.6
Total Costs	**372.8**	**360.8**	**346.8**
Benefits			
Time Savings	442.0	442.0	442.0
Accident Savings	295.8	291.9	296.1
Reduced Emissions	16.0	16.0	16.0
Total Benefits	**753.8**	**749.9**	**754.0**
NPV	381.0	389.1	407.2
BCR	2.02	2.08	2.17
IRR	18%	18%	20%

This conclusion is based on the understanding that service levels at the Webersvallei traffic lights are acceptable and that no specific phasing of the traffic signals is required to accommodate U-turn movements.

Replacing the U-turn Jamestown Cemetery by utilising the existing Webersvallei Road Intersection would improve the efficiency of Alternatives 2 and 4. Table 6.26 presents the updated results for the cost benefit analysis for these alternatives. The findings are as follows:

- The BCR for Alternative 2 increases from 2.02 to 2.17. The NPV increases from R381 m to R407 m and the economic IRR from 18% to 20%.
- The BCR for Alternative 4 improves from 1.66 to 1.76. The NPV increases from R300 m to R326 m and the economic IRR from 14% to 15%.

Table 6.26: Results of the Cost Benefit Analysis for Alternatives 2 and 4 (Webersvallei U-turn)

Present Value of Costs and Benefits, Rm, 2013 Prices (Webersvallei U-turn)	Alternative 2	Alternative 4
	Two GSRs Above Ground Plus Lane & Signal Improvement	Two Diamonds Below Ground Plus Lane & Signal Improvements 30% Rock
Costs		
Initial Capital Costs	182.2	251.2
Land Acquisition	6.1	6.1
Maintenance Costs	8.2	9.6
Professional Fees	28.8	39.5
Additional Travel	121.6	121.6
Total Costs	**346.8**	**428.0**
Benefits		
Time Savings	442.0	442.0
Accident Savings	296.1	296.1
Reduced Emissions	16.0	16.0
Total Benefits	**754.0**	**754.0**
NPV	407.2	326.0
BCR	2.17	1.76
IRR	20%	15%

Sensitivity analysis

The specialist considered various sensitivity analyses for each of the proposed alternatives in order to test the CBA assumptions and the effect on the findings. The analysis also shows, where relevant, the switching values for an assumption. The switching value is the degree to which an assumption has to change to switch an alternative from economically efficient to inefficient. A sensitivity analysis was performed on the following seven assumptions:

- Construction costs;
- Reduction in accidents;
- Value of time savings;
- Number of local access trips;
- Traffic growth;
- Fuel savings; and
- Percentage of below-ground rock.

In most of the ranges tested the sensitivity analysis shows that Alternative 2 is the most efficient. However, when considering the proportion of underground rock, in the highly unlikely case where there is no rock, the BCR for Alternative 4 is slightly higher than for Alternative 2.

6.2.1.2 Economic feasibility of the project alternatives

Impact Description

The proposed project alternatives would have cost and benefit implications to society. The CBA indicates whether the preferred project alternative would be economically feasible.

Assessment

For Alternative 2 the BCR is 2.17 and this is considered to be economically efficient. The impact significance of this alternative is thus considered to be ***HIGH (Positive)*** with and without mitigation (see Table 6.27).

Alternative 4 is also considered to be economically efficient with a BCR of 1.76. As the intensity of the efficiency is lower than for Alternative 2, the significance of this impact is thus considered to be ***MEDIUM to HIGH (Positive)*** with and without mitigation (see Table 6.27).

Mitigation

Mitigation measures include:

- Put measures in place to minimise traffic disruption during construction.

Table 6.27: Economic feasibility of Alternative 2 and 4

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**ALTERNATIVE 2**		**ALTERNATIVE 4**	
Extent	Local	Local	Local	Local
Duration	Long Term	Long Term	Long Term	Long Term
Intensity	High	High	Medium to High	Medium to High
Probability	Definite	Definite	Definite	Definite
Confidence	High	High	High	High
Significance	***HIGH (positive)***	***HIGH (positive)***	***MEDIUM to HIGH (positive)***	***MEDIUM to HIGH (positive)***
Cumulative impact	N/A			
Degree to which impact can be reversed	Irreversible		Partially reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A		Medium	
Degree to which impact can be mitigated	N/A		Mitigation insufficient to change assessment level	

6.2.1.3 Impacts associated with land loss

Impact Description

The loss of private land at the affected intersections would impact on landowners. This would apply to the grade-separated roundabout and below-ground interchange alternatives at Winery and Annandale Roads and to the grade-separated and at-grade U-turn facility alternatives near Jamestown Cemetery.

Assessment

Grade-separated roundabouts

In Table 6.28 the land required at each of the grade-separated interchanges is illustrated. At the proposed Winery Road Intersection roughly 2.0 ha of land would be required for the fill slope option and 1.3 ha for the vertical wall section. For the Annandale Road Interchange roughly 3.3 ha of land would be required for the fill slopes option and 2.8 ha for the vertical wall option.

Table 6.28: Indicative land requirements with the additional and existing alternatives

Intersection / location and alternative	Land take outside the road reserve in hectares	
	With vertical walls	With 1:2 fill slopes
Annandale Road		
Above-ground grade-separated roundabout	2.8	3.3
Below-ground grade-separated interchange	2.5	3.8
Winery Road		
Above-ground grade-separated roundabout	1.3	2.0
Below-ground grade-separated interchange	1.3	2.5
Near Jamestown Cemetery		
Grade-separated U-turn bridge near Jamestown Cemetery	0.2	
At-grade U-turn facility near Jamestown Cemetery	0.5	

The economic specialist has indicated that land losses would be relatively significant and would probably be associated with risks to jobs, especially at the Annandale Road Intersection, unless an expansion of agricultural production is possible elsewhere. The study noted that they are not, however, considered severe enough to threaten the viability of any individual farming or business units at either intersection provided adequate compensation and mitigation are implemented. The land loss is considered to be of medium intensity, although the portion that would be lost is a small percentage of the overall farm size. The impact would be local in extent and permanent. The significance of the impact is thus considered to be **Medium** and with mitigation **LOW to MEDIUM** (see Table 6.29).

Below-ground interchanges

Approximately 2.5 ha of land would be required for the fill slope option and 1.3 ha for the vertical wall option at the proposed Winery Road Interchange. For the proposed Annandale Road Interchange, approximately 3.8 ha of land would be required for the fill slopes option and 2.5 ha for the vertical wall option. The economic specialist indicated that, though there are relatively slight differences, the below-ground interchanges would have the same overall **LOW to MEDIUM** impact significance with mitigation as for the above-ground grade-separated roundabouts (see Table 6.29).

Table 6.29: Potential impact of loss of land at Winery and Annandale Road Intersections

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Medium	Low - medium	Medium	Low - medium
Probability	High	High	High	High
Confidence	Medium - High	Medium - High	Medium - High	Medium - High
Significance	**Medium**	**LOW - MEDIUM**	**Medium**	**LOW - MEDIUM**
Cumulative impact	Low to medium. Productive land is relatively scarce in the area implying that the losses of land associated with the project would have cumulative impacts. The amount of land lost is, however, not highly significant.			
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.			
Degree to which impact may cause irreplaceable loss of resources	Low to medium in keeping with the amount of land lost and its irreplaceability.			
Degree to which impact can be mitigated	Medium as compensation of landowners is possible although the productive potential of the land will be lost to wider society.			

U-turn bridge near Jamestown Cemetery

This proposed alternative would be associated with the need to purchase approximately 0.2 ha of private land not currently under cultivation. While it may not be particularly significant as such, it would add to overall land take associated with the scheme. Thus is has been given an overall impact significance of **VERY LOW to LOW** with mitigation (see Table 6.30).

At-grade U-turn teardrop facility near Jamestown Cemetery

This proposed alternative would be associated with the need to purchase approximately 0.5 ha of private land. As per the grade-separated alternative, this loss is considered to be of low intensity but it would nevertheless add to overall land take associated with the scheme. The overall impact significance is thus also considered **VERY LOW to LOW** with mitigation (see Table 6.30).

There would be **NO** impact on private landowners associated with the lane widening at the Webersvallei Road Intersection that will facilitate the U-turn movements.

Mitigation

Mitigation measures for all alternatives include:

- Ensure that land loss is kept to minimum;
- Ensure market-related compensation for land and any improvements / structures that need to be removed and rebuilt by means of following the prescribed statutory process for acquisition of land;
- Include compensation for any movement or re-orientation of operations;
- Ensure construction activities take the needs of landowners into account;
- Establish a landowner liaison committee including all affected landowners and senior representatives of the applicant, engineers and contractor all with appropriate decision-making power. This committee should meet regularly to discuss and deal with any challenges that arise during construction; and
- Ensure that a complaints register is available and that landowners are aware of it and can make inputs if needed.

Table 6.30: Potential impact of loss of land from the proposed U-turn alternatives at Jamestown Cemetery

CRITERIA	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION
ALTERNATIVE	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE FACILITY**		**WEBERSVALLEI ROAD INTERSECTION**	
Extent	Local	Local	Local	Local	N/A	N/A
Duration	Permanent	Permanent	Permanent	Permanent		
Intensity	Low	Very Low - Low	Low	Very Low - Low		
Probability	High	High	High	High		
Confidence	Medium - High	Medium - High	Medium - High	Medium - High		
Significance	**Low**	**VERY LOW - LOW**	**Low**	**VERY LOW - LOW**	**N/A**	**N/A**
Cumulative impact	Very low to Low. Land is relatively scarce in the area implying that the losses of land associated with the project will have cumulative impacts. The amount of land lost is, however, not significant.				N/A	
Degree to which impact can be reversed	Very low reversibility as structure would effectively be permanent.				N/A	
Degree to which impact may cause irreplaceable loss of resources	Low in keeping with the amount of land lost and its irreplaceability.				N/A	
Degree to which impact can be mitigated	Medium to high as compensation of landowners is possible and the productive potential of the land is limited given its position.				N/A	

6.2.1.4 Impacts on commercial operations associated with access changes

Impact Description

The proposed changes to the direct and indirect access to the R44 for a number of commercial enterprises could impact on their customer bases if accesses are altered at the intersections and through the closure of medians.

Assessment

Table 6.31 lists the farms, tourism and other commercial operations that would be affected by the proposed changes to the R44 and shows the approximate additional distances that drivers would need to cover for affected trips. The specialist study notes that businesses that are not destinations in themselves but, rather, rely heavily on passing traffic would be most vulnerable to losses.

The current access situation at the intersections and numerous median openings along the R44 ensures the maximum possible customer convenience in accessing properties. Closures and changes would therefore decrease this convenience and impact on all trips that currently involve the use of medians and on many trips that use accesses connected to the intersections. However, it should be noted that this convenience would increasingly be traded-off against safety particularly where line of sight is limited. In the short to medium term, it seems likely that most customers would be willing to continue to take advantage of the convenience offered by the median openings. However, in the medium to longer term, it is considered likely that increased traffic flows would result in increasingly fewer customers being willing to use these openings.

The impact assessment per project alternatives is provided below.

Grade-separated roundabouts

The grade-separated roundabouts would result in a number of changes to *access for commercial operations at the intersections*. For the Winery Road Intersection these would include access changes to Avontuur Estate, Ken Forrester Wine Estate and the business premises and mature tree storage areas on Erf 177 and 178. At the Annandale Road Intersection these would include access changes to the Zetler farming operation and associated Mooiberge Farm Stall and restaurant and Audacia Wine Estate / Root 44 Market. A detailed description of the proposed changes is provided in Section 7.3.2.3 of the economic specialist study (see Appendix E6.1).

The majority of the overall impacts of the grade-separated roundabout alternative would be focused on commercial operations at the Annandale Road Intersection where the risk of negative impacts from access changes were found to be greater than for those at the Winery Road Intersection. The intensity of the impact is assessed to be low to medium, of local extent and permanent. Thus the impact on commercial operations associated with the grade-separated roundabouts is assessed to be of **LOW to MEDIUM** significance with and without mitigation (see Table 6.32).

For *commercial operations along the R44*, safe and convenient U-turn opportunities are the key requirement in order to mitigate the longer travel trips associated with the median closures, which the grade-separated roundabouts would provide. The intensity of the impact is considered to be low, of local extent and permanent. The significance of the impact is assessed to be **LOW** with and without mitigation (see Table 6.32).

Table 6.31: Local access points and additional travel distance

Access Point	Distance from Steynsrust Road (km)	E or W off R44	Extra Ave Return Dist (km)	Number of Affected Properties	Average Number Daily Trips (Return)	Increase in daily kms	Average Annual Accidents
Jamestown Road - Cemetry	8.84	East	1.9	1	50	94	4.4
Farm / Gravel Road	8.68	East	3.0	1	25	75	
Uitsig Farm	8.67	West	3.0	1	15	45	3.4
Drie Lande	8.29	West	3.0	3	15	135	5.0
Kleinbosch Lodge	8.06	West	3.0	1	15	45	3.4
Mountain Breeze Farm Stall	8.06	East	3.0	2	100	602	
Zimzala	8.06	West	3.0	1	15	45	
House - Jatan Farm	7.81	West	3.0	1	15	45	5.4
Stellenbosch Airport	7.47	West	2.6	3	60	460	3.8
La Pineta	7.47	West	2.6	1	117	298	
Stellenrust Road Turnoff	7.04	East	0.0	1	224	0	5.9
Unknown; gravel road	6.91	West	3.0	1	24	72	
Audacia	6.68	East	1.0	1	859	859	
De Wilge	6.52	West	3.0	1	15	45	4.4
Annandale Road	**6.44**	**E&W**	**0.0**				
Mooiberge farm stall, restaurants and wine & liquor shop	6.30	East	1.0	1	1 000	1 000	3.2
Mooiberge Farm	6.17	East	3.2	3	10	96	
La Masseria, CC Trailer Hire & Pepino Garden Ornaments	6.17	West	3.2	3	10	96	
Klein Schuur Farm	5.92	West	3.2	1	84	269	2.0
Country Rose Nursery	5.37	West	3.2	1	30	96	
Buena Vista Social Café	5.37	West	3.2	1	100	320	
Rosenview Guesthouse	5.37	East	3.2	1	24	77	3.4
Somerbosch Wines	5.24	West	3.2	1	50	160	4.9
Eikendal Vineyard	4.53	East	3.2	1	50	160	4.9
Cavalli Wine & Stud	4.52	West	3.2	1	168	538	
Eikendal Road Turnoff	4.46	East	3.2	1	256	819	2.6
Sweetwell Farm Access	3.81	West	3.2	1	113	362	4.9
Cape Garden Centre	3.54	West	0.0	1	20	0	
Winery Road	**3.23**	**West**	**0.0**				
Avontuur Estate	3.06	East	0.2	1	164	33	4.6
Cordoba Road	2.63	East	3.4	7	25	590	5.9
Home / Shack	2.53	East	3.4	10	5	169	
Stonewall / Happy Vale Winery	2.24	West	3.4	1	56	189	4.6
Klein Helderberg Road	1.84	East	3.4	1	80	270	9.2
Bredell Road	1.81	West	3.4	1	208	701	
Yonder Hill	1.61	East	3.1	1	50	154	
Oor die Vlakte	1.46	East	3.4	1	25	84	
Majuba	1.29	West	3.2	1	15	48	
Ridge Acres	1.22	East	0.0	1	15	0	
Steynsrust Road	**0.00**	**E&W**	**0.0**				
Total				**61**		**9 049**	**85.9**

Below-ground interchanges

The proposed below-ground alternative would result in approximately the same access changes as for the grade-separated roundabout. Their impacts would thus be similar, namely of a **LOW to MEDIUM** significance with mitigation for commercial operations located at the Annandale Road and Winery Road Intersections (see Table 6.32). The majority of the overall impacts would be focused on commercial operations at the Annandale Road Intersection where the risk of negative impacts from access changes were found to be greater than for those at the Winery Road Intersection.

For those operations along the R44 without direct access to the intersections, **LOW** significance impacts are expected in the longer term with mitigation, given the mitigation offered by the provision of convenient and safe grade-separated U-turn opportunities (see Table 6.32).

The introduction of a grade-separated U-turn bridge or an at-grade teardrop facility near the Jamestown Cemetery in combination with grade-separated interchanges would provide an additional more convenient U-turn option. This would be especially beneficial to commercial operations with accesses off the R44 between Annandale Road and the Jamestown Cemetery (e.g. the Stellenbosch Aerodrome and businesses clustered around it). Using the Webersvallei Road Intersection for U-turn purposes would not hold these advantages and would result in somewhat longer trips.

Mitigation

Mitigation includes the following:

- Ensure that adequate alternative temporary access is provided during construction and that construction activities take the needs of landowners into account;
- Establish a landowner liaison committee including all affected commercial operations and senior representatives of the applicant, engineers and contractor all with appropriate decision-making power. This committee should meet regularly to discuss and deal with any challenges that arise during construction; and
- Provide clear and adequate signage to indicate changes in access.

Table 6.32: Potential impact of access changes on commercial operations associated with grade-separated roundabouts and below-ground interchanges at Winery and Annandale Roads

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Impacts on commercial operations at the intersections:		
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Low – Medium	Low - Medium
Probability	High	High
Confidence	Medium	Medium
Significance	**Low - medium**	**LOW - MEDIUM**
Cumulative impact	Low to medium. Access changes have cumulative impacts on commercial operations in combination with other impacts.	
Degree to which impact can be reversed	Very low reversible as structures would effectively be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Impact affects traffic flows. No irreplaceable resources lost.	
Degree to which impact can be mitigated	Low as road design standards limit the degree to which access near the intersection can be allowed whilst maintaining minimum safety levels.	
Impacts on commercial operations along the R44 without direct access to the intersections:		
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Low	Low
Probability	High	High
Confidence	Medium	Medium
Significance	**Low**	**LOW**
Cumulative impact	Low. Access changes have cumulative impacts on commercial operations in combination with other impacts.	
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Impact affects traffic flows. No irreplaceable resources lost.	
Degree to which impact can be mitigated	Very low. Once medians are closed, mitigation options are limited.	

6.2.1.5 Impacts on commercial operations associated with visual changes

Impact Description

The visual and sense of place impacts associated with the new structures required at the Winery Road and Annandale Road Intersections, especially for the grade-separated roundabout alternative, have the potential to result in commercial impacts if they are likely to impact negatively on customer experiences.

Assessment

In order to assess impacts on customers associated with visual changes, the economic specialist considered the current operations and customer bases of affected businesses drawing on discussions with owners and managers of these businesses. Likely impacts were then assessed drawing on the findings of the visual specialist study.

No businesses relying on the provision of specific customer experiences that may be impacted on by visual changes were identified in the immediate vicinity of the proposed U-turn bridge near the Jameson Cemetery or the U-turn deck at Steynsrust Road Intersection. No significant impacts in relation to these proposed structures are thus anticipated.

Grade-separated roundabouts

The impacts of the rural character associated with the Winery Road Intersection are rated as medium (with mitigation) in the visual specialist study. The visual study further notes that the proposed grade-separated roundabout would not block views of the surrounding rural landscape and mountains, but would partially intrude on these views. Specific details of the impacts on the commercial establishments of Avontuur, Ken Forrester and the business premises of Erf 177 and 178 are discussed in some detail in Section 7.4.2.3 of the economic specialist study (see Appendix E6.1).

At the Annandale Road Intersection impacts on the landscape character associated with this intersection are rated as low to medium by the visual assessment, noting that the rural character of the area is already partially transformed making it semi-rural in nature. A number of sensitive receptors were identified by the specialist study including Mooiberge, Audacia's Root 44 Market, Klein Akkerdraai and the cottages adjacent to Mooiberge Farm stall. These are discussed in more detail in the economic specialist study (see Section 7.4.2.3 in Appendix E6.1). The most noteworthy effect on business is likely to be the effect on the Klein Akkerdraai Lodge from the proposed changed access point that would bring traffic closer to the lodge.

The economic specialist determined that the intensity of the impact for both grade-separated interchanges would be medium, of local extent and permanent. Thus the impact on commercial operations is deemed to be of **MEDIUM** significance before and after mitigation (see Table 6.33).

Below-ground interchange

The below-ground interchange alternatives would entail significantly fewer visual risks to businesses when compared to the above-ground grade-separated roundabout alternative. Their impacts on rural and semi-rural character at Winery Road and Annandale Road Intersections have been assigned a **low** impact significance rating with mitigation by the visual specialist. It is therefore expected that negative visual impacts specifically on customer behaviour would be **VERY LOW to LOW** with mitigation (see Table 6.33).

Mitigation

The mitigation measures identified by the visual specialist study should be implemented.

Table 6.33: Potential impacts on commercial operations associated with visual changes for grade-separated interchanges at Winery and Annandale Roads

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Medium	Medium	Low	Very Low - low
Probability	High	High	High	High
Confidence	Medium	Medium	Medium	Medium
Significance*	**Medium**	**MEDIUM**	**Low**	**VERY LOW - LOW**
Cumulative impact	Medium. Structures have cumulative visual impact on the character and views in the area that are part of the attraction offered to customers.		Low. Structures have cumulative visual impact on the character and views in the area that are part of the attraction offered to customers.	
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.			
Degree to which impact may cause irreplaceable loss of resources	Low - medium		Low	
Degree to which impact can be mitigated	See visual specialist study for mitigation measures the effectiveness of which was rated as low.			

6.2.1.6 Impacts on overall tourism potential

Impact Description

The proposed safety improvements could impact on the tourism industry which plays a critical role in the economy along the R44 and the wider region. This section addresses the wider tourism industry as opposed to impacts on facilities or businesses that cater to the tourist market.

Assessment

In undertaking the assessment on the wider tourism potential the economic specialist study considered current tourism use and potential future use focusing on the wider area along the R44. As part of this assessment, discussions were held with tourism authorities and tourism stakeholders in order to obtain their views on potential impacts. The specialist study reports that these discussions confirmed that tourism concerns centred on visual impacts and the potential for the grade-separated roundabouts to have wide-ranging impacts to the point where they risk changing the overall character of the area. The key aspects of overall visual impacts with the greatest relevance when considering potential to result in changed tourist behaviour with respect to the wider area are:

- Changes in the character of the areas near the intersections; and
- Impacts on the views of users of the R44 as a result of the proposed interchanges.

Grade-separated roundabouts

As addressed in the visual assessment, the impact of a grade-separated roundabout on the visual character of the Winery Road Intersection would be medium (with mitigation) and for the Annandale Road Intersection low to medium with mitigation. This finding relates to the nature of the structures involved and also the visual sensitivity at these intersections rated as moderate in both cases due to lower lying topography and other factors. In addition the zone of visual influence (ZVI), limited to 1.5 km to the south for Winery Road (less in other directions) and approximately 1 km in all directions at the Annandale Road Intersection, indicate that the area of influence is restricted and at most of medium visual character change. The economic study notes that the visual simulations showing the impact on users illustrate that the impacts on overall tourism character should be relatively muted.

The economic study concludes that given these factors, overall risks to tourism stemming from visual changes are considered to have medium impact intensity. The extent of the impact is considered to be local to regional and be permanent. The significance of the impact on tourism is thus considered to be **Medium** before mitigation and **LOW to MEDIUM** with mitigation (see Table 6.34).

Below-ground interchanges

As noted previously, the visual specialist study found that the impact of the below-ground interchanges on the visual character around the Annandale and Winery Road Intersection areas would be low with mitigation. The tourism impacts associated with these alternatives should be slightly higher when compared to the current situation in the light of the increased size of the infrastructure, even if much of it would be below ground. In addition to impacts on visual character, the visual assessment addressed impacts of the intersections on users of the R44 including tourists and found them to be low with mitigation. The overall impacts of these alternatives on tourism have consequently been assigned a **VERY LOW** impact significance rating with mitigation (see Table 6.34).

Table 6.34: Potential impacts on overall tourism potential associated with grade-separated interchanges at Winery and Annandale Roads

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
ALTERNATIVE	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
Extent	Local and regional	Local and regional	Local and regional	Local and regional
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Medium	Low to medium	Low	Very low
Probability	High	High	High	High
Confidence	Medium	Medium	Medium	Medium
Significance*	**Medium**	**LOW - MEDIUM**	**Low**	**VERY LOW**
Cumulative impact	Low to medium. Structures have cumulative visual impact on the character and views in the area that are part of the attraction offered to customers.		Very low to low. Structures have cumulative visual impact on the character and views in the area that are part of the attraction offered to customers.	
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.			
Degree to which impact may cause irreplaceable loss of resources	Low - medium		Low	
Degree to which impact can be mitigated	See visual specialist study for mitigation measures the effectiveness of which was rated as low.		Low to medium. See visual specialist study for mitigation measures.	

U-turn bridge near Jamestown Cemetery

The visual specialist study found that the impact on visual character of this alternative would be medium with mitigation. In addition to impacts on visual character, the visual study addressed impacts on users of the R44 including tourists and found them to be low to medium with mitigation. Note that risks to tourism should be lessened given the position of the bridge near to the urban areas and associated large structures and developments such as the Stellenbosch Square Mall. However, in the light of the sensitivity of the wider area, the overall impacts of the alternative on tourism have been assigned a **medium** impact significance rating given the sensitivity of the wider area. With mitigation as indicated by the visual study, this could reduce too **LOW to MEDIUM** significance (see Table 6.35).

Note that overall risks to tourism would increase if the U-turn bridge is combined with above-ground grade-separated roundabouts at Winery and Annandale Road Intersections.

Table 6.35: Potential impacts on overall tourism potential associated with the proposed U-turn bridge near Jameson Cemetery

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local and regional	Local and regional
Duration	Permanent	Permanent
Intensity	Medium	Low - medium
Probability	High	High
Confidence	Medium	Medium
Significance	**Medium**	**LOW - MEDIUM**
Cumulative impact	Low - medium. Structures have cumulative visual impact on the character and views in the area that are part of its overall attraction to tourists.	
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Low - medium. See visual specialist study for mitigation measures.	

At-grade U-turn facility near Jamestown Cemetery and Webersvallei Road Intersection

It is not anticipated that the proposed at-grade U-turn facility near Jamestown Cemetery nor the use of Webersvallei Road Intersection for U-turn movements would introduce structures with visual impacts and thus not have any impact on tourism.

Mitigation

The following mitigation measures are recommended:

- Implement recommendation of the visual specialist study to limit aesthetic impacts; and
- Ensure that tourism signage is adequate and clear.

6.2.1.7 Impacts on local property values

Impact Description

The proposed safety improvements to the R44 could result in changes to property values. Such changes are not expected to be evenly distributed spatially. For example, local access and visual impacts would be prominent drivers of local property value effects particularly at the intersections, but would be less relevant at wider spatial scales where mobility impacts would play a more prominent role.

Assessment

Property values generally reflect the wide variety of attributes or characteristics that are associated with a given property. These include all factors relevant to buyers such as productive potential, access, structural, neighbourhood, environmental characteristics, etc. When one or a number of these attributes change, property values generally respond accordingly (unless distortions in the market prevent this).

As indicated in previous sections in this assessment, there are various factors affecting property values. These assessments were considered by the economic specialist in order to broadly assess impacts on property values. This simultaneous consideration of multiple sources of impact including land loss, access change and visual impacts means that the process of assessing impacts on property values allows for a holistic view of the overall combined effect of these impacts. The economic study notes, however, that it needs to be recognised that it is difficult to confidently predict likely impacts on property values particularly over the long term. Among the reasons for this are the complexity of factors that play a role in the determination of values and difficulty associated with assessing the role of perceptions (that may prove incorrect) in determining values. Value drivers also change with time. For example, in the Stellenbosch area, the value of farm land used to be driven almost exclusively by its agricultural potential.

This is no longer the case with lifestyle, aesthetic, access and mobility factors playing an increasingly important or even primary role (for e.g. see Kleynhans and Opperman, 2005).

The assessment is focused on the local level making distinctions between properties at the intersections and properties along the R44. It should, however, be recognised that the value of properties in the wider sub-region serviced by the R44 are likely to be influenced primarily by changes to mobility as this is the key benefit offered by the R44 to the wider sub-region particularly in the medium to longer term.

Grade-separated roundabouts

The grade-separated roundabout alternative would largely result in the highest level of risk to *properties near the intersections*. These risks would include land loss, changed access and visual impacts associated with new structures all of which could impact on property values. The economic assessment has noted that determining the significance of this impact is challenging, however, the intensity of the impact before mitigation is considered to be medium. This permanent impact of local extent would thus have an impact significance of **Medium** before mitigation. With mitigation the impact significance would be **LOW to MEDIUM** (see Table 6.36). It should be noted that within the overall rating there would be variations. For example, properties such as Mooiberge would experience higher levels of risk relative to others such as Avontuur.

Properties along the R44 with no direct access to the intersection would experience negative impacts on their access due to the closure of median openings implying risks to property values. Convenient and safe U-turn opportunities would, however, mitigate this impact. The impact on property values is considered to have a low to medium intensity, be of local extent and permanent. The significance of the impact is thus considered to be **LOW** with and without mitigation (see Table 6.36).

Below-ground interchanges

Below-ground interchanges would introduce lower risks to properties near the intersections than would be the case for the above-ground grade-separated roundabouts. They would have substantially lower visual impacts along with similar land losses and changes in access. Determining the significance of their impact is particularly challenging. Nevertheless, a significance rating of **LOW** with mitigation seems most appropriate given their lower visual impacts (see Table 6.37). Within this overall rating there will be variations. For example, properties such as Mooiberge and Brakelsdal would experience higher levels of risk relative to others such as Avontuur.

Table 6.36: Potential impacts on property values for the grade-separated roundabouts

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Impacts on property values at the intersections:		
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Medium	Low - Medium
Probability	High	High
Confidence	Medium	Medium
Significance	**Medium**	**LOW - MEDIUM**
Cumulative impact	Low to medium. Structures and access, traffic changes combine to have cumulative impacts on property values.	
Degree to which impact can be reversed	Very low reversible as structures would effectively be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Impact affects property values. No irreplaceable resources lost.	
Degree to which impact can be mitigated	Low as road design standards limit the degree to which access near the intersection can be allowed whilst maintaining minimum safety levels.	

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Impacts on property values along the R44 without direct access to the intersections:		
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Low	Low
Probability	High	High
Confidence	Medium	Medium
Significance	**Low**	**LOW**
Cumulative impact	Low. Structures and access, traffic changes combine to have cumulative impacts on property values.	
Degree to which impact can be reversed	Not reversible as structures would effectively be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Impact affects property values. No irreplaceable resources lost.	
Degree to which impact can be mitigated	Low. Once medians are closed, mitigation options are limited.	

Table 6.37: Potential impacts on property values associated with below-ground interchanges

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Impacts on properties at the intersections:		
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Low to Medium	Low
Probability	High	High
Confidence	Medium	Medium
Significance	**Low to Medium**	**LOW**
Nature of Cumulative impact	Low - Medium. Structures and access, traffic changes combine to have cumulative impacts on property values.	
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Impact affects property values. No irreplaceable resources lost.	
Degree to which impact can be mitigated	Low to medium	

U-turn bridge near Jameson Cemetery

The key properties in close proximity to the proposed U-turn bridge that may be particularly sensitive to visual impacts include:

- The farmstead on the farm Uitsig (Farm 1298);
- Stellenpark Business Park (partially developed on Farm 510 Portion 87 on the corner of the R44 and the Jamestown Cemetery Road); and
- Blaauwklip Office Park (adjacent to Stellenpark Business Park along the R44 towards Stellenbosch).

Other immediately adjacent lands include the Jamestown Cemetery and agricultural lands, the values of which are less likely to be sensitive to visual impacts. The south-eastern corner of the Kleine Zalze Golf Estate is also situated approximately 150 m from the proposed bridge.

The visual specialist study found that the U-turn bridge would have a medium impact with mitigation on visual character. It would be particularly close to the Stellenpark Business Park (approximately 35 m from the nearest building) and, at roughly 7.5 m, would be of a comparatively similar height to the buildings in the Business Park which are two and three stories. It would be a highly dominant feature in any views from the Park particularly in a westerly direction. It would also be visible in south-westerly views from the

Blaauwklip Office Park, although these buildings would be at a greater distance of approximately 105 m from the bridge and would enjoy better screening from trees.

The start of the up-ramp would be approximately 70 m to the east of the Uitsig farmstead. This would be approximately 20 m further away from the farmstead than the closest part of the R44, which currently passes approximately 50 m from the farmstead to the south-east. The up-ramp would thus not result in cars passing closer to the farmstead than they currently do. There would be some level of visual risk introduced by the up-ramp. It should, however, be possible to keep this risk low considering the low elevation of the up-ramp at its start and the potential for screening with vegetation.

Note also that risks to property values should be lessened given the position of the bridge near to the urban areas and associated large structures and developments such as the Stellenbosch Square Mall. The overall impacts of the alternative on property values in the wider area has consequently been assigned a **LOW TO MEDIUM** impact significance after mitigation (see Table 6.38). Within this overall rating there would be variations. Immediate neighbours such as the Stellenpark Business Park would experience highly significant impacts relative to others such as the Blaauwklip Office Park, which would be further away from the bridge.

Properties along the R44 between Annandale Road and the Jamestown Cemetery would experience negative impacts on their access due to the closure of median crossings implying risks to property values. The U-turn bridge or at-grade facility would provide convenient and safe U-turn opportunities for these properties resulting in overall impacts of **VERY LOW TO LOW** significance (see Table 6.38). In the case of U-turn opportunities at the Webersvallei Road Intersection, somewhat longer trips would be required for these properties than for being able to U-turn at Jamestown Cemetery. The significance of impacts on these properties should remain of a low significance given the limited additional distance to reach the U-turn opportunity and relatively low traffic volumes.

At-grade U-turn facility near Jamestown Cemetery

The at-grade U-turn facility at the same site would result in similar impacts on these properties. This alternative would not, however, introduce any raised structures implying no impacts on adjacent property values stemming from visual impacts.

Webersvallei Road Intersection

The use of the Webersvallei Road Intersection for U-turns would not introduce any structures at the intersection implying no risks to adjacent property values stemming from visual impacts.

Mitigation

Apply the mitigation measures already outlined in previous sections of this assessment dealing with impacts on land loss, changes in access, visual impacts and overall tourism impacts.

Table 6.38: Impacts on property values associated with the U-turn facilities near Jameson Cemetery

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Impacts on properties nearby the U-turn bridge:		
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Medium	Low - medium
Probability	High	High
Confidence	Medium	Medium
Significance	**Medium**	**LOW - MEDIUM**
Nature of Cumulative impact	Low - medium. Structures and access, traffic changes combine to have cumulative impacts on property values.	
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.	

Degree to which impact may cause irreplaceable loss of resources	Impact affects property values. No irreplaceable resources lost.	
Degree to which impact can be mitigated	Low to medium and focused on visual impact mitigation	
Impacts on properties along the R44 especially between Annandale Road and the Jamestown Cemetery:		
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Low	Very low - low
Probability	High	High
Confidence	Medium	Medium
Significance	**Low**	**VERY LOW - LOW**
Nature of Cumulative impact	Very low to low. Structures and access, traffic changes combine to have cumulative impacts on property values.	
Degree to which impact can be reversed	Very low reversibility as structures would effectively be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Impact affects property values. No irreplaceable resources lost.	
Degree to which impact can be mitigated	Low to medium	

6.2.2 HERITAGE IMPACT: CLOSING OF THE R44 MEDIAN OPENINGS

Impact Description

The heritage specialist study identified the proposed closing of the R44 median openings as having an impact on the quality of the R44 as an identified scenic route and on the surrounding rural cultural landscape.

Assessment

Certain of the median openings are seen as being of important historic significance as part of the traditional movement routes within the rural cultural landscape. These median openings are linked to the history of the landscape and the value of the R44 as an identified scenic route. Thus the median openings are regarded as a heritage resource in themselves rather than simply a means to provide access to the R44.

In the discussion of the identified heritage resources, the cultural heritage study states that the R44 in its current state detracts from the significance and quality of the landscape. The R44 upgrades from the 1970s onwards served to separate the landscape on either side of it, namely the Eerste River Basin to the west of the road and the Mountain Foothills to the east. The median crossings are considered to still retain a linkage with the Eerste River Basin and Mountain Foothills.

The heritage study concludes that there are no heritage related reasons that would support the closing of all the medians, particularly those which are not redundant and still have strong linkage with the underlying and tangible rural cultural landscape. The study states that, from a cultural heritage perspective, the proposal to close the median crossings cannot be supported as it does not respond to heritage resource indicators and recommendations.

The study rates the potential impact of the closing of the R44 medians on the surrounding rural cultural landscape and on the quality of the R44 as a scenic route as a localised permanent impact of high intensity. The impact significance would be **HIGH** with and without mitigation (see Table 6.39).

Mitigation

The specialist study indicated that it would not be possible to mitigate the potential impact.

Table 6.39: Potential impact of closing the R44 median openings on the cultural landscape and on the quality of the R44 as a scenic route

Extent	Local	Local
Duration	Permanent	Permanent
Intensity	High	High
Probability	Definite	Definite
Confidence	High	High
Significance	**High**	**HIGH**
Cumulative impact	High	
Degree to which impact can be reversed	Irreversible	
Degree to which impact may cause irreplaceable loss of resources	High	
Degree to which impact can be mitigated	None	

6.2.3 IMPACTS RELATED TO CONSTRUCTION

6.2.3.1 Jobs and procurement

Impact Description

The construction phase would result in short-term job creation and procurement.

Assessment

Construction expenditure would bring a large new investment to the area of more than R 256 million for a construction period of between 24 and 32 months (depending on the interchange alternative to be implemented). The consequent increase in economic activity could be measured in terms of impacts on employment and associated incomes in the local area and the region. Labour costs associated with the project would be in the order of R 66 million, which would equate to 300 employment opportunities that would be available in the local area throughout the construction phase. Although details in this regard are not available at this stage, it is anticipated that a proportion of the job opportunities would be allocated to the local population during the construction phase in compliance with normal public sector standards. This would be in addition to contributing to maintaining existing semi- and skilled jobs in the civil and other construction sectors in the region. Procurement expenditure associated with the contract would also accrue to local service providers. Further indirect opportunities may stem from expenditure by construction workers in the vicinity of the construction site and in the local community. The direct participation of the contractor and employees in the local economy for the duration of the contract would directly benefit the local economy.

The contribution to the local and regional economy through creating employment and procurement opportunities as well as the participation in the local economy by the contractor would result in a local, short-term impact of medium intensity, and is therefore considered to have ***Very Low (Positive)*** significance. With appropriate mitigation measures the significance of the impact would increase to ***LOW (POSITIVE)*** (see Table 6.40).

Mitigation

The following mitigation measures are recommended:

- Employ local SMME and BEE service providers and local labour as far as possible in line with standard public sector procurement policy; and
- Ensure appropriate training is provided.

Table 6.40: Potential impact of construction on jobs and procurement

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short term	Short term
Intensity	Medium	High
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	***Very Low (Positive)***	***LOW (POSITIVE)***
Cumulative impact	Low – construction related employment would increase the amount of employed people in the area	
Degree to which impact can be reversed	N/A – positive impact	
Degree to which impact may cause irreplaceable loss of resources	N/A – positive impact	
Degree to which impact can be mitigated	Low	

6.2.3.2 Construction disturbance

Impact Description

The construction of the proposed interchange structures and related infrastructure and the closing of the median openings would result in short-term disturbances to the surrounding area as a result of construction activities.

Assessment

Potential construction-related impacts are generic to most construction projects and include construction vehicle traffic noise, visual, dust and travel delays / inconvenience. Residents of the farms immediately adjacent to the Winery and Annandale Road Intersections would be the most directly affected. Other residents of surrounding properties and any businesses along the R44 would experience a more indirect impact. Road users, especially commuters, would also experience inconvenience or delays in travel time as a result of the construction-related activities.

Although some impacts could be of high local intensity, they are expected to be of short term duration and local in extent. The potential construction-related impacts are thus considered to be **Low** without mitigation. With the successful implementation of the recommended mitigation measures and compliance with the Construction EMP, the impact significance could be reduced to **VERY LOW** (see Table 6.41).

Table 6.41: Potential impact of construction disturbance

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short term	Short term
Intensity	High	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Low**	**VERY LOW**
Cumulative impact	Very low – this impact would only contribute cumulatively if other construction projects are taking place in the area.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Low	

Mitigation

Ensure compliance with conditions of the Construction EMP (see Appendix G). The Construction EMP identifies general mitigation measures to reduce impacts on both the biophysical and socio-economic environments during the construction phase. Specific mitigation measures recommended by the specialists have also been included in the Construction EMP.

6.2.4 IMPACTS OF THE NO-GO ALTERNATIVE

Impact Description

The no-go alternative would result in the maintenance of the status quo. For each of the identified issues the implications of the no-go alternative are assessed below and summarised in Table 6.42.

Assessment

Vegetation:

The no-go alternative would not result in any loss of natural or non-natural vegetation. The significance of the no-go alternative is therefore considered to be **NEUTRAL**.

Freshwater:

The no-go alternative would not result in any additional impacts on freshwater ecosystems in the area. The significance of the no-go alternative is therefore considered to be **NEUTRAL**.

Groundwater:

The no-go alternative would not result in the loss of or impact to any boreholes surrounding the intersections. The significance of the no-go alternative is therefore considered to be **NEUTRAL**.

Heritage:

The no-go alternative would not disturb or destroy any archaeological remains, heritage artefacts or historic buildings or change the rural cultural landscape. The significance of the no-go alternative is therefore considered to be **NEUTRAL**.

Visual:

The no-go alternative would not result in any visual impacts, as there would be no change to the existing visual landscape. The significance of the no-go alternative is therefore considered to be **NEUTRAL**.

Economic:

The no-go alternative would not result in any impacts relative to the identified project-related benefits. Thus no positive construction-related expenditure injection into the area would result in the short term. The potential contribution to economic development and growth as a result of improved road infrastructure provision would also not realise in the medium- to longer term. However, the negative impacts related to business operations would also not occur. The significance of the no-go alternative is therefore considered to be **VERY LOW** to **MEDIUM**.

Road safety:

The no-go alternative would not result in any of the positive project-related road safety and LOS benefits. The significance of the no-go alternative is therefore considered to be **MEDIUM**.

Construction:

The no-go alternative would not result in any construction-related impacts.

Table 6.42: No-go impacts for the proposed project

ASPECT	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE	CONFIDENCE
Vegetation	Local	Short- to Long-term	Very Low	Improbable	**NEUTRAL**	Medium
Freshwater	Local	Short- to Long-term	Very Low	Improbable	**NEUTRAL**	Medium
Groundwater	Local	Short- to Long-term	Very Low	Improbable	**NEUTRAL**	Medium
Heritage	Local	Short- to Long-term	Very Low	Improbable	**NEUTRAL**	Medium
Visual	Local	Short- to Long-term	Medium – High	Probable	**NEUTRAL**	Medium
Economic	Local to Subregional	Short- to Long-term	Low	Probable	**VERY LOW - MEDIUM**	Medium
Road safety	Local	Long-term	Medium	Highly probable	**MEDIUM**	Medium
Construction	Local	Short-term	Zero	Probable	**NEUTRAL**	Medium

7. CONCLUSION AND RECOMMENDATIONS

This Revised Final BAR has identified and assessed the key biophysical and socio-economic impacts associated with the proposed safety and level of service (LOS) improvements to the R44 between Somerset West and Stellenbosch. This chapter provides a summary of the impact assessment findings, makes conclusions to the BA study and recommends key mitigation measures for the proposed project.

7.1 SUMMARY OF FINDINGS

The environmental impacts of the proposed project are summarised under the two sections below. First the main findings regarding overall project impacts are discussed. Thereafter the findings regarding the proposed intersection improvements and a comparative assessment of the proposed alternatives for the Winery and Annandale Road Intersections and the U-turn facility in the vicinity of Jamestown are summarized. Summary impact significance tables are presented for each.

7.1.1 RATIONALE AND ALTERNATIVES

The proposed project identified the need to find a holistic solution to the safety and LOS issues along the R44 between Somerset West and Stellenbosch. At the same time the strategic mobility function of the R44 necessitates that such safety improvements would have to be effected without sacrificing capacity and mobility along the route. In order to address these issues, an overarching improvement project was initially proposed by DTPW which included the closure of all median openings along the R44 and the provision of grade-separated roundabouts at two key intersections in order to provide safe turnaround (U-turn) facilities.

During the BID public consultation process it became apparent that many I&APs did not, for various reasons, consider the proposed grade-separated roundabouts a suitable solution. This was largely based on concern over the visual impact that they would have in a largely rural environment and associated negative impacts on tourism. Directly affected neighbours were also concerned about the impact it could have on issues such as access, business and agriculture. Regarding the median closures, a number of landowners and businesses located between the proposed interchanges were concerned about additional travel distance associated with closed medians.

Thus various other options were suggested as a solution to the safety and LOS problem along this stretch of road. These included suggestions such as a Stellenbosch bypass, additional access to Techno Park, secondary service roads running parallel to the R44, an additional new road closer to the mountain foothills, improved public transport, dedicated bus lanes and a reduction in the speed limit. These alternatives were then considered by the technical team and as indicated in Chapter 3 none of these alternatives were deemed as suitable as that proposed to resolve the safety and LOS deficiencies that precipitated this project.

Various suggestions were subsequently raised as alternatives to the grade-separated roundabouts. Thus in the Draft BAR at-grade roundabouts and signalised intersections were included and assessed as alternatives at both the Winery Road and Annandale Road Intersections. Many concerns and strong objections were again raised in relation to the findings of the Draft BAR which, based on the economic specialist input, concluded that grade-separated roundabouts were recommended. The main objections were the same as those raised during comment on the initial BID. These included the visual impact and effect on the rural landscape character, effects on tourism and direct effects on adjacent landowners. Other key concerns included the cost implications of the grade-separated roundabouts and that the

grade-separated roundabouts were investigated in isolation from the system-wide traffic flows as the impact on the local traffic system at each end of the R44 corridor had not been fully analysed. This highlighted the statement in the Draft BAR that time gained due to improved traffic flow along the R44 could be reduced or nullified as the traffic builds up at the signalised intersections entering Stellenbosch as well as on the urban road network in Somerset West.

In taking cognisance of the strong opposition to the proposed grade-separated roundabouts and submissions received from I&APs, the project engineers were tasked to look at other possible solutions to address the project needs. This led to the identification of further conceptual design alternatives, which included *inter alia* a dedicated U-turn bridge at the existing Steynsrust Road Interchange to avoid increased loading of the street network in this area, and the provision of three at-grade roundabouts along the route, namely at Bredell, Winery and Annandale Roads as well as a dedicated at-grade U-turn facility near the Jamestown Cemetery. In order to test the viability of these additional conceptual alternatives (in terms of overall performance in relation to system-wide traffic flows) a detailed traffic operational analysis was commissioned. This served as a basis to develop and assess a revised project scheme and alternatives.

The findings of the traffic analysis determined that the at-grade schemes considered (either a signalised intersection or at-grade roundabouts) would not be viable as they would reach capacity limits immediately or very shortly thereafter. Providing realistic U-turn movements at Annandale Road would in fact result in a decrease in capacity of this intersection.

Other design options were then considered to address the visual, heritage and tourism concerns raised regarding the above-ground grade-separated roundabouts. Thus, the option of placing Winery and Annandale Roads below the R44 in the form of below-ground interchanges was identified and included in the project description for assessment.

The main issues raised in response to the Revised Draft BAR again focused on similar themes as those raised previously during the BA process, with most of the 44 respondents raising strong objections against the grade-separated interchange component of the proposed project. In addition, Heritage Western Cape (HCW) formally responded to the submission of the Heritage Impact Assessment (HIA) undertaken for the study. In response to HWC's recommendations, a heritage practitioner experienced in cultural landscape assessments was appointed to review and update the HIA. The findings of this additional specialist study have been incorporated into this Revised Final BAR.

7.1.2 PROJECT SCALE IMPACTS

7.1.2.1 Economic efficiency of upgrade / cost benefit analysis

The overall economic efficiency of the project was determined by means of conducting a cost benefit analysis (CBA). The result of the cost benefit analysis (which included a grade-separated facility near Jamestown) was that both the grade-separated roundabouts (Alternative 2) and the below-ground interchanges (Alternative 4) would be economically efficient. The results for each are as follows:

- Alternative 2: The NPV is R 381 m, the BCR is 2.02 and the IRR 18%. This is considered to be economically robust and is the most efficient alternative; and
- Alternative 4: A NPV of R 300 m, a BCR of 1.66 and an IRR of 14%. This alternative is economically efficient but less so than for Alternative 2.

The economic analysis of the three solutions considered for the Jamestown / Webersvallei U-turn movement, concluded that the use of the Webersvallei Road Intersection is the most efficient of the

options considered. This conclusion is based on the understanding that the service levels at the Webersvallei traffic lights are acceptable and that no phasing of lights is required to accommodate U-turn movements.

The efficiency of Alternatives 2 and 4 is further improved if the Webersvallei Road U-turn option is included in the overall cost benefit. For Alternative 2, the NPV increases to R 407 m (from R 381 m), the BCR from 2.02 to 2.17, and the IRR from 18% to 20%. For Alternative 4, the NPV increases to R 326 m (from R 300 m), the BCR from 1.66 to 1.76, and the IRR from 14% to 15%.

A sensitivity analysis was performed on a number of assumptions, including:

- Construction costs;
- Reduction in accidents;
- Value of time savings;
- Number of local access trips;
- Traffic growth;
- Fuel savings; and
- Percentage of below-ground rock.

In most of the ranges tested the sensitivity analysis shows that Alternative 2 is the most efficient. However, when considering the proportion of underground rock, in the highly unlikely case where there is no rock, the BCR for Alternative 4 is marginally higher than for Alternative 2, thus in this case this would be the most efficient option.

7.1.2.2 Economic feasibility of the project alternatives

As previously indicated (see Sections 3.2.4.2 and 6.2.1.1), a BCR greater than 1 indicates that the completed project would constitute an economic asset; a BCR of less than 1 implies that the project would be an economic liability. Alternative 2 with a BCR of 2.17 is economically efficient and is assessed to have an impact of ***HIGH (Positive)*** significance with and without mitigation. Alternative 4 is also economically efficient with a BCR of 1.76. The impact significance is assessed to be ***MEDIUM to HIGH (Positive)*** with and without mitigation. The summary of anticipated economic feasibility impacts for each alternative is provided in Table 7.1.

Table 7.1: Summary of economic feasibility impacts of the project alternatives

	ALTERNATIVE 2		ALTERNATIVE 4	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Economic feasibility of the project alternatives	***High (positive)***	***HIGH (positive)***	***Medium to High (positive)***	***MEDIUM to HIGH (positive)***

7.1.2.3 Heritage impact: Closing of the R44 median openings

Certain of the median openings along the R44 are considered to be an underlying and tangible historic informant of the surrounding rural cultural landscape which retain a linkage with the Eerste River Basin and Mountain Foothills on either side of the R44. As a heritage resource in its own right, the median openings are considered to contribute significantly to the R44 as a scenic route.

The potential impact of the closing of the R44 median openings on the quality of the R44 as an identified scenic route and on the surrounding rural cultural landscape is assessed to be of **HIGH** significance with and without mitigation (see Table 7.2).

Table 7.2: Summary of the potential impact of closing the R44 median openings on the cultural landscape

IMPACT	WITHOUT MITIGATION	WITH MITIGATION
Closing of the R44 median openings	**High**	**HIGH**

7.1.3 IMPACTS OF PROPOSED INTERSECTION IMPROVEMENTS

7.1.3.1 Biophysical and social impacts

The impacts of the proposed intersections alternatives on the affected environment in terms of vegetation, freshwater, groundwater, heritage and visual are described below and summarised in Tables 7.3 to 7.6.

At the existing **Steynsrust Road Interchange** the natural environment is severely modified and only a small area outside the existing road reserve would be affected by the proposed U-turn bridge and ramps. After mitigation the impact on vegetation and freshwater is anticipated to be of **LOW** and **VERY LOW** significance, respectively. The visual impact is considered to be of **LOW** significance after mitigation due to the existing transformed nature of the current Steynsrust Bridge. It is not anticipated that any impacts would be experienced on groundwater and heritage as a result of this project component (see Table 7.3).

At the **Bredell Road Intersection** the proposed safety improvements would not extend outside the existing road reserve. It is therefore not anticipated that any impacts would be experienced on vegetation, freshwater, groundwater, heritage or visual features (see Table 7.3).

Table 7.3: Comparative summary of potential impacts associated with proposed intersection improvements and alternatives at Steynsrust and Bredell Roads

	STEYNSRUST ROAD	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**
Freshwater	**Low**	**VERY LOW**
Visual	**Low to Medium**	**LOW**
Groundwater	None	
Heritage		
	BREDELL ROAD	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	None	
Freshwater		
Groundwater		
Heritage		
Visual		

At the **Winery Road Intersection** vegetation, groundwater, heritage and visual impacts would occur (see Table 7.4):

- *Grade-separated roundabout alternative*:
  - For the grade-separated roundabout alternative the anticipated impacts on vegetation and groundwater range between **INSIGNIFICANT** and **LOW** with mitigation.
  - Heritage impacts are assessed to be of **VERY LOW** significance after mitigation in terms of archaeological and historical artefacts and as a result of the intrusion of the grade-separated roundabout of **HIGH** significance, with no mitigation considered possible, in terms of changes to the cultural landscape and the R44 scenic drive. The potential cultural heritage impact of the above-ground grade-separated alternative would be greater in visual terms compared to the

below-ground alternative. This is due to the visibility of the structures imposed on the landscape, as well as in material terms, in that the concrete structures and the considerable amount of cut and fill would not be in line with the recommendations for a scenic drive.

- Visual impacts are anticipated to range between **LOW to MEDIUM** and **MEDIUM** after mitigation with the most significant impacts that of light pollution, a change in the landscape character and impacts on sensitive receptors in the area.

- *Below-ground interchange alternative:*
  - The below-ground interchange would have an impact on vegetation of **LOW** significance with mitigation.
  - The groundwater impact, which in this case would also include lowering of the water table, would be **INSIGNIFICANT** after mitigation.
  - The heritage impacts in terms of archaeological and historical artefacts are assessed to be of **VERY LOW** significance after mitigation. In terms of changes to the cultural landscape and the R44 scenic drive the impact is assessed to be of **HIGH** significance, with no mitigation considered possible. The cultural heritage specialist study recognised that the below-ground alternative represents a potentially less intrusive option than the above-ground alternative in that it would visually maintain a degree of continuity with the surrounding cultural landscape. Nevertheless, the study sees the below-ground alternative as still representing a fundamental intrusion onto the established historic pattern which underpins the heritage significance of the wider rural cultural landscape.
  - The visual impacts range from **VERY LOW to LOW** with mitigation due to Winery Road being located below the R44 for this alternative.

Table 7.4: Comparative summary of potential impacts associated with proposed grade-separated alternatives at Winery Road

WINERY ROAD				
ALTERNATIVES	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**	**Low**	**LOW**
Freshwater	None		None	
Groundwater				
Damage to or loss of existing boreholes	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Blasting	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Lowering of water table	**N/A**	**N/A**	**Insignificant**	**INSIGNIFICANT**
Heritage				
Archaeological and historical artefacts	**Very low**	**VERY LOW**	**Very low**	**VERY LOW**
Cultural landscape	**High**	**HIGH**	**High**	**HIGH**
Visual				
Change in landscape character	**High**	**MEDIUM**	**Low**	**LOW**
Light Pollution	**Medium – High**	**MEDIUM**	**Low**	**VERY LOW**
Visibility from sensitive receptors	**High**	**MEDIUM**	**Low**	**LOW**
Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route	**Medium**	**LOW – MEDIUM**	**Low – Medium**	**LOW**

At the **Annandale Road Intersection** impacts are anticipated on vegetation, freshwater, groundwater, heritage and the visual environment (see Table 7.5):

- *Grade-separated roundabout alternative:*
  - Anticipated impacts on vegetation, freshwater and groundwater for the *grade-separated roundabout alternative* range between **INSIGNIFICANT** and **VERY LOW to LOW** with mitigation.
  - Heritage impacts in terms of archaeological and historical artefacts are assessed to be **VERY LOW** after mitigation; **MEDIUM to HIGH** after mitigation in terms of the built environment as a result of the loss of the labourer's cottage in the north-eastern quadrant; and as a result of intrusion of the grade-separated roundabout of **HIGH** significance, with no mitigation considered possible, in terms of changes to the cultural landscape and the R44 scenic drive. As is the case for Winery Road, the potential cultural heritage impact of the above-ground grade-separated alternative would be greater in visual terms compared to the below-ground alternative.
  - Visual impacts are anticipated to range between **LOW** and **MEDIUM** after mitigation with the most significant impacts relating to the loss of a visual resource (the labourer's cottage) and the loss of views due to the presence of the structure in close proximity to a residence.

Table 7.5: Comparative summary of potential impacts associated with proposed grade-separated alternatives at Annandale Road

ANNANDALE ROAD				
ALTERNATIVES	**GRADE-SEPARATED ROUNDABOUT**		**BELOW-GROUND INTERCHANGE**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**	**Low**	**LOW**
Freshwater	**Low**	**VERY LOW – LOW**	**Low**	**VERY LOW - LOW**
Groundwater				
Damage to or loss of existing boreholes	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Blasting	**High**	**INSIGNIFICANT**	**High**	**INSIGNIFICANT**
Lowering of water table	**N/A**	**N/A**	**Insignificant**	**INSIGNIFICANT**
Heritage				
Archaeological and historical artefacts	**Medium**	**VERY LOW**	**Medium**	**VERY LOW**
Built environment	**High**	**MEDIUM – HIGH**	**High**	**MEDIUM – HIGH**
Cultural landscape	**High**	**HIGH**	**High**	**HIGH**
Visual				
Change in landscape character	**Medium**	**LOW - MEDIUM**	**Low**	**LOW**
Light Pollution	No change	No change	No change	No change
Loss of visual resource	**Medium**	**MEDIUM**	**Low - Medium**	**LOW - MEDIUM**
Loss of view	**Medium**	**MEDIUM**	N/A	N/A
Visibility from sensitive receptors	**Medium**	**LOW – MEDIUM**	**Low**	**LOW**
Visual impact of the proposed interchange on the users of the R44 as a scenic and tourist route	**Low - Medium**	**LOW**	**Low - Medium**	**LOW**

- *Below-ground interchange alternative :*
  - The anticipated impacts of the *below-ground interchange* on vegetation, freshwater and groundwater all range from **INSIGNIFICANT** to **LOW** with mitigation.
  - Heritage impacts have been assessed to have the same impact significance as for the grade-separated roundabout, namely **VERY LOW** after mitigation for archaeological and historical artefacts; **MEDIUM** to **HIGH** after mitigation for the built environment as a result of the loss of the labourer's cottage in the north-eastern quadrant; and **HIGH** significance, with no mitigation

considered possible, for the cultural landscape and the R44 scenic drive as a result of the intrusion of the below-ground interchange onto the established historic pattern. The below-ground interchange alternative does represent a potentially less intrusive option to that of the grade-separated roundabout alternative.

- o The visual impacts are mostly of **LOW** significance, with the exception of the loss of visual resources which is assessed to have the same impact as for the *grade-separated roundabout*, namely **LOW to MEDIUM** with mitigation.

At the **Jamestown Cemetery/Webersvallei Road U-turn options** impacts are anticipated on vegetation, freshwater, heritage and the visual environment (see Table 7.6).

- For the *U-turn bridge alternative* the impacts on vegetation and freshwater were assessed to be **LOW** and **VERY LOW** after mitigation, respectively. The impact on archaeology was also assessed as being **VERY LOW**. Due to the semi urban nature and visual nature of the bridge, the impact on cultural heritage and visual change in character were assessed to be of **MEDIUM** significance with mitigation. The impact on visible receptors was assessed to be **LOW.**

- The *at-grade teardrop facility* would result in an impact of **MEDIUM** significance on freshwater due to the impact on the nearby wetland. The impact on vegetation, heritage and the visual environment would with mitigation range from **VERY LOW** to **LOW to MEDIUM.**

- At the *Webersvallei Road Intersection* the only impact would be on freshwater with a significance of **VERY LOW**. All other issues would remain the same.

Table 7.6: Comparative summary of potential impacts associated with proposed U-turn facilities near Jamestown Cemetery and Webersvallei Road.

JAMESTOWN CEMETERY / WEBERSVALLEI ROAD INTERSECTION						
ALTERNATIVES	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP FACILITY**		**SIGNALISED INTERSECTION**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Vegetation	**Low**	**LOW**	**Low**	**LOW**	N/A	
Freshwater	**Very Low**	**VERY LOW**	**Medium**	**MEDIUM**	**Very Low**	**VERY LOW**
Heritage						
Archaeological impacts	**Very Low**	**VERY LOW**	**Very Low**	**VERY LOW**	N/A	N/A
Cultural heritage impacts	**Medium-High**	**MEDIUM**	**Low-Medium**	**LOW - MEDIUM**	N/A	N/A
Visual						
Change in landscape character	**Medium - High**	**MEDIUM**	**Low - Medium**	**LOW**	N/A	N/A
Visibility from sensitive receptors	**Medium**	**LOW**	**Low - Medium**	**LOW**	N/A	N/A

In the case of **improvements to the existing signalised intersections**, they would remain largely within the existing road reserve, thus there would be no impact of any significance on vegetation, groundwater, heritage or visual aspects. At the Techno Road Intersection the potential freshwater impact on a local tributary is assessed to be **INSIGNIFICANT**.

7.1.3.2 Local economic impacts

Impacts assessed by the economic specialist include negative localised impacts associated with land loss, impacts on commercial operations associated with access and visual changes and impacts on local property values, which are summarised below and presented in Tables 7.7 and 7.8.

Land loss associated with the *below-ground interchanges* would in both cases be higher than for the *grade-separated roundabouts* at Winery and Annandale Road Intersections. The economic specialist report indicated that despite the relatively slight differences between the two, the impacts associated with land loss would be of **LOW TO MEDIUM** significance with mitigation for both alternatives.

At the Jamestown Cemetery location, the impact on land loss for both the raised *U-turn bridge and at-grade U-turn teardrop facility* is assessed to be of **VERY LOW to LOW** significance with mitigation. There would be no impact on private landowners at Webersvallei Road Intersection.

Impacts on commercial operations associated with access changes are divided into impacts on commercial operations at the intersections and commercial operations along the R44 without direct access to the intersections since these operations would be affected differently by the proposed access changes and travel distances. Commercial operations at the intersections would experience a **LOW to MEDIUM** significance impact after mitigation due to the implementation of either the *grade-separated roundabouts* or *below-ground interchanges.* For operations along the R44 with no direct access to the intersections, it is anticipated that the *grade-separated roundabouts* and below-ground interchanges would have a **LOW** significance impact after mitigation.

Table 7.7: Summary of potential economic impacts associated with the proposed project: Comparison of grade-separated roundabout and below-ground interchange alternatives

ALTERNATIVE	GRADE-SEPARATED ROUNDABOUT		BELOW-GROUND INTERCHANGE	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Impacts associated with land loss	**Medium**	**LOW - MEDIUM**	**Medium**	**LOW - MEDIUM**
Impacts on commercial operations associated with access change				
Impacts on commercial operations at the intersections	**Low - medium**	**LOW - MEDIUM**	**Low - medium**	**LOW - MEDIUM**
Impacts on commercial operations along the R44 without direct access to the intersections	**Low**	**LOW**	**Low**	**LOW**
Impacts on commercial operations associated with visual changes	**Medium**	**MEDIUM**	**Low**	**VERY LOW - LOW**
Impacts on overall tourism potential	**Medium**	**LOW - MEDIUM**	**Low**	**VERY LOW**
Impacts on local property values				
Impacts on property values at the intersections	**Medium**	**LOW - MEDIUM**	**Low - medium**	**LOW**
Impacts on property values along the R44 without direct access to the intersections	**Low**	**LOW**	**Low**	**LOW**

Either *U-turn facility near Jamestown* would provide an additional more convenient U-turn option. Using the *Webersvallei Road Intersection* would result in somewhat longer trips for those between Annandale Road and Jamestown Cemetery.

Impacts on commercial operations associated with visual changes are anticipated to be the same for those operations at the intersections and those along the R44 without direct access to the intersections. *Grade-separated roundabouts* are anticipated to have a **MEDIUM** significance impact on these operations

after mitigation while the impact of the *below-ground interchanges* is anticipated to be of **VERY LOW to LOW** significance after mitigation.

As no businesses that rely on specific customer experience were identified at the proposed Steynsrust and Jamestown bridges no significant impacts in relation to these structures are anticipated.

Key aspects affecting impacts on overall tourism potential with the greatest relevance when considering potential to result in changed tourist behaviour with respect to the wider area include:

- Changes in the character of the areas near the intersections; and
- Impacts on the views of users of the R44 as a result of the proposed interchanges.

For the *grade-separated roundabouts alternative* it is anticipated that the overall impact on tourism potential would be **LOW to MEDIUM** with mitigation. This is due to the nature of the structures involved and also the visual sensitivity at these intersections which was rated as moderate in both cases due to lower lying topography and other factors. Given their low visual impacts, the *below-ground interchanges* would have limited impacts when viewed from a wider tourism impact perspective. The economic specialist study thus concluded that the impacts of these alternatives on tourism are likely to be **VERY LOW**.

For the *U-turn bridge near Jamestown Cemetery* the impacts on overall tourism potential is assessed to be of **LOW to MEDIUM** significance after mitigation. The *at-grade and Webersvallei Road options* are not expected to result in any impact on tourism.

Impacts on local property values have also been divided into those properties at the intersections and those properties along the R44. For the properties at the intersections it is anticipated that the *grade-separated roundabouts* would have a **LOW to MEDIUM** significance impact after mitigation while the *below-ground interchange*s would have a **LOW** significance impact with mitigation. For properties along the R44, both grade-separated alternatives would have a **LOW** significance impact after mitigation.

For the *U-turn bridge near Jamestown Cemetery* the impact on property values is assessed to be of **LOW TO MEDIUM** significance after mitigation. The *at-grade and Webersvallei Road options* are not expected to result in any impact on property values.

Table 7.8: Summary of potential economic impacts associated with the proposed project: Comparison of proposed U-turn facilities near Jamestown Cemetery and Webersvallei Road.

JAMESTOWN CEMETERY / WEBERSVALLEI ROAD INTERSECTION						
ALTERNATIVES	**GRADE-SEPARATED U-TURN BRIDGE**		**AT-GRADE TEARDROP FACILITY**		**SIGNALISED INTERSECTION**	
IMPACT	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Impacts associated with land loss	**Low**	**VERY LOW - LOW**	**Low**	**VERY LOW - LOW**	N/A	
Impacts on overall tourism potential	**Medium**	**LOW - MEDIUM**	N/A		N/A	
Impacts on local property values						
Impacts on property values at the intersections	**Medium**	**LOW - MEDIUM**	N/A		N/A	
Impacts on property values along the R44 especially between Annandale Road and the Jamestown Cemetery	**Low**	**VERY LOW - LOW**	N/A		N/A	

7.1.4 SHORT-TERM CONSTRUCTION-PHASE IMPACTS

Impacts anticipated to occur during the construction phase relate to short-term job creation and procurement which is considered to have an overall ***LOW (POSITIVE)*** impact with mitigation and construction disturbances such as dust, noise, visual and travel inconvenience or travel delays are considered to have an overall **VERY LOW** significance after mitigation (see Table 7.9).

Table 7.9: Summary of potential short term construction related impacts associated with the proposed project

IMPACT	WITHOUT MITIGATION	WITH MITIGATION
Jobs and procurement	***Very Low (positive)***	***LOW (POSITIVE)***
Dust, noise, visual, travel inconvenience / travel delays	**Low**	**VERY LOW**

7.2 CONCLUSIONS

Key conclusions of the assessment findings are provided below:

7.2.1 Perhaps the major dilemma/conflict that confronts this proposed project is what can be considered as the dual function of the R44. The DTPW (and most likely many users) see the R44 as a strategic mobility route that provides both a commuter link between Somerset West and Stellenbosch and a major regional provincial road link between the N1 and N2. Another group which consists of people that live along the R44 and various Stellenbosch interest groups see the R44 in the context as a local road with local functions servicing the agricultural and tourism sectors. Thus the needs of both user functions have to be considered in moving forward with the proposed safety and LOS improvements along the R44.

7.2.2 The R44 has formed an integral part of the provincial road network for many decades. Thus the function of the R44 as a strategic mobility route must be acknowledged within this context. The original R44, a single lane undivided rural road, was replaced with the road in its current form in the 1970s to provide a regional link between Somerset West and Stellenbosch and as part of the larger provincial route between Kleinmond and Malmesbury (via Wellington). Thus the status of the R44 as a strategic mobility route within the broader context of the provincial road network is a fact that preceded the initiation of this proposed project.

Many of the approximately 30 000 vehicles travelling daily along the R44 between Somerset West and Stellenbosch include daily commuters between the two towns for purposes of work or study, including staff and students from the University of Stellenbosch. They need to move from one point to another as efficiently as possible. With further economic development that is supported in all future planning documents for Somerset West and Stellenbosch, it is expected that traffic volumes on the R44 would increase (regardless of what level of growth is assumed). Even with a range of measures that could be put in place to initiate a reduction in traffic volumes on the R44, empirical evidence from South African cities and most big cities around the world would suggest that even if traffic growth is slowed by implementing such measures, actual traffic volumes are most likely to continue growing. This underlines the requirement to retain the mobility function of the R44.

7.2.3 The R44 fulfills a range of local functions such as providing access to farms, other businesses and tourism related activities. Agriculture is a key activity on either side of the R44 itself generating slower moving farm traffic along the route. Numerous farms have also converted to or added tourist-orientated businesses to their core agricultural activities, such as farm stalls,

restaurants and tourist accommodation. Cyclists and pedestrians also use sections of the route on a regular basis for commuting and sport.

The R44 is regarded as a historic cultural heritage route with significant gateway conditions into the rural farming areas of the mountain foothills and the Eerste River basin and into Stellenbosch itself. The heritage study regards the R44 as a Grade III Scenic Drive Heritage Resource in the light of its designation as a Scenic Route in the Provincial Spatial Development Framework and its inclusion as an Rural Scenic Drive in the Overlay Zone of the draft Revised Zoning Scheme of the Stellenbosch Municipality. The heritage study argues that the proposed solution is not appropriate from a cultural heritage perspective and should not be considered further.

7.2.4 The closure of the median openings would result in a significant improvement to safety for all road users (including the local community, commuters and tourists). However, such closure would result in dis-benefits to landowners / commercial operations located between the intersections in terms of additional travel distance and possible effect on businesses. The closure of the median openings would also have a negative impact on the cultural landscape. Seen from a longer-term perspective the proposed closure of the median openings would be less of a dis-benefit in relation to the implications of vastly deteriorating safety if the median openings were to remain open as traffic volumes increase.

7.2.5 The traffic analysis undertaken to evaluate *various at-grade U-turn solutions* showed that none of the solutions would be viable as they would reach operating capacity limits immediately or very shortly thereafter. Thus DTPW would not be able to justify providing a solution that would immediately be at capacity or could in fact reduce the existing LOS. In the context of the at-grade options, it should be pointed out that the cultural heritage study assessed the impact significance of at-grade roundabouts and a new signalised intersection as being of **HIGH** and **MEDIUM** significance, respectively.

7.2.6 The economic cost benefit analysis which considered a *grade-separated solution for the U-turn movement* has shown that both Alternative 2 (above-ground grade-separated roundabouts) and Alternative 4 (below-ground diamond interchanges) would be economically efficient. Assuming the use of the existing Webersvallei Road Intersection for U-turn movements at the northern end of the project, Alternative 2 is economically robust with an NPV of R 407 m and BCR of 2.17. Alternative 4 is less efficient with a NPV of R 326 m and BCR of 1.76. The difference in costs (NPV at 2013 prices) between the two alternatives is R 81 million (Alternative 2 having the higher NPV). Thus both alternatives are considered to be economically feasible with Alternative 2 being assessed as high positive significance and Alternative 4 as medium to high positive significance. However, the risk associated with Alternative 4 is the unknown below-ground conditions and extent of rock that may exist.

7.2.7 It should be noted that the operational efficiency of the below-ground diamond interchange would be lower than that of the above-ground grade-separated roundabout, meaning that the U-turn movements would take longer. A diamond interchange would also have more conflicting movements than a roundabout interchange (which has a left-turn only approach and departure and hence has fewer conflicting movements). Roundabout interchanges are thus more efficient in processing U-turn manoeuvres for which the project caters. However, both are considered to be technically suitable.

7.2.8 In addition to the economic analysis findings, consideration is also given to the impacts of the grade-separated roundabouts and below-ground interchanges on the *biophysical and socio-economic environments* at Winery and Annandale Road Intersections. The biophysical impacts

of both alternatives are assessed to be of insignificant to low significance for both intersections and are not considered to be factors that should affect decision-making of the proposed project.

The assessment of the *visual impact*, a key issue raised strongly by the local community, shows that the below-ground interchanges would substantially reduce the impact significance at these intersections compared to the above-ground grade-separated roundabouts. The below-ground interchange alternative would also address many of the concerns related to the impacts on tourism along the R44. The *local economic impacts* for the below-ground interchanges would be the same or lower in comparison to the grade-separated roundabouts. *Effects on landowners* would include land loss, impacts on commercial operations due to access and visual changes and property values. The impact on these operations is considered to be of low to medium significance. However, the size of these farming operations is such that the land loss associated with either alternative would not result in any substantial effect on the overall farming operations.

The *cultural heritage impact* is another key issue raised by I&APs which has been assessed to be of high significance for both the above- and below-ground alternatives at both locations. While it is recognised that a degree of visual continuity would be achieved with the below-ground option, this alternative is still considered to represent a fundamental intrusion onto the underlying historic pattern of both the R44 as a scenic route and the broader rural cultural landscape.

7.2.9 The HIA has assessed all alternatives that have been considered in this assessment including the closure of the median openings, as having a highly significant impact on the cultural heritage of the area through which the R44 passes. From a cultural heritage perspective the heritage specialist study concludes that the project in its current form and all alternatives that have been considered should not be developed.

This, however, has to be put in context – the R44 as a dual carriageway has existed since the 1970s. When the four-lane dual carriageway replaced the existing single lane road, this could be regarded as when the major change to the cultural landscape actually occurred. The safety and LOS improvements that are now being proposed would largely take place within the confines of the existing road reserve (except at the two interchanges) and should be considered in this context.

The proposed project scheme is based on the premise that the safety issue can only be addressed by closing the median openings as DTPW has proposed. Thus, although recognising the cultural heritage value of these openings, their closure is the key component of the project rationale. Should the medians openings not be closed, the safety concerns associated with vehicles using the openings would continue – with the safety risk expected to increase in the future in line with anticipated traffic growth.

7.2.10. With regards to which grade-separated alternative to implement at Winery and Annandale Road intersections, a decision would have to weigh up the substantially more economically and operationally efficient above-ground grade-separated roundabout with its associated visual, cultural heritage and tourism impacts versus a more costly, higher risk and less efficient below-ground interchange that would mostly address the strong visual concerns raised by the local community.

7.2.11 The economic analysis of the three solutions considered for the Jamestown Cemetery / Webersvallei U-turn movement, concluded that the Webersvallei Road Intersection would be the most efficient. The assessment of the biophysical and socio-economic impacts resulting from the three alternatives similarly shows that the Webersvallei Road Intersection would have

significantly lower impacts than the Jamestown Cemetery options, specifically much lower than the grade-separated U-turn bridge. Thus the Webersvallei Road Intersection is recommended for implementation.

7.2.12 The No-go option of leaving the R44 as it is currently is not considered as an option. The high accident rate and LOS issues need to be addressed as has been motivated by this project and requested by the community. In the No-go scenario the accident rate will further increase as the level of service further deteriorates. The interventions needed for these improvements would clearly result in changes to the local environment, businesses and travel patterns. However, the benefits to society as a whole are considered to outweigh the negative implications of the proposed project that would occur in the short term.

The positive implications of not going ahead with the project are that the status quo in terms of historic features at the Winery and Annandale Road intersections, local road use and access, would remain unchanged. No negative visual impact on the landscape or change to the quality of the R44 as a scenic route or to the surrounding cultural landscape would occur.

7.2.13 It should be noted that DTPW's preferred alternative is the proposed project scheme that includes the above-ground grade-separated roundabouts at Winery and Annandale Roads and accommodating U-turn movements at the Webersvallei Road Intersection.

7.3 RECOMMENDATIONS FOR MITIGATION

The recommended mitigation measures that should be undertaken, if a positive Environmental Authorisation is issued by DEA&DP, are summarised below:

Natural vegetation:

- Rehabilitate the road reserve and road islands using endemic shrub species (rather than replacing vegetation with hard-wood species);
- Replace vegetation removed from the hedge and tree line at the Winery Road and Annandale Road Intersections with similar sized indigenous vegetation / trees, to retain the screening function currently provided; and
- Where possible, relocate, transplant or replace the wild olive trees.

Freshwater:

- New structures should not constrict the flow in the watercourse channels but should aim to improve storm water management as far as possible;
- Control invasive alien vegetation within the road reserve;
- Rehabilitate disturbed areas within the freshwater features after construction;
- For the proposed U-turn facility near Jamestown Cemetery: The structure should avoid or minimise any impact on freshwater features and avoid affecting the flow of watercourse channels; and
- Overflow from the upstream dam flows along the Techno Road and into the stormwater drains which results in erosion of the road edges. It is recommended that this informal stream be accommodated within the upgrade activities.

Groundwater:

- Prior to construction, replace the boreholes that would be destroyed so as to provide a continuous supply of the same volume of water to the affected groundwater users;
- Monitor the high risk boreholes so that any impacts to borehole performance due to any blasting can be quantified; and

- Use a retaining wall rather than a fill slope to reduce the risk of loss of any boreholes where possible or feasible (potentially boreholes DW1 and MB1 at the Annandale Road Intersection).

Heritage:

- Ensure that the project footprint is kept to a minimum;
- Undertake archaeological test excavations to look for historical dumps and/or earlier foundations near the labourer's cottage at the Annandale Road Intersection;
- Undertake plaster sampling and a detailed recording of the above-ground characteristics and features of the labourer's cottage; and
- For the proposed U-turn bridge near Jamestown Cemetery:
  - Plant appropriate trees around the retaining walls to screen the structure;
  - Use columns were feasible to reduce the length of walling; and
  - Use surface textures and colours on the concrete that are sympathetic to the landscape.

Visual:

- For the proposed U-turn facility at Steynsrust Road:
  - Limit the extent of disturbance;
  - Appoint a Landscape Architect to develop the landscape philosophy, provide detail drawings and specifications for the tender documentation and to monitor implementation;
  - Consult with the City of Cape Town's Spatial Planning and Urban Design Department to obtain input into the proposed landscape plans prior to construction; and
  - Rehabilitate and revegetate disturbed areas with appropriate vegetation after construction;
- Use 'low spill' light which directs light downward;
- Cover associated infrastructure such as electrical kiosks with rural type coverings or where feasible, bury them;
- Reduce the extent of the cut/fill slopes by the use of retaining walls, especially in the north-western quadrant of the Annandale Road Intersection;
- Provide a planted berm adjacent to the new access road on the Klein Akkerdraai property to serve as a visual and noise screen;
- Plant vegetation on the fill slopes / embankments or in front of the vertical retaining walls to screen the interchange from sensitive receptors;
- Landscape cut embankments and disturbed areas in appropriate ways to blend with the rural nature of the surrounds;
- For the below-ground interchange alternative: Use exposed aggregate finish to provide a more natural aesthetic;
- Screen the lights at the intersections from the surrounding landscape through tree planting of a rural nature, where possible; and
- For the proposed U-turn bridge near Jamestown Cemetery:
  - Use exposed aggregate finish on ramp retaining walls to provide a more natural aesthetic;
  - Appoint an arborist to manage root and crown pruning of trees;
  - Replant trees and plant new trees to screen the elevated structure from the surrounding landscape.

Economic:

- Put measures in place to minimise traffic disruption during construction;
- Ensure that land loss is kept to minimum;
- Ensure market-related compensation for land and any improvements / structures that need to be removed and rebuilt by means of following the prescribed statutory process for acquisition of land;
- Include compensation for any movement or re-orientation of operations;
- Ensure construction activities take the needs of landowners into account;

- Establish a landowner liaison committee including all affected landowners and senior representatives of the applicant, engineers and contractor all with appropriate decision-making power. This committee should meet regularly to discuss and deal with any challenges that arise during construction;
- Ensure that a complaints register is available and that landowners are aware of it and can make inputs if needed;
- Ensure that adequate alternative temporary access is provided during construction and that the timing of construction takes into account the needs of landowners to the greatest degree possible (e.g. avoid busy times of year); and
- Provide clear and adequate signage to indicate changes in access.

Construction:

- Tender documents should include a detailed Construction EMP which covers all relevant biophysical concerns and recommended mitigation measures to ensure that sufficient project budget is allocated for its implementation; and
- Appropriate targets for local labour, including training, and local affirmative business enterprises should be included in the tender documentation in line with standard public sector procurement policy.

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