5. Environmental Assessment

5.1 Introduction and Method of Assessment

5.1.1 This section of the report constitutes a Stage 2 Environmental Assessment in accordance with the Design Manual for Roads and Bridges (DMRB), Volume 11: Environmental Assessment. The report has assessed the proposed route options for the A77 Maybole bypass that were developed from the Bypass Route Options Assessment Report (referenced 5028091/05/02/001). The function of the environmental information in the Stage 2 Report is to "*identify the factors and effects to be taken into account in choosing the route options and to identify the environmental advantages, disadvantages and constraints associated with those routes*"[5].

5.1.2 Volume 11 of the DMRB provides comprehensive guidance on environmental assessment techniques for each of the topic areas under consideration and is specifically written for the assessment of road schemes. The guidance has three stages of assessment, which in turn, consist of greater levels of assessment detail, and allow the assessment and selection of a preferred option taking full account of all relevant environmental issues.

Report Structure

5.1.3 The report is structured around the environmental topic areas described in DMRB Volume 11:

- **Air Quality** (Section 5.2) assesses the impact of the route options on local and regional air quality;
- **Cultural Heritage** (Section 5.3) assesses the impact of the route options on cultural heritage and archaeology within the study area;
- **Disruption due to Construction** (Section 5.4) assesses the impact of the construction of the route options on people and the natural environment within the study area;
- **Ecology and Nature Conservation** (Section 5.5) assesses the impact of the route options on flora, fauna and biodiversity within the study area;
- **Landscape Effects** (Section 5.6) assesses the impact of the route options on the surrounding landscape and visual environment;
- **Land Use** (Section 5.7) assesses the impact of the route options on agricultural land, development land and land used by the local community;
- **Traffic Noise and Vibration** (Section 5.8) assesses the impact of the route options on the surrounding noise environment;
- **Pedestrians, Cyclists and Community Effects** (Section 5.9) assesses the impact of the route options on journeys made by pedestrians, cyclists and equestrians within the study area;
- **Vehicle Travellers** (Section 5.10) assesses the impact of the route options on drivers considering driver view from the road and driver stress;
- **Road Drainage and the Water Environment** (Section 5.11) assesses the impact of the route options on the local freshwater environment considering the implications of the existing drainage design;

[5] DMRB 11:4:1, p2/1

- **Geology and Soils** (Section 5.12) assesses the impact of the route options on soils and underlying rock within the study area; and,
- **Policies and Plans** (Section 5.13) assesses the impact of the route options in terms of the wider context of national, regional, strategic and detailed planning policies.

5.1.4 For each topic area the following is included:

- The **Introduction** section sets the context for the assessment;
- The **Key Issues** section outlines those factors that are considered pertinent to the environmental topic area;
- The **Methodology** section describes the methods used to assess the impact of the proposed route options;
- The **Baseline Conditions** section describes the existing environmental conditions;
- The **Consultation** section describes any consultation undertaken in order to obtain any information held by statutory and non statutory consultees in relation to the proposed route options;
- The **Impacts (Opening Year 1) without Mitigation** section describes the major impacts of the proposed route options;
- The **Mitigation** section identifies areas which would potentially require mitigation measures. This section provides general mitigation measures and where appropriate, specific route mitigation; and,
- The **Impacts (Design Year 15)** section describes the major impacts of the proposed route options once mitigation measures are in place;
- The **Conclusions** section summarises the findings of the environmental topic area and outlines the route option preferences of the topic area.

5.1.5 An Environmental Impacts table (Section 5.14, **Table 5.14.78**), a requirement of DMRB Stage 2, has been populated for this report. This table outlines route option impacts across environmental topic areas and compares them with the do-minimum scenario.

5.1.6 A Route Preferences table (Section 5.15, **Table 5.15.79**) has also been populated. Each route option has been assigned a value on a ranking between 1 and 12 with 1 being most preferred and 12 being least preferred. This allows comparison of route preferences across environmental disciplines at this stage of assessment and the environmental route preferences to be clearly identified.

5.1.7 For the purposes of this report, the route options have been split into three base corridors; Blue, Yellow and Red. Within each base corridor there are four alignment configurations; single carriageway (S2) and wide single carriageway with overtaking (WS2+1), each either with or without a roundabout at the B7023. The base corridor has been assessed initially, with only any additional impacts resulting from the difference in configuration, outlined in subsequent sections. This format has been adopted to avoid repetition of the impacts given the similarity between options. In addition, the Blue and Yellow routes have been assessed prior to the Red route (this differs from other sections of this report) as the impacts associated with Red route are considered, in general, to be a combination of the impacts from the Blue and Yellow routes.

5.1.8 Details on tie-in junctions at each extent of the proposed bypass have been provided for this assessment. Where appropriate, and where impacts differ between the routes, the impacts have been reported in a separate section within the Impacts section.

5.1.9 All drawings are located in Appendix A. Route Options have been described in detail in Section 3.1 – Description of Route Options.

5.2 Air Quality

Introduction

5.2.1 This chapter describes the air quality assessment undertaken for the proposed A77 Maybole bypass, South Ayrshire, Scotland.

5.2.2 The assessment was carried out in general accordance with the DMRB 11:3:1[6], Scottish Transport Appraisal Guidance (STAG)[7], and Transport Analysis Guidance (TAG)[8].

5.2.3 The assessment focuses on the impacts on the local air pollutants (nitrogen dioxide, particulate matter (PM_{10}), carbon monoxide and hydrocarbons) as the air quality strategy pollutants most likely to be exceeded in the UK. In addition, changes in emissions of carbon dioxide – an important greenhouse gas and the key indicator for the impacts of transport schemes on climate change – have been examined.

5.2.4 There are currently three proposed options for different route alignments of the bypass. Each of the alignments is subject to four online variations with an optional roundabout included for variations 2 and 4 and additional lanes for variations 3 and 4. There are a total of twelve options under consideration at this stage (see Table 5.2.1 for a tabular summary of proposed options).

5.2.5 The route options have been proposed to alleviate the problems associated with large numbers of cars and heavy goods vehicles (HGVs) on the A77 trunk road passing through the main retail area in the centre of Maybole. All options have been assessed to determine the likely impact on air quality at nearby properties.

5.2.6 The assessment has been carried out in six parts:

- Measured air pollutant concentrations have been discussed in relation to the air quality criteria;
- A constraints map has been produced to show areas which may be affected by changes in air quality;
- Pollutant concentrations have been calculated for selected properties which would be affected by the proposals;
- An assessment has been made to estimate the overall change in exposure to concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10}), with the scheme in place;
- An assessment of the changes in emissions of the greenhouse gas carbon dioxide with the scheme has been carried out; and
- The effects of construction on air quality and potential mitigation methods have been discussed.

[6] Highways Agency, 2003, DMRB 11:3:1
[7] Scottish Transport Appraisal Guidelines, Chapter 6 Environment, v1.0 September 2003
[8] Transport Appraisal Guidelines, www.webtag.org.uk, units 3.3.3 and 3.3.4

Table 5.2.1 – Summary of Proposed Route Options

Option	Code	Roundabout	Additional Lanes
2004 base year	2004 Base	n/a	n/a
2012 Do minimum scenario	2012 DM	n/a	n/a
2012 Blue Route 1 Option 1	B_1	×	×
2012 Blue Route 1 Option 2	B_2	✓	×
2012 Blue Route 1 Option 3	B_3	×	✓
2012 Blue Route 1 Option 4	B_4	✓	✓
2012 Red Route 2 Option 1	R_1	×	×
2012 Red Route 2 Option 2	R_2	✓	×
2012 Red Route 2 Option 3	R_3	×	✓
2012 Red Route 2 Option 4	R_4	✓	✓
2012 Yellow Route 3 Option 1	Y_1	×	×
2012 Yellow Route 3 Option 2	Y_2	✓	×
2012 Yellow Route 3 Option 3	Y_3	×	✓
2012 Yellow Route 3 Option 4	Y_4	✓	✓

Air Quality Criteria and Pollutants

5.2.7 Air quality criteria can be readily divided into two groups; those that are mandatory and those that are designed for guidance. Mandatory criteria that apply to the UK are the objectives from the Air Quality Strategy for the UK and the European Community Directive limit values, which are incorporated into regulations as discussed in the following paragraphs.

Air Quality Objectives

5.2.8 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) provides details of national air quality standards and objectives for eight pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, ozone, nitrogen dioxide, particulate matter and sulphur dioxide). These criteria are defined in Regulations SSI 2000/97 and SSI 2002/297. The standards define the level of pollution below which health effects are unlikely to be experienced even by the most sensitive members of the population. These are based upon recommendations of the Expert Panel on Air Quality Standards (EPAQS). The objectives are targets for air pollution levels, which take account of the costs and benefits of achieving the standard. Local authorities have a responsibility, under the Environment Act 1995, to review and assess local pollution levels against these objectives.

5.2.9 The AQS was first published in 1997 and subsequently revised in January 2000 to take account of movement in legislation and further evidence on health effects outcomes and cost-benefit analysis.

5.2.10 An addendum to the AQS was published by the UK Government and devolved administrations in February 2003 which gives an additional, more stringent, objective for benzene and a tighter objective for carbon monoxide and PM_{10} that are included in new regulations.

Limit Values

5.2.11 The first European Community (EC) air pollution limit values were introduced in the 1980s. These contained limit values that must be attained and more stringent, but non-obligatory, guide values. The EC Directives were incorporated into the UK legislation through SI 1989/317, amended by SI1995/3146. In 1996, the European Union adopted a Directive on ambient air quality assessment and management and later supporting pollutant specific Daughter Directives were, and are, being prepared.

5.2.12 The first Daughter Directive set legally binding limit values for concentrations of sulphur dioxide, nitrogen dioxide, particles and lead in air, which must be complied with by 1st January 2005 or, in the case of nitrogen dioxide, 2010. The Daughter Directive limit values will supersede previous EC Directives on their achievement date (i.e. 1st January 2005 or 1st January 2010).

5.2.13 A second Daughter Directive sets limit values for concentrations of benzene and carbon monoxide to be complied with by 2010 and 2005. A third Daughter Directive for ozone and a fourth Daughter Directive for polycyclic aromatic hydrocarbons and several metals has been agreed with EU institutions.

5.2.14 The Air Quality Framework Directive and the Air Quality Daughter Directives are implemented in Scotland by the Air Quality Limit Values Regulations 2001, 2002, 2003 and 2005 (SSI 2001/224, SSI 2002/556, SSI 2003/428, SSI 2003/547 and SSI 2005/300). The air quality criteria for vehicle derived pollutants are detailed in Appendix C.

Assessment of Effects Significance

5.2.15 The modelled pollutant concentrations will be compared to the national air quality objectives set out in the Government's Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) shown in Appendix A. The Local Air Quality Criteria most at risk of being exceeded near to major roads are the Air Quality Strategy Objectives and EU Limit Values for annual mean NO_2 and PM_{10} and the 24 hour mean for PM_{10}. The magnitude of the change in air pollutant concentration estimated for the With scheme scenario, when compared with the Do Minimum scenario, will be described using the terminology detailed in **Table 5.2.2** below. The criteria for significance in changes of long-term traffic-derived pollutant concentrations is based on the Development Control: Planning for Air Quality Guidance 9, updated by NSCA in 2006.

[9] NSCA, 2006, Development Control: Planning for Air Quality Guidance.

Table 5.2.1a – Criteria for Impact Assessment Based on NSCA Guidance for Planning

Descriptors for changes in ambient concentrations of nitrogen dioxide and PM_{10}

Magnitude of Change	**Annual Mean NO_2 / PM_{10}**	**Days PM_{10} >50 mg/m^3**
Very large	increase/decrease >25%	increase/decrease >25 days
Large	increase/decrease 15-25%	increase/decrease 15-25days
Medium	increase/decrease 10-15%	increase/decrease 10-15 days
Small	increase/decrease 5-10%	increase/decrease 5-10 days
Very small	increase/decrease 1-5%	increase/decrease 1-5 days
Extremely small	increase/decrease <1%	increase/decrease <1day

Descriptors for Impact Significance for Nitrogen Dioxide and PM_{10}

Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Standard	Extremely small	Very small	Small	Medium	Large	Very large
Decrease with scheme						
Above standard with scheme	slight beneficial	slight beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Above standard without scheme, below with scheme	slight beneficial	moderate beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Below standard without scheme, but not well below	negligible	slight beneficial	slight beneficial	moderate beneficial	moderate beneficial	substantial beneficial
Well below standard without scheme	negligible	negligible	slight beneficial	slight beneficial	slight beneficial	moderate beneficial
Increase with scheme						
Above standard without scheme	slight adverse	slight adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below standard without scheme, above with scheme	slight adverse	moderate adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below standard with scheme, but not well below	negligible	slight adverse	slight adverse	moderate adverse	moderate adverse	substantial adverse
Well below standard with scheme	negligible	negligible	slight adverse	slight adverse	slight adverse	moderate adverse

Well below the standard = 50% of the standard level

5.2.16 The STAG assessment methodology identifies a significant change in pollutants, as a result of a proposed road scheme, to be:-

- The proposal leads to an increase in annual mean PM_{10} levels at 20 m from the road centre of at least 1 $\mu g/m^3$;
- The proposal leads to an increase in annual mean NO_2 levels at 20 m from the road centre of at least 2 $\mu g/m^3$ and where concentrations are above the AQS NO_2 objective of 40 $\mu g/m^3$.

Air Pollutants

5.2.17 Details of traffic related pollutants are given below:

Nitrogen Dioxide (NO2)

5.2.18 Nitrogen dioxide is a secondary pollutant produced by the oxidation of nitric oxide (NO). Nitric oxide and nitrogen dioxide are collectively termed nitrogen oxides (NOx). Approximately half of the UK NOx emissions are from road transport. The majority of NOx emitted from vehicles is in the form nitric oxide, which oxidises rapidly in the presence of ozone to form nitrogen dioxide. In high concentrations, nitrogen dioxide can affect the respiratory system.

Particulate Matter

5.2.19 Particulate matter in vehicle exhaust gases consists of carbon nuclei onto which a wide range of compounds are absorbed. These particles are less than 10 micrometers (μm) in diameter. Particles with a median diameter of less than 10 μm are referred to as PM_{10}. Diesel engines produce the majority of particulate emissions from the vehicle fleet. About a quarter of primary PM_{10} emissions in the UK are derived from road transport. Particulate matter appears to be associated with a range of symptoms of ill health including effects on the respiratory and cardiovascular systems, on asthma and on mortality. It is currently not possible to determine if there is a threshold particle concentration below which there are no adverse effects on the population.

Carbon Monoxide (CO)

5.2.20 The majority of carbon monoxide emitted in the UK is from motor vehicles. It is readily absorbed through the lungs and reduces the oxygen carrying capability of the blood.

Hydrocarbons

5.2.21 The term 'hydrocarbons' is used to include all organic compounds emitted from vehicles both in the exhaust and by evaporation from the fuel system, and covers many hundreds of different compounds. About one third of the UK hydrocarbon emissions are produced by road transport. Hydrocarbons are important precursors of photochemical smog and oxidising compounds. The DMRB 11:3:1 requires an assessment for benzene and 1,3-butadiene as these are included in the Air Quality Strategy. They are both genotoxic carcinogens and exposure to them is associated with certain types of leukaemia.

Carbon Dioxide (CO_2)

5.2.22 Carbon dioxide is a major product of the combustion of carbon-containing materials. Carbon dioxide does not affect human health at ambient levels and so is not significant as a local pollutant, but is important for its national and international role in climate change. About 20% of UK carbon dioxide emissions are produced by road transport.

Key Issues

5.2.23 A total of 1437 properties were identified within 200 metres of the affected road network for all scheme options. These properties may experience a change in air quality due to traffic being diverted away from the existing network onto the proposed bypass. Three schools, St Cuthbert's and Cairn Primary Schools and Carrick Academy, Maybole Health Centre and Day Hospital and Fairknowe House Nursing Home were also identified as sensitive properties (namely schools, hospitals or homes for the elderly) within 200 metres of the affected road network.

- There are 1389 properties within 200 metres of the Blue(1) options affected road network, six of which are within 200 metres of the proposed new road;
- There are 1413 properties within 200 metres of the Red(2) options affected road network, 30 of which are within 200 metres of the proposed new road;
- There are 1431 properties within 200 metres of the Yellow(3) options affected road network, 48 of which are within 200 metres of the proposed new road.

5.2.24 A total of 1437 properties were identified within 200 metres of the affected road network for all scheme options. There are 1383 properties within 200 metres of the existing road network with a further 6, 30 and 48 properties within 200 metres of bypass options Blue (1), Red (2) and Yellow (3), respectively. A number of the properties counted against the bypass routes are within 200m of more than one route, so these additional properties account for a further 54 individual properties in addition to those 1383 properties which are within 200m of existing affected road network. These properties may experience a change in air quality due to traffic being diverted away from the existing network onto the proposed bypass. Three schools, St Cuthbert's and Cairn Primary Schools and Carrick Academy, Maybole Health Centre and Day Hospital and Fairknowe House Nursing Home were also identified as sensitive properties (namely schools, hospitals or homes for the elderly) within 200 metres of the affected road network.

Methodology

5.2.25 The proposed options for improvements to the A77 at Maybole have been assessed by producing:

- A constraints map showing areas within 200 metres of roads affected by the proposed scheme, which may experience changes in air quality (See Appendix A – Air Quality Constraints Map);
- A Local Impact Assessment comprising estimated pollutant concentrations at selected properties in relation to the relevant air quality criteria and assessment of significant effects;
- An assessment of the overall change in exposure to concentrations of NO_2 and PM_{10} following guidance in the Transport Scotland (Scottish Transport Appraisal Guidance (STAG) and the Department for Transport (DfT) Transport Analysis Guidance (TAG); and
- Calculation of emissions of the greenhouse gas, carbon dioxide, from the local road network with and without the scheme using the Regional Impact Assessment application of the DMRB 11:3:1.

Constraints Map

5.2.26 A constraints map (Figure 5028091_AIR_001 in Appendix A) was drawn to show areas within 200 metres of the roads affected by the proposed schemes that are likely to have a change in air quality. This enables identification of properties likely to be subjected to a change in air quality and the identification of properties likely to experience higher than usual pollutant concentrations at locations such as road junctions. Sensitive properties are defined as those where there may be vulnerable occupants, such as schools, hospitals or homes for the elderly. A total of 1437 properties were identified within 200 metres of the affected road network. Three schools, a day hospital and a nursing home were identified as sensitive properties within 200 metres of the existing road network. There are three sites for proposed new housing identified within 200 metres of some of the possible route alignments. These properties have not been included in the counts as insufficient detail was available at the time of assessment. The site closest to the proposed route alignments has been selected as a receptor for the local air quality assessment.

Local Air Quality Impact Assessment

5.2.27 The DMRB 11:3:1 screening method was used to estimate concentrations of carbon monoxide, nitrogen dioxide, benzene, 1,3-butadiene and fine particulate matter (PM_{10}) to compare with AQS objectives. The screening method takes into account:

- Annual average daily vehicle flows and speeds;
- The proportion of heavy duty vehicles (HDVs)[10];
- Changes in future exhaust emissions due to legislation; and
- Background concentrations.

5.2.28 Models were produced for all the scheme sub-options and for the do-minimum situation. The years selected for assessment were the base year for the traffic model (2004) and the proposed opening year for the bypass scheme (2012).

Traffic Data

5.2.29 Annual average daily traffic flows, the proportion of HDVs and average vehicle speeds were provided for the base year (2004) and with and without the proposed scheme in the opening year (2012) by Atkins Highways and Transportation. Traffic data used in the air quality assessment is presented in Appendix C.

5.2.30 The four sub options (1-4) result in similar changes to the general traffic flows. The inclusion of a roundabout (B_2, R_2, Y_2, B_4, R_4 & Y_4) with the B7023, north of Maybole, results in higher flows on the bypass and therefore less traffic on the A77 resulting in slightly increased annual average speeds. The sub-options which include an additional lane for the majority of the length of the scheme, (B_3, R_3, Y_3, B_4, R_4 & Y_4) do not show much change in traffic or speeds on the A77.

5.2.31 The proposed layouts confirm that the four sub-options for each of the three major route alignments result in the same road centre line along the sections of the proposed bypass in the vicinity of the receptors. Therefore, this assessment assumes that the road centre line is the same for existing and do-minimum scenarios and that there is no change in distance between receptor and road for each sub option with each of the three major route alignments.

[10] Any vehicle with a gross weight greater than 3.5 tonnes, including heavy goods vehicles (HGVs) and coaches.

Background Concentrations

5.2.32 When estimating pollutant concentrations, it is necessary to specify background concentrations on which local, traffic-derived emissions are superimposed. In the absence of long term ambient measurements of all the pollutants of interest at a suitable background site in the vicinity of the proposed scheme, background concentrations were obtained from the National Air Quality Information Archive[17] for one-kilometre grid squares covering the proposed scheme area. Concentrations were obtained from the appropriate estimated background concentration maps and were subsequently adjusted to 2012 levels in accordance with Defra's Technical Guidance18, to take account of changes in UK emissions. An average concentration was taken of grid squares covering Maybole. Background concentrations used in the assessment are presented in Table 5.2.3.

Table 5.2.3 – Annual Mean Background Concentrations

Pollutant	Estimated Background Concentration from Map	Background Concentration in 2004	Background Concentration in 2012
CO (mg/m^3)[11]	0.15 (2001)	0.11	0.07
Benzene ($\mu g/m^3$)	0.12 (2001)	0.10	0.09
1,3-Butadiene ($\mu g/m^3$)	0.04 (2001)	0.04	0.02
NO_x ($\mu g/m^3$)	5.42 (2010)	7.79	5.12
NO_2 ($\mu g/m^3$)	4.25 (2010)	6.38	4.11
PM_{10} ($\mu g/m^3$)	11.40 (2010)	12.10	11.13

Receptor Selection

5.2.33 1437 properties including three schools, one day hospital/health centre and one nursing home were identified within 200 metres of the affected routes. Twelve receptors were selected for the assessment, including one location on a site planned for new housing (R11). The location of these receptors is shown in Appendix A. The receptor numbers and names are given in Table 5.2.4.

Table 5.2.4 – Receptors Used in the Assessment

Receptor ID	Description
R1	Carrick Academy, Kirkoswald Road (A77)
R2	42 Whitehall, Maybole (A77)
R3	57 Culzean Road, Maybole (B7023)
R4	19 Cassillis Terrace (A77)
R5	2 High Smithston Cottages (A77)

[11] Defra 2003, Local Air Quality Management Technical Guidance: LAQM TG(03) states that it can be assumed that if the annual mean is less than 2 mg/m^3 the AQS objective for carbon monoxide is unlikely to be exceeded.

Receptor ID	Description
R6	52 McAdam Way, (W of Maybole)
R7	21 Enoch Road (N of Maybole)
R8	East Enoch Farm (Farm near Blue and Red routes)
R9	Kirklandhill Farm, (Farm between Blue and Red/Yellow Routes)
R10	Casillis View, (Isolated house on B7024 near Blue Route)
R11	New Housing site (W of Maybole on B7023)
R12	Housing at Broomknowes (W of Maybole close to A77 new links)

5.2.34 The proposed layouts confirm that the four sub-options for each of the three major route alignments results in the same road centre line along the sections of the proposed bypass in the vicinity of the receptors. Therefore, this assessment assumes that although the road centre line is different for each of the three bypass alignments, there is no change in the distance between receptor and road for each sub option. The distances between the road centre line and the nearest facade for each receptor are given in Table 5.2.5 below.

Table 5.2.5 – Distance between Road Centre Line and Receptors used in the Assessment*

Receptor ID	Distance to nearest existing road, m	Distance to nearest road with Blue Option(B), m	Distance to nearest road with Red Option (R), m	Distance to nearest road with Yellow Option (Y), m
R1	35(19)	35(19)	35(19)	35(19)
R2	6(18)	6(18)	6(18)	6(18)
R3	8(4)	8(4)	8(4)	8(4)
R4	10(16)	10(16)	10(16)	10(16)
R5	15(13)	15(13)	15(13)	15(13)
R6	>200(3)	>200(3)	>200(3)	185(57)
R7	>200(3)	>200(60)	174(52)	145(58)
R8	>200(3)	144(60)	126(52)	>200(3)
R9	>200(24)	>200(60)	113(52)	125(58)
R10	25(24)	25(24)	25(24)	25(24)
R11	15(3)	15(3)	15(3)	15(3)
R12	50 (19)	50 (19)	50 (19)	50 (19)

* Numbers in parentheses indicate the road references used in the assessment. Road references are listed in **Table 3**.

Assessment of Designated Sites

5.2.35 The locations of nature conservation sites designated as Special Areas of Conservation-SAC, (including Sites of Community Importance- SCI or candidate SAC- cSAC), Special Protection Areas-SPA, potential SPA- pSPA, Sites of Special Scientific Interest- SSSIs and Ramsar sites designated under the International Convention on Wetlands of International Importance especially as Waterfowl Habitat, were determined in the region around the study area. The nearest designated site to the study area was a SSSI called Maidens Doonfoot along the west coast, 5km away from the nearest affected route. As the local impact of a road scheme is generally limited to the area within 200m of the affected road centre line, the designated site was not further assessed as it would not be affected by the proposed road scheme.

STAG Assessment

5.2.36 This assessment gives a quantitative indication of whether the scheme would lead to an overall improvement or deterioration in air quality at properties and is based on the STAG and TAG Guidance.

5.2.37 The method involves estimating concentrations of NO_2 and PM_{10} using the DMRB 11:3:1 screening method described above. The calculations were carried out with and without the proposed scheme for the opening year (2012) for each of the scheme options. Pollutant concentrations decrease with increasing distance from the roads carrying traffic; and concentrations are calculated at 20, 70, 115 and 175 metres from the road centre, with and without the proposed scheme, for each route option.

5.2.38 The number of properties in four 50 metre bands from the centre of each road link was counted to a distance of 200 metres for the do-minimum and with-scheme scenarios. Property counts were undertaken using GIS software to calculate the distance between properties and the nearest road link. Where properties were within 200 metres of more than one road link the property was counted against all links and reported in the STAG assessment tables as “property count with double counting”. Each property was then assigned to the closest road link and thus counted only once and reported in the STAG assessment tables as “property count without double counting”.

5.2.39 To obtain the STAG assessment scores the number of properties in each band with double counting was multiplied by the concentration calculated for that band for the do minimum and scheme scenarios. This was carried out for each of the four bands and the results added together to give a total for each scenario. The do-minimum value was deducted from the scheme value to give a score for each affected link. The overall assessment score was calculated by summing scores over all links, with an improvement (decrease in concentrations) having a negative value and deterioration (increase in concentrations) having a positive value. In addition, the number of properties without double counting was combined with the change in concentration within each band and the total number of properties experiencing an improvement, no change or deterioration in air quality was calculated.

Greenhouse Gases

5.2.40 Total emissions of carbon dioxide were calculated for the affected road network using average traffic flow, average vehicle speed, proportion of HDVs and emission rates given in the DMRB 11:3:1. Emissions were calculated for the existing case (2004) and with and without the schemes in the opening year (2012).

Baseline Conditions

5.2.41 All local authorities are required by the Environment Act 1995 Part IV to carry out a review and assessment of air quality. This involves examining current pollutant concentrations, estimating future concentrations and comparing the future concentrations with the objectives in the AQS.

5.2.42 Where the objectives are not likely to be achieved in all relevant locations, the authority must designate these areas as Air Quality Management Areas (AQMAs) by order and develop an action plan to improve air quality. Relevant locations include areas outside buildings or man-made structures above or below ground level and where members of the public are regularly present and are likely to be exposed over the averaging time of the objective.

5.2.43 Air quality review and assessment is an iterative process, which requires periodic updating due to the changing nature of air quality with time. Local authorities should have completed the two rounds of the review and assessment process to determine the need for designation of any AQMAs in their area. The first round consisted of 4 stages. Stages 1 and 2 identified whether there is a possibility that any of the AQS objectives will be exceeded. Stage 3 involves the detailed assessment of current and future air quality and the formal proposals for AQMAs where AQS objectives are likely to be exceeded. Stage 4 is completed where AQMAs have been designated.

5.2.44 The second and subsequent rounds of the review and assessment process require an updating and screening assessment (USA) to be completed. The USA identifies matters that have changed since the previous round of review and assessment and identifies sources that may lead to an air quality objective being exceeded. A detailed assessment is required where there is a possibility of AQS objectives being exceeded.

5.2.45 No AQMAs were designated in South Ayrshire following the first and second rounds of the review and assessment process. The latest, third round USA was produced in 200612 and this report concluded that no exceedences of the AQS objectives for benzene, 1,3-butadiene, CO, lead, NO2 or SO2 are expected. PM10 concentrations are unlikely to exceed the 2004 AQS objectives. However, there may be exceedences of the annual mean objective set by the Scottish Executive for 2010 at Maybole and Coylton for road traffic and in the vicinity of Craigie, Tormitchell and Hillhouse quarries. It is anticipated that these potential exceedences will be reviewed at the next USA in 2009.

Monitoring

Continuous Monitoring

5.2.46 Defra operates a network of automated continuous monitoring sites throughout the UK. This data is available from the Air Quality Archive. These sites provide high resolution data which is fully ratified. However, sites may not be located in proximity to the area of interest. The closest sites in the network are located in Glasgow and Dumfries.

5.2.47 A description of these sites is given below:

- Dumfries – A roadside site, located approximately 81 kilometres south east of Maybole. The station is located approximately five metres from the kerb of Buccleuch Street, a busy ring road round the town centre 50 metres west of traffic lights. CO and NO_2 have been monitored since 2001. OS Grid Reference: NX970763.

[12] 2006 LAQM Updating and Screening Assessment, South Ayrshire Council, June 2006

- Glasgow Centre – An urban centre site, located approximately 70 kilometres north east of Maybole. The site is located in a pedestrianised area in the city centre. The nearest road is situated 10 metres from the site with a busy commercial thoroughfare with flows of approximately 20,000 vehicles per day approximately 20 metres distance from the monitoring station. O_3, CO, SO_2, PM_{10} and NO_x have been monitored since 1996. OS grid reference NS589651.
- Glasgow City Chambers – An urban background site located approximately 70 kilometres north east of Maybole. The site is located at the junction of Montrose Street and Cochrane Street. Both streets are subject to frequent congestion. CO and NO_x have been monitored since 1987. OS grid reference NS595653.
- Glasgow Kerbside – A roadside site, located approximately 70 kilometres north east of Maybole. The nearest road is approximately one metre from the station, with traffic flows greater than 25,000 vehicles per day, and is subject to frequent congestion during peak traffic flow periods. CO, PM_{10} and NO_x have been monitored since 1997. OS grid reference NS581652.

5.2.48 Additional continuous monitoring of PM_{10} using a Tapered Element Oscillating Multibalance (TEOM) analyser is currently being undertaken by South Ayrshire Council at two locations. The Tarbolton Primary School TEOM is located in Dailly Village which has a high density of coal burning appliances. The other TEOM is located at Prestwick Academy, which is in close proximity to Prestwick International Airport. An OSIRIS optical particle analyser is located in Sandgate Ayr, to monitor the impact of the high traffic flows and street canyon effects likely to be present at this location. A second OSIRIS analyser is to be located within Maybole High Street in the near future.

Non-Continuous Monitoring

5.2.49 Nitrogen dioxide can also be monitored passively using diffusion tubes. This monitoring method provides pollutant concentrations over longer averaging periods, but due to the low cost, monitoring can be conducted at a large number of locations.

5.2.50 Four sites in the national diffusion tube network are located within South Ayrshire. However, these are located approximately 12 kilometres north of Maybole in Ayr. South Ayrshire Council has conducted a diffusion tube survey at up to 34 sites. One site is located in Maybole, which is selected for inclusion in this report. Local Air Quality Management Technical Guidance[13] recommends that diffusion tubes should be co-located with a continuous monitor to validate the performance of the diffusion tubes and analysis technique. South Ayrshire Council has applied correction factors to the diffusion tube results presented since 2002. In addition, passive sampling of benzene is undertaken at three sites in Maybole.

5.2.51 Measured pollutant concentrations of vehicle derived pollutants indicate that background concentrations at Maybole are well below the relevant current AQS objectives.

5.2.52 All monitoring data is presented in Appendix C.

[13] Defra 2003, LAQM TG(03).

Property Counts

5.2.53 A total of 1383 properties were identified within 200 metres of those existing roads that may be affected by the proposed scheme. An additional 54 houses are within 200 metres of the three different bypass route alignments. Three schools, one day hospital/health centre and one nursing home have been identified within 200 metres of the scheme roads, (occupants of these property types are considered most vulnerable to increased pollutant concentrations). Property counts are presented in **Table 5.2.6** below.

Table 5.2.6 – Properties within 200 metres of Scheme Roads

Road Name	Road Ref	Distance from Road (m)			
		50	100	150	200
B7023 East of Bypass	3	36	53	74	43
B7023 Cargill Rd - Queens Terrace	4	19	19	30	19
B7023 Culzean Rd Town Centre	8	37	38	18	8
B7023 Town Centre - A77	9	3	1	0	1
Kirkmichael Rd	10	23	8	1	0
A77 Lovers Lane - B742	12	0	1	0	0
A77 B742 - Bypass	13	4	1	0	0
A77 St Cuthberts St - Kirkland St	15	64	59	25	35
A77 Kirkland St - Kirkmichael Rd	16	38	16	5	5
A77 Kirkmichael Rd - Lovers Lane	17	14	0	0	1
A77 High St Town Centre	18	165	148	78	47
A77 West of Ladyland Rd	19	77	61	49	19
B7024 - Barns Terrace	25	10	3	4	7
B7024 - Barns Road	26	9	3	0	4
Totals for existing affected network	**1383**	**499**	**411**	**284**	**189**
Bypass A77 SW of Maybole - B7023-Blue	59	0	0	0	0
Bypass B7023 - A77 NE of Maybole-Blue	60	0	1	2	3
Totals for DS scenario with Blue Bypass	**1389**	**499**	**412**	**286**	**191**
Bypass A77 SW of Maybole - B7023-Red	51	0	0	0	0
Bypass B7023 - A77 NE of Maybole-Red	52	0	0	2	28
Totals for DS scenario with Red Bypass	**1413**	**499**	**411**	**286**	**217**
Bypass A77 SW of Maybole - B7023-Yellow	57	0	0	0	4
Bypass B7023 - A77 NE of Maybole-Yellow	58	0	0	10	34
Totals for DS scenario with Yellow Bypass	**1431**	**499**	**411**	**294**	**227**

Consultation

5.2.54 No consultation with any third parties was undertaken, as it was not deemed necessary for this proposed scheme.

Impacts (Opening Year 1) without Mitigation

Local Air Quality Impact Assessment

5.2.55 This section describes the results from the local air quality impact assessment. All modelled values are for annual mean concentrations with the exception of the number of exceedences of the PM_{10} 24 hour AQS objective. Excluding the base year modelled for 2004, all of the other assessments were made for 2012, the opening year.

5.2.56 The estimated pollutant concentrations for each receptor within 200 metres of the road network affected by the proposed Blue, Red and Yellow bypass alignments are shown below in **Tables 5.2.7 to 5.2.18.**

5.2.57 If the receptor is over 200 metres from the affected roads, then the route option is not assessed for that receptor.

Table 5.2.7 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 1 – Carrick Academy, Kirkoswald Road (A77)

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	10.65	6.90	4.57	4.68	4.57	4.66	4.57	4.66	4.57	4.66	4.61	4.65	4.61	4.65	40
PM_{10} (µg/m^3)	13.5	11.8	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.14	0.09	0.07	0.08	0.07	0.08	0.07	0.08	0.07	0.08	0.08	0.08	0.08	0.08	10
Benzene (µg/m^3)	0.13	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	3.25
1,3-Butadiene (µg/m^3)	0.09	0.06	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.25

Table 5.2.8 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 2 – 42 Whitehall, Maybole (A77)

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	15.90	10.58	5.71	5.74	5.70	5.73	5.71	5.73	5.73	5.72	5.66	5.64	5.67	5.63	40
PM_{10} (µg/m^3)	16.4	13.2	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.22	0.14	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	10
Benzene (µg/m^3)	0.21	0.16	0.13	0.13	0.12	0.12	0.13	0.12	0.13	0.12	0.12	0.12	0.12	0.12	3.25
1,3-Butadiene (µg/m^3)	0.20	0.13	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	2.25

Table 5.2.9 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) At Receptor 3 – 57 Culzean Road, Maybole (B7023)

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	9.18	6.07	6.07	5.23	6.07	5.27	6.07	5.28	6.07	5.28	6.06	5.42	6.07	5.40	40
PM_{10} (µg/m^3)	13.1	11.7	11.7	11.4	11.7	11.5	11.7	11.5	11.7	11.5	11.7	11.5	11.7	11.5	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.15	0.10	0.10	0.08	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	10
Benzene (µg/m^3)	0.15	0.12	0.12	0.11	0.12	0.11	0.12	0.11	0.12	0.11	0.12	0.11	0.12	0.11	3.25
1,3-Butadiene (µg/m^3)	0.07	0.05	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	2.25

Table 5.2.10 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) At Receptor 4 – 19 Cassillis Terrace, (A77)

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	15.58	10.34	6.45	5.61	6.45	5.59	6.45	5.59	6.45	5.58	6.41	5.47	6.41	5.47	40
PM_{10} (µg/m^3)	15.7	12.9	11.8	11.6	11.8	11.6	11.8	11.6	11.8	11.5	11.8	11.5	11.8	11.5	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.20	0.13	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	10
Benzene (µg/m^3)	0.19	0.15	0.12	0.11	0.12	0.11	0.12	0.11	0.12	0.11	0.12	0.11	0.12	0.11	3.25
1,3-Butadiene (µg/m^3)	0.17	0.12	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	2.25

Table 5.2.11 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) At Receptor 5 – 2 High Smithston Cottages (A77)

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	14.25	9.20	6.12	5.35	6.12	5.33	6.13	5.35	6.14	5.33	6.09	5.23	6.09	5.23	40
PM_{10} (µg/m^3)	14.7	12.3	11.7	11.5	11.7	11.5	11.7	11.5	11.7	11.5	11.7	11.4	11.7	11.4	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.16	0.10	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	10
Benzene (µg/m^3)	0.15	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	3.25
1,3-Butadiene (µg/m^3)	0.12	0.08	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	2.25

Table 5.2.12 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) At Receptor 6 – 52 McAdam Way

Pollutant	2004 (base)	DM	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	6.38	4.11	4.23	4.24	4.23	4.24	40
PM_{10} (µg/m^3)	12.1	11.1	11.2	11.2	11.2	11.2	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.11	0.07	0.07	0.07	0.07	0.07	10
Benzene (µg/m^3)	0.10	0.09	0.09	0.09	0.09	0.09	3.25
1,3-Butadiene (µg/m^3)	0.04	0.02	0.02	0.02	0.02	0.02	2.25

Table 5.2.13 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 7 – 21 Enoch Road

Pollutant	2004 (base)	DM	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	6.38	4.11	4.24	4.26	4.24	4.26	4.30	4.35	4.31	4.35	40
PM_{10} (µg/m^3)	12.1	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.11	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	10
Benzene (µg/m^3)	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	3.25
1,3-Butadiene (µg/m^3)	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	2.25

Table 5.2.14 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 8 – East Enoch Farm

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	AQS Criteria
NO_2 (µg/m^3)	6.38	4.11	4.30	4.34	4.30	4.34	4.40	4.46	4.40	4.46	40
PM_{10} (µg/m^3)	12.1	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.11	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	10
Benzene (µg/m^3)	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	3.25
1,3-Butadiene (µg/m^3)	0.04	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	2.25

Table 5.2.15 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 9 – Kirklandhill Farm

Pollutant	2004 (base)	DM	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	6.38	4.11	4.48	4.55	4.48	4.55	4.40	4.47	4.41	4.47	40
PM_{10} (µg/m^3)	12.1	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.11	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	10
Benzene (µg/m^3)	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	3.25
1,3-Butadiene (µg/m^3)	0.04	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.25

Table 5.2.16 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 10 – Casillis View, B7024

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	AQS Criteria
NO_2 (µg/m^3)	7.45	4.80	4.97	5.00	4.97	5.00	40
PM_{10} (µg/m^3)	12.4	11.3	11.3	11.3	11.3	11.3	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.12	0.07	0.07	0.07	0.07	0.07	10
Benzene (µg/m^3)	0.11	0.09	0.09	0.10	0.09	0.10	3.25
1,3-Butadiene (µg/m^3)	0.05	0.03	0.03	0.03	0.03	0.03	2.25

Table 5.2.17 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 11 – New Housing Site, B7023

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	8.81	5.79	5.79	5.16	5.79	5.20	5.79	5.21	5.79	5.21	7.22	6.91	7.23	6.91	40
PM_{10} (µg/m^3)	12.9	11.6	11.6	11.4	**11.6**	11.4	11.6	11.4	11.6	11.4	11.9	11.8	11.9	11.8	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.15	0.09	0.09	0.08	0.09	0.08	0.09	0.08	0.09	0.08	0.10	0.09	0.10	0.09	10
Benzene (µg/m^3)	0.14	0.11	0.11	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	3.25
1,3-Butadiene (µg/m^3)	0.07	0.04	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.06	0.05	0.06	0.05	2.25

Table 5.2.18 – Estimated Annual Mean Pollutant Concentrations in Opening Year (2012) at Receptor 12 – Housing at Broomknowes

Pollutant	2004 (base)	DM	B_1	B_2	B_3	B_4	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	AQS Criteria
NO_2 (µg/m^3)	9.48	6.12	4.51	4.59	4.51	4.58	4.43	4.50	4.43	4.50	4.68	4.73	4.68	4.73	40
PM_{10} (µg/m^3)	13.1	11.6	11.2	11.3	11.2	11.3	11.2	11.2	11.2	11.2	11.3	11.3	11.3	11.3	40/18
PM_{10} exceedences (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35/7
CO (mg/m^3)	0.13	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	10
Benzene (µg/m^3)	0.12	0.10	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.09	0.10	3.25
1,3-Butadiene (µg/m^3)	0.07	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.25

5.2.58 Modelled concentrations are expected to easily achieve the AQS objectives for all pollutants and scenarios assessed. The changes in concentrations of benzene, 1,3-butadiene and CO pollutants at the receptors are considered negligible (change in concentrations of less than ±0.1 μg/m^3 for benzene and 1,3-butadiene and a change of less than 0.1 mg/m^3 for CO) with all scheme options.

5.2.59 Annual average PM_{10} concentrations are generally expected to have insignificant changes of less than 1 μg/m^3, but reductions of 1.5 μg/m^3 and 1.4 μg/m^3 were also observed at receptor 2 (from option Y_4) and receptor 4 (from option Y_2) respectively. This corresponds with a substantial reduction in traffic on the A77 where both receptors are located.

5.2.60 Annual average NO_2 levels show the most significant change in concentrations ranging from a reduction of 4.9 μg/m^3 observed at receptor 2 (from option Y_2 and Y_4) to an increase of 1.4 μg/m^3 observed at receptor 11 (from option Y_3). Overall the majority of the changes in concentration indicate a reduction in pollutant concentrations due to the new bypass options. The NO_2 concentrations change by the greatest amount as a result of the different route options, when compared with the do minimum scenario, and are used to discuss the difference between the route options in the sections below.

5.2.61 The most significant changes are observed at receptors located close to the A77 where a reduction in traffic due to the proposed new road will reduce the concentrations by up to 4.9 μg/m^3 for NO_2 and by up to 1.5 μg/m^3 for PM_{10} when compared with the do minimum scenario. The highest reductions are expected with the Yellow route option. The differences in concentration at other receptors closer to the new bypasses are less significant.

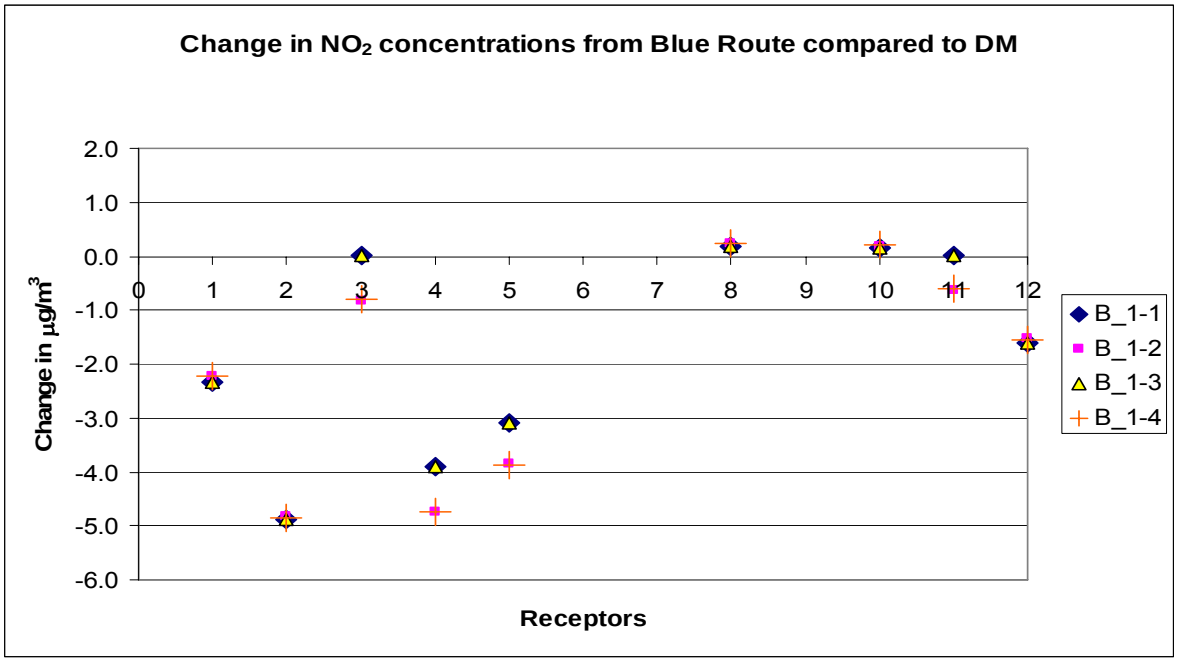
5.2.62 It should be noted that the number of exceedences of the hourly AQS objective for nitrogen dioxide is no longer assessed in the DMRB 11:3:1 as evaluation of monitoring data indicated a weak relationship between annual mean and number of hourly exceedences. If the annual mean objective of 40 μg/m^3 is not exceeded then it is unlikely that the hourly mean objective of 200 μg/m^3, not to be exceeded more than 18 times a year, will be exceeded.

5.2.63 For all pollutants, concentrations are expected to decrease in future years due to increasingly stringent vehicle emission legislation and cleaner vehicle emission technology.

Blue Base Route

5.2.64 The Blue route affects the least number of receptors, with 1389 properties within 200 metres which could be affected by changes in concentrations of air pollutants. The change in NO_2 concentrations when the With scheme scenario is compared with the Do minimum scenario is presented in the figure below.

Figure 5.2.5.1 – Blue Route Options Change in NO_2 Compared with DM Option



5.2.65 The estimated pollutant concentrations for each receptor within 200 metres of the road network affected by the proposed Blue bypass alignment are shown in **Table 5.2.7 to Table 5.2.18** as routes B_1 – B_4. Note that receptors 6, 7 and 9 are not within 200 metres of the Blue base route or affected existing network and hence are not discussed below.

5.2.66 None of the receptors exceed the AQS objectives. The only increases in concentrations are experienced at receptor 8 (East Enoch Farm) and receptor 10 (Casillis View) which have increases of 5% and 4% respectively in NO_2 with each of the four Blue route options compared with Do Minimum. This is a negligible increase as the absolute concentrations are well below the AQS objectives.

5.2.67 Five receptors, 1, 2, 4, 5 and 12 (all located near to A77) experience a very large decrease in NO_2 of more than 25% with all blue routes, when compared with the do minimum concentration. This is considered to be a moderate beneficial impact as the absolute concentrations are well below the air quality objectives.

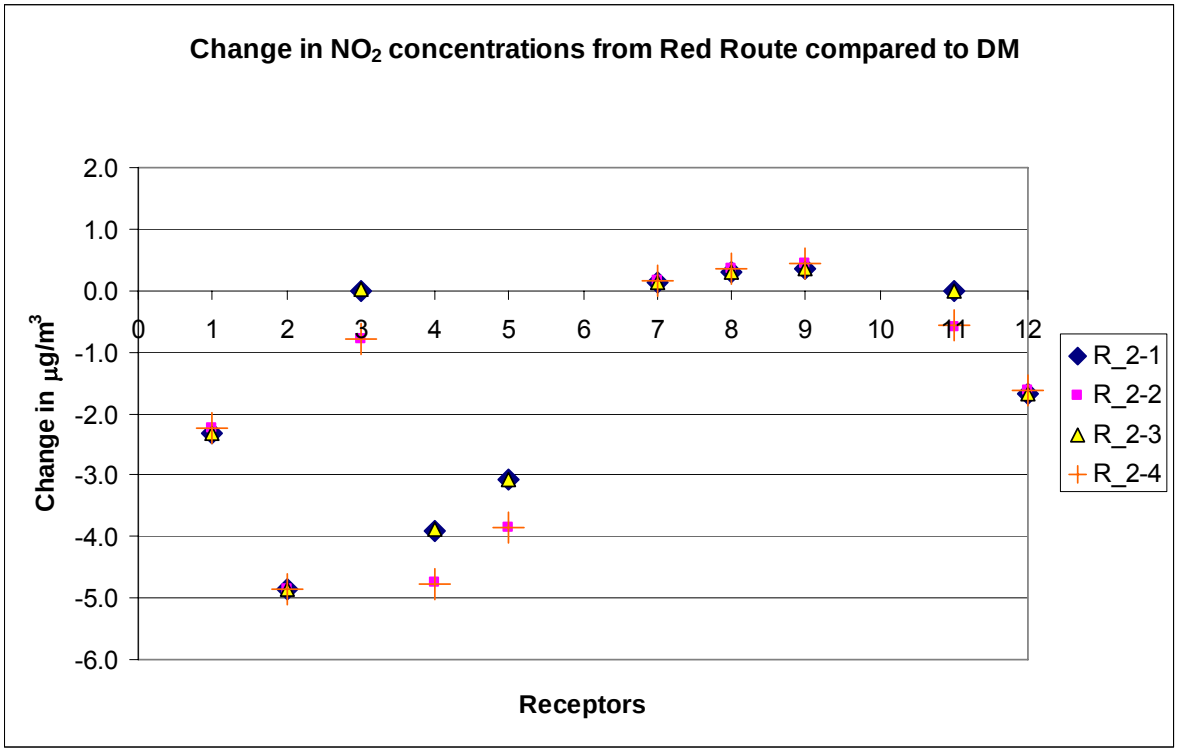
5.2.68 Two receptors, 3 and 11 on the B7023 experience a medium decrease in NO_2 of 14 and 11% respectively with route B_2 and 13 and 10% with route B_4. This results in a slight beneficial impact on these receptors as the absolute concentrations are well below the air quality objectives.

5.2.69 The change in NO_2 concentration is the same for routes B_1 and B_3 for all selected receptors and there is no difference between the change in NO_2 concentration with routes B_2 and B_4. These results imply that the additional lanes have a negligible impact on air quality. Routes B_2 and B_4 are marginally preferable to routes B_1 and B_3 as they result in moderate beneficial impacts at five receptors and additional slight beneficial impacts at a further two receptors. This is as a result of the lower flows on the B7023 and A77 when the additional roundabout is included as part of the proposed road layout.

Red Base Route

5.2.70 The Red route is within 200 metres of 1413 properties which could be affected by changes in concentrations of air pollutants. The change in NO_2 concentrations when the With scheme scenario is compared with the Do minimum scenario is presented in **Figure 5.2.2** below.

Figure 5.2.5.2 – Red Route Options Change in NO_2 Compared with DM Option



5.2.71 The estimated pollutant concentrations for each receptor within 200 metres of the road network affected by the proposed Red bypass alignment are shown in **Tables 5.2.7 to 5.2.18** as R_1 – R_4. Note that receptors 6 and 10 are not within 200 metres of the Red base route or affected existing network and so are not discussed below.

5.2.72 None of the receptors exceed the AQS criteria. Increases in concentrations are only experienced at receptors 7 (21 Enoch Road), 8 (East Enoch Farm) and 9 (Kirklandhill Farm), outlying properties near to the proposed new route. Concentrations of NO_2 at receptor 7 are expected to increase by approximately 3% with all red route options resulting in a negligible impact on local air quality. Receptors 8 and 9 increase by 7 and 9% respectively with options R_1 and R_3 and by 9 and 11% respectively with options R_2 and R_4. This results in a slight adverse impact on these 2 receptors as the absolute values are well below the air quality objectives.

5.2.73 Five receptors, 1, 2, 4, 5 and 12 (all located near to A77) experience a very large decrease in NO_2 of more than 25% for all red routes, when compared with the do minimum concentration. This is considered to be a moderate beneficial impact as the absolute concentrations are well below the air quality objectives.

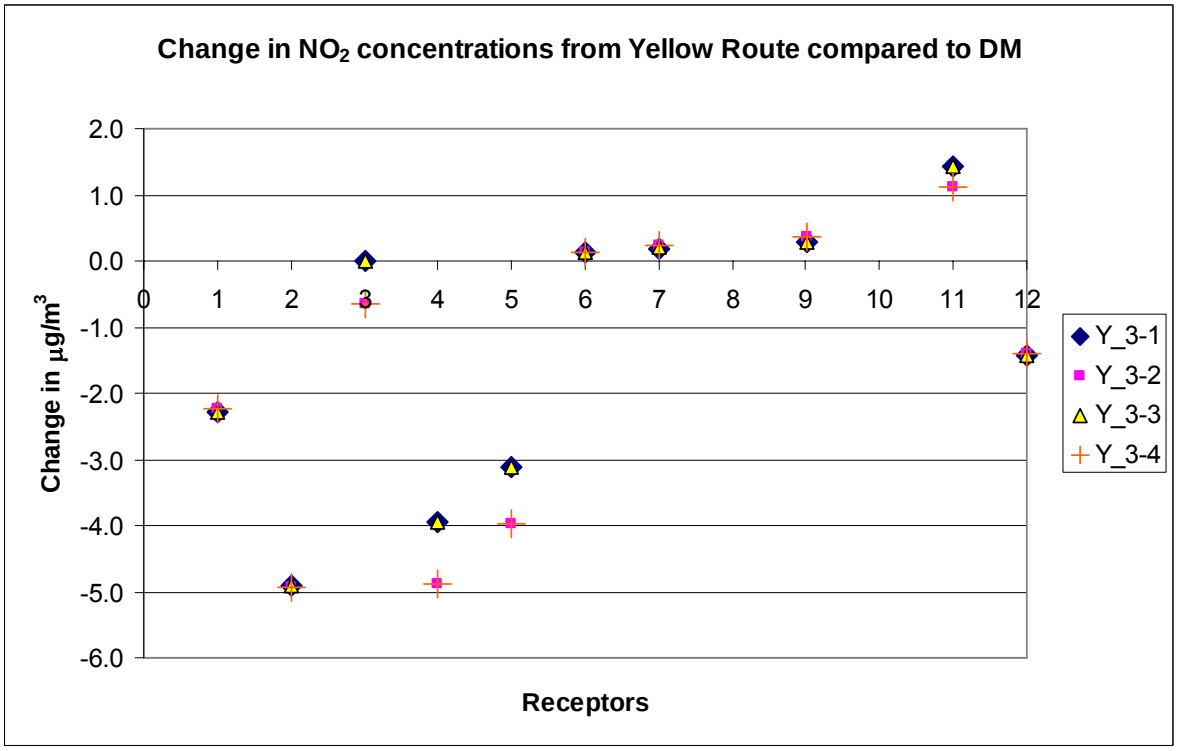
5.2.74 Two receptors, 3 and 11 on the B7023 experience medium decreases in NO_2 of 13% and 10% respectively with both routes R_2 and R_4, resulting in a slight beneficial impact for these receptors as the absolute concentrations are well below the air quality objectives.

5.2.75 The change in NO_2 concentrations is the same for routes R_1 and R_3 and is also the same for routes R_2 and R_4 for all selected receptors. These results imply that the additional lanes have a negligible impact on air quality. Routes R_2 and R_4 are marginally preferable as they result in a decrease in NO2 at receptors 3 and 11, located on the B7023, in addition to larger decreases at receptors 4 and 5. This is as a result of the lower flows on the B7023 and A77 when the additional roundabout is included in the proposed new road.

Yellow Base Route

5.2.76 The Yellow route has the potential to affect air quality at the greatest number of receptors, with 1431 properties within 200 metres. The change in NO_2 concentrations when the With scheme scenario is compared with the Do minimum scenario is presented in the figure below.

Figure 5.2.5.3 – Yellow Route Options Change in NO_2 Compared with DM Option



5.2.77 The estimated pollutant concentrations for each receptor within 200 metres of the road network affected by the proposed Yellow bypass alignment are shown in **Table 5.2.7 to Table 5.2.18** as Y_1 to Y_4. Note that receptors 8 and 10 are not within 200 metres of the Yellow base route or affected existing network and are therefore not discussed below.

5.2.78 None of the receptors exceed the AQS criteria. Increases are experienced at receptors 6 (52 McAdam Way), 7 (21 Enoch Road), 9 (Kirklandhill Farm) and 11 (New Housing Site B7023), properties near to the proposed new route which is the closest to the existing settlement. Concentrations of NO_2 at receptors 6 and 7 are expected to increase by approximately 3% and 5% respectively with all yellow route options resulting in a negligible impact on local air quality. Receptor 9 is expected to increase by 7% with options Y_1 and Y_3 and 9% with options Y_2 and Y_4, this is a small increase. Receptor 11 is expected to increase by 19% with options Y_1 and Y_3 and by 25% with options Y_2 and Y_4, this is a large increase. The change in concentrations at receptors 9 and 11 is considered to be a slight adverse impact as the absolute values are well below the air quality objectives. It should be noted however that receptor 11 is not the location of a façade but the nearest boundary of an area identified for residential development and may not be significantly affected depending on the final siting of the houses.

5.2.79 Four receptors, 1, 2, 4 and 5 (all located near to A77) experience a very large decrease in NO_2 of more than 25% for all yellow routes, when compared with the Do minimum concentration. This is considered to be a moderate beneficial impact as the absolute concentrations are well below the air quality objectives.

5.2.80 One receptor, 12, is expected to experience a large decrease in NO_2 of 24% with routes Y_1 and Y_3 and 23% with routes Y_2 and Y_4. This is considered to be a slight beneficial impact as the absolute concentrations are well below the air quality objectives.

5.2.81 One receptor, 3 on the B7023 experiences a medium decrease in NO_2 of 11% with routes Y_2 and Y_4 only, resulting in a slight beneficial impact for this receptor as the absolute concentrations are well below the air quality objectives.

5.2.82 The change in NO_2 concentrations is the same when comparing routes Y_1 and Y_3 with the do minimum and is also the same when comparing routes Y_2 and Y_4 with the Do minimum scenario for all selected receptors. These results imply that the additional lanes have a negligible impact on air quality. Routes Y_2 and Y_4 are marginally preferable as they result in a decrease in NO2 at receptor 3, located on the B7023, in addition to larger decreases at receptors 4 and 5. This is as a result of the lower flows on the B7023 and A77 when the additional roundabout is included in the proposed new road.

Tie-In Junctions

Broomknowes Roundabout

5.2.83 Receptor 12 is located at the farm at Broomknowes. **Table 5.2.18** presents the modelled concentration at this site resulting from the different options with the Blue, Red and Yellow Routes. The discussion of each route alignment above highlights that receptor 12 experiences a very large decrease with all options for Blue and Red route alignments and a large decrease with all Yellow route options, when compared to the do minimum scenario.

Smithston Bridge Roundabout

5.2.84 There are no properties located within 200 metres of this junction therefore no receptors to experience a change in air quality.

Summary of Route Assessment

5.2.85 Blue route options do not result in a significant adverse impact at any selected receptors and result in a moderate beneficial impact at five receptors. Blue options B_2 and B_4 provide additional benefits at receptors 3 and 11 along the B7023. The increases at receptors 8 and 10 are considered negligible.

5.2.86 All Red route options result in a slight adverse impact for receptors 8 and 9 and moderate benefits for five other receptors with additional benefits for receptors 3 and 11 with options R_2 and R_4. The impact at receptor 7 is negligible.

5.2.87 All Yellow routes result in a slight adverse impact for receptors 9 and 11 and a negligible impact at receptors 6 and 7. There are moderate benefits for four other receptors and slight benefits at two others. Route options Y_2 and Y_4 result in a slight benefit for receptor 3 only.

STAG Assessment

5.2.88 The results of the STAG Assessment are given in **Table 5.2.19** and **Table 5.2.20** and the detailed calculation sheets are presented in Appendix C.

Table 5.2.19 – Results from the STAG Assessment – NO_2

Route Option	No. of properties with an improvement in air quality	No. of properties with a deterioration in air quality	No. of properties with no change in air quality	Total no. residential properties affected	Net total assessment options
B_1	933	107	349	1389	-2450
B_2	1335	22	32	1389	-2791
B_3	933	107	349	1389	-2453
B_4	1335	22	32	1389	-2797
R_1	933	131	349	1413	-2446
R_2	1335	46	32	1413	-2795
R_3	917	131	365	1413	-2441
R_4	1335	46	32	1413	-2800
Y_1	933	173	325	1431	-2455
Y_2	1311	48	72	1431	-2822
Y_3	917	149	365	1431	-2452
Y_4	1335	48	48	1431	-2824

Table 5.2.20 – Results from the STAG Assessment – PM_{10}

Route Option	No. of properties with an improvement in air quality	No. of properties with a deterioration in air quality	No. of properties with no change in air quality	Total no. residential properties affected	Net total assessment options
B_1	917	107	365	1389	-629
B_2	1335	22	32	1389	-719
B_3	917	107	365	1389	-628
B_4	1335	22	32	1389	-720
R_1	933	131	349	1413	-628
R_2	1335	46	32	1413	-721
R_3	917	131	365	1413	-628
R_4	1335	46	32	1413	-720
Y_1	933	149	349	1431	-636
Y_2	1311	48	72	1431	-733
Y_3	917	149	365	1431	-633
Y_4	1311	48	72	1431	-732

5.2.89 All the options result in a negative score for PM_{10} and NO_2 indicating an overall improvement in air pollution as a result of implementing any of the scheme options when compared with the Do-Minimum scenario in the opening year. Option Y_4 and Y_2 have the largest negative score for both PM_{10} and NO_2 and result in an improvement at the highest number of properties when compared with the other schemes. Implementing Option Y_4 or Y_2 would result in the largest flow of traffic being diverted away from the existing A77 onto the bypass, resulting in the largest decreases at properties along the A77 where the majority of the properties in the study area are located.

5.2.90 Options R_1 and R_3 result in the smallest PM_{10} and NO_2 assessment scores and some of the lowest number of houses experiencing an improvement in air quality, although it is noted that the scores are still negative, which indicates an overall benefit when compared with the Do-Minimum scenario. All of these options result in very similar flows of traffic being diverted onto the proposed bypass and only reduce traffic on the A77, not the B7023 or other minor roads.

5.2.91 The STAG assessment results, presented in Appendix C, indicate that none of the schemes result in an increase in annual mean PM_{10} levels at 20 m from the road centre of at least 1 $\mu g/m^3$ links. The links which represent the new road do experience increases of more than 2 $\mu g/m^3$ in annual mean NO_2 levels at 20m from the road centre but the resulting concentrations are between 7 – 8 $\mu g/m^3$ and are well below the AQS NO_2 objective of 40 $\mu g/m^3$

5.2.92 The options are ranked in **Table 5.2.21**; with the most beneficial at the top and the least beneficial at the bottom for both pollutants:

Table 5.2.21 – Ranked Results from Each Pollutant Assessment

Ranked Route Option	NO_2 Assessment Score	PM_{10} Assessment Score
Y_4	-2824	-732
Y_2	-2822	-733
R_4	-2800	-720
B_4	-2797	-720
R_2	-2795	-721
B_2	-2791	-719
Y_1	-2455	-636
B_3	-2453	-628
Y_3	-2452	-633
B_1	-2450	-629
R_1	-2446	-628
R_3	-2441	-628

5.2.93 Generally the options which include a roundabout with the B7023 (B_2, R_2, Y_2, B_4, R_4 & Y_4) are ranked higher as these tend to divert more traffic away from the existing A77 onto the proposed bypass. The routes incorporating additional lanes tend to result in higher average speeds which result in slightly better scores. The Yellow route is ranked higher than the Blue and Red routes as this route results in higher flows being re-directed away from the existing A77.

Greenhouse Gases

Table 5.2.22 – Carbon Dioxide Emissions (tonnes/year)

Route Option	Do-minimum		Do-something	Do-something as % of	
	Existing (2004)	Future (2012)	(2012)	Existing	Future Do-Min
B_1_2012	6,223	6,532	6,397	102.8	97.9
B_2_2012	6,223	6,532	6,355	102.1	97.3
B_3_2012	6,223	6,532	6,401	102.9	98.0
B_4_2012	6,223	6,532	6,372	102.4	97.6
R_1_2012	6,223	6,532	6,386	102.6	97.8
R_2_2012	6,223	6,532	6,361	102.2	97.4
R_3_2012	6,223	6,532	6,393	102.7	97.9
R_4_2012	6,223	6,532	6,354	102.1	97.3
Y_1_2012	6,223	6,532	6,329	101.7	96.9
Y_2_2012	6,223	6,532	6,296	101.2	96.4
Y_3_2012	6,223	6,532	6,356	102.1	97.3
Y_4_2012	6,223	6,532	6,306	101.3	96.6

5.2.94 **Table 5.2.23** shows expected emissions of carbon dioxide from the affected road network with and without the proposed bypass options in the opening year (2012). All options result in a slight decrease of CO_2 compared to the Do-minimum scenario. Route B_3 results in the lowest decrease of CO_2, when compared with the Do-Minimum scenario. This route alignment is the longest and results in the largest increase in vehicle kilometres travelled.

Table 5.2.23– Route Options Ranked by Change in Carbon Dioxide Emissions (tonnes/year) when Do Something is compared with Do Minimum

Route Option	% decrease Do Something v Do Minimumin
Y_2_2012	3.6
Y_4_2012	3.4
Y_1_2012	3.1
Y_3_2012	2.7
R_4_2012	2.7
B_2_2012	2.7
R_2_2012	2.6
B_4_2012	2.4
R_1_2012	2.2
R_3_2012	2.1
B_1_2012	2.1
B_3_2012	2.0

5.2.95 The four sub-options of the Yellow route are ranked the highest as they result in the largest percentage decrease in CO_2 emissions when compared with the 2012 Do-Minimum scenario. This is because the Yellow route results in the shortest route and carries the highest volume of traffic on the new road. Routes Y_2 and Y_4 result in the lowest total vehicle kms travelled and therefore have the highest impact on the carbon dioxide emissions in the opening year.

5.2.96 All options result in a slight decrease in carbon dioxide emissions, when compared with the Do-Minimum scenario, as they all result in the majority of the traffic being diverted away from the A77 which runs through the town centre onto one of the bypass options. The existing A77 through the town centre has modelled speeds of between 23 and 48 kilometres per hour (kph), whereas the bypass options have modelled speeds of between 66 and 76 kph. Carbon dioxide emissions are closely related to fuel consumption and vehicles operate most efficiently between 55 and 65 kph, therefore carbon dioxide emissions will be at their lowest when vehicles are travelling close to these speeds. The decrease in emissions is expected to be between 2% and 3%, compared with the Do-Minimum scenario in the opening year. These changes are considered negligible (change of less than 10%) in the context of overall road transport emissions for South Ayrshire Council and Scotland[14].

[14] Defra, 2005, Defra Statistical information release 465/05: Experimental carbon dioxide emissions statistics at local authority and Government Office Region level 2003. Road transport emissions are estimated at 10.6 million tonnes for Scotland and 225 kilo tonnes for South Ayrshire Council.

Mitigation Measures

General

Road Traffic

5.2.97 No mitigation measures are proposed for road traffic as any scope for mitigation of adverse effects on air quality from changes in traffic flow is limited compared with the reductions in emissions achievable through anticipated improved vehicle technology.

Construction Activities

5.2.98 Mitigation measures to control dust during reclamation and construction would typically be specified within contract documentation. The precise measures will depend on the intended operations and the degree of severity of the dust issue. Some typical measures which are easily implemented and managed may include:

- Regular water-spraying and sweeping of unpaved and paved roads to minimise dust and remove mud and debris;
- Using wheel washes for vehicles leaving the site where appropriate to minimise the amount of mud and debris deposited on the roads;
- Sheeting vehicles carrying dusty materials to prevent materials being blown from the vehicles whilst travelling;
- Enforcing speed limits for vehicles on unmade surfaces to minimise dust entrainment and dispersion;
- Dampening down of surfaces prior to their being worked; and,
- Storing dusty materials away from site boundaries.

5.2.99 Other measures requiring more planning and capital investment may be considered if high dust measurements and/or complaints persist. These may include:

- Erecting windbreaks around known problem areas or stockpiles; and,
- Installing a full or partial site boundary dust suppression system..

5.2.100 The latter approach takes the form of a network of sprinklers above working height around the site boundary or between the site and nearby receptors (the prevailing wind direction must also be considered if a partial system is employed). The size of the sprinkler nozzle apertures dictates the particulate fraction removed. A fine mist will generally be more effective in reducing PM_{10}, whereas a coarser spray abates larger diameter particles more readily. The implementation of sprinklers would need to be considered in the management of runoff from the construction site.

Impacts (Design Year 15)

5.2.101 The design year does not require assessment for air quality as any modelled results are likely to have a high uncertainty.

Conclusions

5.2.102 The air quality assessment has examined existing conditions and identified whether there is likely to be a significant air quality impact associated with each of the proposed bypass scheme options.

5.2.103 There are currently no Air Quality Management Areas (AQMAs) in the vicinity of the scheme, implying that AQS objectives are likely to be met at properties. Modelled concentrations of air pollutants for the Do Minimum and With scheme scenarios are well below all AQS objectives including those more stringent for Scotland, implying that air quality in the area is good.

5.2.104 Changes in concentrations of nitrogen dioxide, carbon monoxide, benzene, 1,3-butadiene and particulate matter (PM_{10}) were estimated at twelve properties within 200 metres of the affected roads using the screening method as described in the DMRB 11:3:1. The assessment was carried out for the existing case (2004), and with and without the 12 scheme options in the opening year (2012). Modelled concentrations of all pollutants at the selected properties are unlikely to exceed the AQS objectives with or without any of the scheme options in any of the years assessed. As the concentrations of nitrogen dioxide experience the greatest changes, these values were used to assess the impact on the selected receptors of each of the 12 route options.

5.2.105 Most receptors experience a reduction in air pollutant concentrations, particularly those located near to the A77. The assessment of NO_2 concentrations identified that three receptors were expected to experience a slight adverse increase in NO_2: receptors 8 and 9 with all red routes and receptors 9 and 11 with all yellow routes. It should be noted however that the increases are less than 2 $\mu g/m^3$ (the significant change level identified in the TAG unit 3.3.3) and the concentrations remain well below air quality objectives with all schemes.

5.2.106 The STAG assessment has shown that there is expected to be an overall reduction in annual mean NO_2 and annual mean PM_{10} concentrations with each of the proposed bypass schemes. None of the schemes result in a significant (as described in TAG unit 3.3.3) increase in annual mean PM_{10} and annual mean NO_2. All of the proposed alignments divert traffic away from the existing A77 which runs through a town centre, resulting in an improvement in air quality for the many properties near to roads on the existing affected network.

5.2.107 Each of the options has been ranked based on its assessment score for NO_2 and PM_{10}. The Yellow route options Y_2 and Y_4 result in the greatest overall improvement in air quality when compared with the Do-Minimum scenario. Those routes which incorporate roundabouts (B_2, B_4, R_2, R_4, Y_2 and Y_4) are ranked higher than those that do not and those which also include additional lanes (B_4, R_4 & Y_4) are ranked highest for each route.

5.2.108 Each option resulted in a decrease in greenhouse gases, although the decrease was found to be less than 10%. The Yellow route results in the highest decrease in greenhouse gases (3% less than the Do minimum scenario) as it is the shortest route and results in a decrease in vehicle kilometres travelled.

5.2.109 Route options Y_4 and Y_2 are the preferred options as they result in the highest improvement in air quality and the lowest increase in greenhouse gases respectively. This is because they divert the most traffic away from the existing road network. Although the yellow routes were identified as having a slight adverse impact on two receptors it should be highlighted that both of these receptors remain well below the air quality objectives and one receptor is not an existing property façade location, rather it is the boundary of an area identified for future residential development.

5.3 Cultural Heritage

Introduction

5.3.1 The objective of this desk-based assessment is to identify known and potential cultural heritage resources that may be affected by the proposed A77 Maybole Transport Study.

5.3.2 The aims of the assessment are to:

- Identify the known Cultural Heritage constraints relating to the preferred scheme;
- Determine the potential for disturbing previously unknown archaeological remains within the preferred scheme footprint;
- Assess the impact of the preferred scheme on existing and potential cultural heritage resources;
- Make recommendations for any further investigation which may be required (e.g. further desk-based assessment, geophysical surveys, field walking, trial trenching etc.) to further assess the archaeological potential and impacts of the proposed improvements; and
- Make recommendations for a suitable archaeological mitigation strategy.

Key Issues

5.3.3 Known and potential cultural heritage resources that may be affected by this type of development may, in principle, include both archaeology and built heritage. These resources could, therefore, include non-designated archaeological sites[15] or structures of historic interest, Listed Buildings, Scheduled Monuments, Conservation Areas or Gardens and Designed Landscapes, and World Heritage Sites.

Methodology

5.3.4 A DMRB Cultural Heritage assessment drawing on guidance laid down in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 2, Cultural Heritage (1993) was undertaken in August 2006, as part of the A77 Maybole Transport Study (Stage 1). The report assessed a study area of 500m either side of the centreline for each proposed route option. The assessment highlighted only the principal constraints to potential highway improvements.

5.3.5 To further understand the potential impacts of the proposed routes on the cultural heritage resource, this assessment updates the information gathered during the previous assessment and consults further sources to assess the Stage 2 options in a cultural heritage context.

5.3.6 During this appraisal the following sources have been consulted:

- The West of Scotland Archaeology Service Sites and Monuments Record (WoSAS SMR);

[15] Non-designated sites are not offered the same legal protection as Scheduled Monuments and Listed Buildings; where development proposals affect such sites of known or suspected archaeological interest, the prospective developer may still be required to arrange for an archaeological evaluation to determine the importance of the site, its sensitivity to development and the most appropriate means for preserving or recording any archaeological information. The evaluation will be taken into account when determining whether planning permission should be granted with or without conditions or refused.

- The List of Scheduled Monuments, Properties in Care and Protected Wrecks in Scotland 2002;
- The National Monuments Record of Scotland (NMRS) maintained by the Royal Commission on the Ancient and Historic Monuments of Scotland (RCAHMS) for information on Scheduled Monuments, Listed Buildings, Historic Gardens & Designed Landscapes and undesignated sites;
- NMRS Aerial photograph library

5.3.7 On 10th January 2007, as part of the assessment process, the study area was visited by a heritage consultant. During the visit the likely effects of the routes on the cultural heritage resource and in particular the nature of the ground (made, disturbed or undisturbed) was assessed, and these results are incorporated in the following sections.

5.3.8 Based on an analysis of this data and the site visit this assessment has sought to identify and quantify the likely effects of the scheme proposals on the cultural heritage resource.

5.3.9 There is no standard scale for determining the significance of the environmental effect with regard to cultural heritage assets. The assessment draws on current approaches and will be based on guidance outlined in DMRB and STAG. These approaches are founded on the principle that the significance of environmental effect is determined by assessing the magnitude of change and the importance of the affected resource. In this way a small impact on a nationally important site may result in the same significance of effect as a large impact on a locally important site.

Magnitude of Change

5.3.10 In order to assess the magnitude of change brought about by the proposed scheme options on the identified sites and areas of the cultural heritage resource the following grading system has been used:

Negative Changes

- **Major negative change**: the proposals would result in the complete destruction of an element of the built heritage; be highly visually intrusive and would seriously damage the setting of the cultural heritage resource, (particularly designated assets such as Scheduled Monuments and Listed Buildings, but also considered are undesignated assets of local and regional importance) such that their integrity is compromised and appreciation and understanding of them is diminished; or the proposals would disturb more than 75% of the area of known or estimated buried archaeological features.
- **Moderate negative change**: the proposals would result in the partial destruction of an element of the built heritage; the proposals would be intrusive in the setting, and would adversely affect the appreciation and understanding of the characteristic heritage resource; or the proposals would disturb between 25% and 75% of the area of known or estimated buried archaeological features.
- **Minor negative change**: the proposal would change the existing setting of the heritage resource but would not result in the severance or loss of integrity, appreciation or understanding of the resource; or the proposals would disturb less than 25% of the area of known or estimated buried archaeological features.

Beneficial Changes

- **Major beneficial change**: the proposals would prevent any further natural or accelerated degradation of buried archaeological remains and potentially ensure their long-term preservation; the proposals would provide increased accessibility to visible archaeological remains or an element of the built heritage and, through the restoration of lost or damaged elements, enhance the understanding, appreciation and setting of the asset.
- **Moderate beneficial change**: the proposals would retard any further natural or accelerated degradation of buried archaeological remains by improving the existing situation (such as the cessation of ploughing); the proposals would provide accessibility to visible archaeological remains or an element of the built heritage resource such that the understanding and appreciation of the asset is improved; the proposals would greatly improve the setting of a cultural heritage asset or remove existing intrusive elements such that the integrity and setting of the resource would be enhanced.
- **Minor beneficial change**: the proposals would re-introduce accessibility to visible archaeological remains or an element of the built heritage resource; the proposals would improve the setting of a cultural heritage asset.

Importance of the Affected Resource

5.3.11 The importance (or value) of each element of the cultural heritage resource has been developed using the Secretary of State's criteria for Scheduling Monuments[16]. The criteria (period; rarity; documentation; group value; survival/condition; fragility/vulnerability; diversity; potential) were used to determine whether the resources are of National, Regional (County/District) or Local importance. An additional grade of 'no grade' has been given to sites that are significantly destroyed or disturbed so that they would not warrant inclusion in a higher grade.

5.3.12 The importance of the built heritage also takes into consideration whether the structures are listed or not. The various grades for Listed Buildings are hierarchical, Grade A buildings being of National or international importance, Grade B buildings are of Regional or more than local importance, and Grade C(S) buildings are of Local importance[17]. These classifications are combined with the above referenced four tier system to assess the importance of the affected resource. For those resources that are not a Listed Building, an example of relative importance is that, generally, places on the Inventory of Gardens and Designed Landscapes in Scotland are judged to be of National importance and Conservation Areas are judged to be of Regional importance.

Significance of Effect

5.3.13 Using professional judgement, the importance of each resource, combined with the magnitude of the change, an assessment of the significance of the effect can be made. The significance of the effect is defined as being beneficial (slight, moderate or major), adverse (slight, moderate or major) or neutral.

Table 5.3.24 – Significance of Effects Matrix

Magnitude of Change	Importance of Affected Resource			
	National	Regional	Local	No Grade
Major	Large	Large/Moderate	Moderate/Slight	Neutral
Moderate	Large/Moderate	Moderate	Slight	Neutral
Minor	Moderate/Slight	Moderate/Slight	Slight	Neutral

[16] PAN 42: Archaeology, SO Environment Dept. 1994

[17] *Historic Scotland, Memorandum of Guidance on listed buildings and conservation areas, 1998*

5.3.14 The above matrix can be used to determine both adverse and beneficial effects.

Baseline Conditions

5.3.15 Refer to Figures 5028091_HER_001 & 002 in Appendix A for an outline of the baseline conditions of the Maybole study area in terms of Cultural Heritage.

Topographical and Geological Background

5.3.16 Refer to Section 5.12, Geology and Soils for details.

Archaeological and Historical Background

5.3.17 In order to set the context for the baseline data listed below, the following provides a brief synopsis of the development of the area surrounding Maybole from the prehistoric through to modern periods. The 'surrounding area' referred to above is based on a roughly 10km radius surrounding the town of Maybole. This section is based on a summary of the information provided in the Historic Scotland Burgh Survey *Historic Maybole: Archaeology and Development* 2005.

5.3.18 Each cultural heritage asset described below has been assigned a 'A No.'

Palaeolithic – Mesolithic (500,000BC – 4,000BC)

5.3.19 The earliest known settlement of this part of Scotland is thought to have occurred around 7,000BC, during the Mesolithic period, although future work may provide evidence for earlier human activity. During the Mesolithic period evidence of human activity appears to have been concentrated along the coastline and river banks. Their nomadic 'hunter-gatherer' lifestyle means that they left little behind by way of structural remains, although shell middens and flint tools are relatively common finds in the wider area.

5.3.20 No evidence from these periods has been recorded within the study area or the wider environs.

Neolithic (4,000BC – 2,300BC)

5.3.21 The Neolithic period saw the development of more settled communities. Large areas of woodland were cleared, and farming began to develop with the keeping of livestock and the farming of fields for crops. Evidence of ritual and funerary activities associated with these settlements is attested in South Ayrshire at Balmalloch, just to the south-east of Girvan. Close to Maybole the Lyonston standing stone (A No. 1) may have been erected as a focus for ritual activity. Artefacts have been recovered in the locality including a polished stone axe-hammer found during the draining of the Heart Loch, 2km south-east of Maybole.

Bronze Age (2,300BC – 700BC)

5.3.22 By around 2,300BC, changes in society were gradually taking place; and the tradition of monumental tombs containing large numbers of burials waned in favour of single grave burials – or barrows. A food vessel found near Maybole in the 19th century could have been from such a burial, and there are possible barrow sites close to St Murray Plantation just to the north-east of the town (A No. 69). Other evidence for Bronze Age activity has been recorded within the environs of Maybole including a socketed axe from around 1,200BC – 700BC which was found near Maybole in 1880, and another which was found at Auchendrane, 6km to the north-east. A hoard of the same period was discovered on a farm at Dalduff near Crosshill in 1846 that comprised the remains of a pot with two swords placed over its mouth, with nine socketed axes and the remains of a cauldron found inside the pot.

Iron Age and Roman periods (700BC – AD450)

5.3.23 Towards the end of the Bronze Age and the beginning of the Iron Age, settlements began to dominate the landscape. Numerous fortified settlements, ranging from large hill forts to enclosed villages and isolated dwellings are known. Less defensive types of settlement also existed, but the remains from this period may reflect a more competitive society, in which groups perhaps competed for natural resources. The general impression is that there was a move away from large monuments that served the community in the 2nd and 3rd millennia BC, towards settlement indicative of tribal division.

5.3.24 During the 1st century AD the Roman army slowly advanced north into Scotland where they established a network of fortifications and communications throughout the southern part of the country, ensuring their effective control of the native tribes. According to Ptolemy, Ayrshire was the domain of the Damnonii tribe. Evidence for settlement of this period is found near Maybole, at the hillfort at Kildoon, 2.5km to the south of the town; and a dun (small fortified settlement) at Castle Knoll (locally known as Dunean), 3km north-west of Maybole. There are a number of small lochs to the south and west of Maybole, and these could potentially provide sites for crannogs (lake dwellings), such as at Lochspouts.

5.3.25 Little is known further about Roman activity in Ayrshire, and few sites have been identified. However, temporary camps at Girvan would seem to have acted as a base for naval manoeuvres by Agricola in his campaigns in the late 1st century AD, while the large fort at Loudoun Hill, in the north of Ayrshire, also dates from this period. Nothing is recorded within the study area from either the Iron Age or Roman periods, although it is possible that an enclosure recorded at St Murray Plantation (A No. 68) could relate to some form of settlement activity from this time.

Early medieval period (AD450 – 1066)

5.3.26 Maybole first appears in documentary sources in the 12th century. The earliest recorded form of the place name is *Meibothel*, possibly derived from the Old English *meage-botl*: the maiden's hall. This, and the dedication of the parish church to St Cuthbert, a Northumbrian saint, suggests that Maybole was an Anglian settlement created during the period of Northumbrian supremacy of the area, lasting from the mid-7th to the 10th century.

5.3.27 Maybole appears to have been prominent in the early ecclesiastical organisation of Ayrshire, acting as a mother church with subordinate churches at Auchendrane and Kirkbride, which became separate parishes after the Reformation.

Medieval period – post-medieval (AD1066 –1901)

5.3.28 The area surrounding Maybole is rich in late medieval structural remains. The Abbey of Crossraguel lies 2km to the south-west of the town centre and the towers of Cassillis, Auchendrane, Dunure, Baltersan and Blairquhan all lie within an 8km radius of the town. Within the town itself the castle and the tollbooth (now the town hall) survive today. These buildings dominated the burgh and contained its development.

5.3.29 By 1216 Maybole had become an important ecclesiastical centre, with the parish church being granted to the Cistercian monastery at North Berwick. Throughout the pre-Reformation period the teinds (tithes) of the parish were divided between the collegiate church of the Virgin Mary and St Anne in Glasgow and the nunnery at North Berwick.

5.3.30 The establishment of Maybole as a burgh of barony in 1516 gave extra commercial impetus to a settlement that already contained both a parish and collegiate church. Agricultural activity intensified, to provide food for the people of the town and surrounding settlements as well as to facilitate the local industries of tanning, wool-making and weaving. These industries were contained within the town, and it is unlikely that any associated remains survive in the areas to the north.

Modern period (1901 – present day)

5.3.31 Maybole continued to expand throughout the early 20th century, with its main industries being weaving and shoemaking. The town expanded further north, although not into the open fields through which the route options are located. An analysis of historic OS maps from 1859 through to the 1970s has shown that there has been little extensive development within the open fields to the north of Maybole, with the exception of the large residential development at Whitefaulds, from this time to the present day.

Historic Ordnance Survey Maps

5.3.32 Historic Ordnance Survey (OS) maps were accessed that dated from the 1st edition of 1859 through to 2001. In all instances the area to the north of Maybole that is the subject of this assessment has remained relatively undeveloped and unchanged since at least 1859. It is likely that the enclosed fields that are smaller than the open fields to the north are the product of 18th century enclosure (Historic Scotland, 2005, p. 34).

5.3.33 Several areas of interest were identified that are not recorded on the WoSAS SMR or the NMRS and could potentially be constraints to development. These are described below.

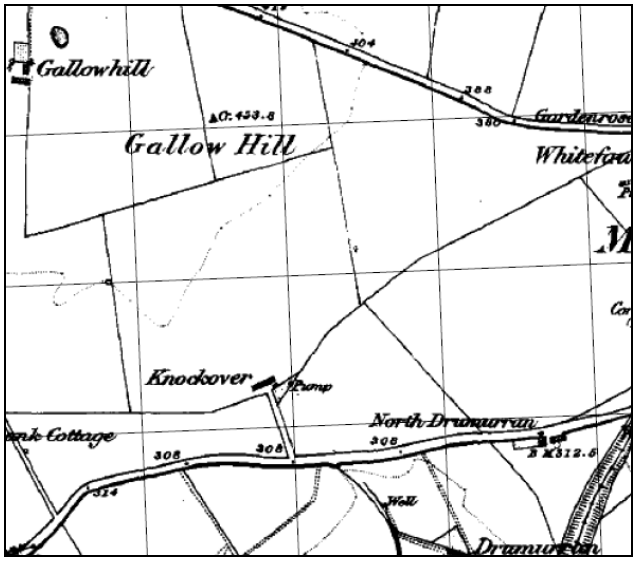
5.3.34 Possible tracks and remnants of a quarry recorded on the 1st edition OS County Series Map of Ayrshire 1859 – 1860 (see map extract Figure 5.3.4 below), located between Kirklandhill Farm and Lover's Lane. Also on this map is the site of Kirklandhill Cottage (A No. 79) the remains of which still survive above ground (see photograph below). The remains of a quarry are also shown on this map.

Photo 5.1 – The Remains of Kirklandhill Cottage, Taken from the North

5.3.35 The site of a no longer extant farmhouse called *Knockover* and an associated pump are recorded just to the north of Broomknowes on the 1st edition OS County Series Map of Ayrshire 1859 (see map extract below), although none of the route options are located within this area.

Figure 5.3.5.4 – 1859 OS 1st Edition County Series Map, Showing Kirklandhill Cottage and Old Quarry

Figure 5.3.5 – 1859 OS 1st Edition County Series Map, Showing Knockover and Pump



Aerial Photographs

5.3.36 The following aerial photographs were accessed at the National Monuments Record for Scotland (NMRS). No areas of archaeological potential were identified.

Table 5.3.25 – Aerial Photographs Sourced

Sortie	Frames	Date
106/G/SCOT/UK90	4011 – 4008	12.05.1946
	3065 – 3059	12.05.1946
	4067 – 4060	12.05.1946
58/RAF/1414	F22 0211 - 0204	20.04.1954
	F22 0172 - 0179	20.04.1954
58/RAF/1414	F21 0173 – 0180	20.04.1954
05/67/130	395 – 391	31.05.1967
	361 – 369	31.05.1967
	331 – 323	31.05.1967
	150 – 144	31.05.1967
BKS Surveys Ltd: 2431	090 – 088	June 1974
All Scotland Survey: 62188	140 – 137	10.06.1988

Scheduled Monuments

5.3.37 There are two Scheduled Monuments within or in close proximity to the study area, Lyonston standing stone (A No. 1) and Maybole Collegiate Church (A No. 2). Given their distance from the proposed route options it is considered that they will not experience adverse impacts. However, the potential reduction in traffic passing them could have an overall beneficial impact on their current settings.

Table 5.3.26 – Scheduled Monuments

A No	SM Number	Site name and description	Importance
1	5787	Lyonston Standing Stone: NS 3090 1030: a single standing stone, likely to have been erected in the Neolithic or Bronze Age. It is situated on a slight rise of a field 250m SE of the Lyonston Farmstead.	National
2	90212	Maybole Collegiate Church: NS 3010 0980: the monument comprises the remains of the collegiate church of St Mary, founded with a pre-existing chapel in 1382.	National

Listed and Non-Listed Buildings

5.3.38 There are 51 Listed Buildings within the study area (details in Appendix D). Of these four lie within close proximity to the proposed Options and could be considered to be potential constraints. The remaining 47 buildings lie within the historic core of the town. Those buildings and structures that could be considered to be constraints comprise three farmsteads of post-medieval date (A Nos. 3, 5 & 6) and the Covenanter's Memorial (A No. 4) that was erected in the memory of the martyred Covenanters of Maybole in 1679 and 1681.

5.3.39 Nether Culzean is well screened from the surrounding areas, and is unlikely to be impacted on by any of the options. It has therefore not been considered further in this assessment.

5.3.40 In general the reduction in traffic through Maybole would have an overall beneficial effect on some of the 47 listed buildings within the town.

Table 5.3.27 – Listed and Non-Listed Buildings

A No	HB Number	Building Name	Category	Importance
3	14291	East Enoch House	B	Regional
4	47573	Covenanter's Memorial, Brockloch:	C(S)	Local
5	18205	Kirklandhill	C(S)	Local
6	19685	Nether Culzean	B	Regional

Conservation Areas and Designed Landscapes

5.3.41 There is one Conservation Area and one Historic Garden and Designed Landscape within the study area. The Conservation Area covers the historic core of Maybole and is not considered be a constraint to development. In fact, reducing traffic congestion in the town centre would have a major beneficial effect.

5.3.42 The south-eastern extent of the Historic Garden and Designed Landscape of Culzean Castle is located just within the north-western part of the study area. From the visual assessment undertaken during the site visit it does not appear to have any identified constraints to development. Further consideration of this area is given in the Landscape and Visual Impact Assessment in **Section 5.6**.

Table 5.3.28 – Conservation Areas and Designed Landscapes

A No	Designation	Description	Importance
55	Conservation Area	Maybole Town Centre	Regional
56	Historic Gardens and Designed Landscapes (No. 305)	Culzean Castle and gardens	Regional

Known archaeological remains within the study area

5.3.43 There are 13 recorded sites on the WoSAS SMR within the study area, the majority of which are located within the urban areas of Maybole. Ten of these sites do not lie within the area of the proposed options, and are listed in Appendix D. Three sites do lie within close proximity to the proposed Options and are listed in **Section 3**.

5.3.44 These remains indicate that the northern area of Maybole has some potential for later prehistoric burial and settlement remains as shown by the presence of possible enclosures and a barrow at St Murray and the possible medieval settlement activity at Smithston. Within the wider surrounding area, sites identified and shown in Appendix A indicate further evidence for elements of prehistoric activity with the presence of a Neolithic axe-head hammer at Lochlands (A No. 64) and the Lyonston standing stone (A No. 1).

5.3.45 Evidence of human activity within the early medieval and medieval periods is attested by the presence of settlement, agricultural and small-scale industrial remains. The evidence includes ecclesiastical sites recorded at St Murray (A No. 67), and St Cuthbert's church in Maybole (A No. 65), the site of a water mill and farmstead at Brockloch (A No. 77) and the remains of a plantation embankment at Bogton Mount (A No. 76). William Roy's *Military Survey of Scotland* undertaken in the late 18th century shows the area surrounding Maybole as large open areas of cultivation (Historic Scotland, 2005), and the area has retained this use to the present day.

5.3.46 Later industrial remains are recorded within Maybole itself, and comprise a boot and shoe factory (A No. 63) and the Harkieston Smithy (A No. 62).

Table 5.3.29 – Known Archaeological Remains

A No	SMR Number	Site Name and Description	Importance
66	WoSAS SMR Site 6220	Smithston Castle (site of) – no remains of the castle survive today.	Local
68	WoSAS SMR Site 6223	Possible enclosure at St Murray – indistinct cropmark relating to a possible oval-shaped enclosure.	Local
69	WoSAS SMR Site 6242	Site of a possible prehistoric barrow at St Murray.	Local

A No	SMR Number	Site Name and Description	Importance
79	Not on WoSAS SMR	Kirklandhill Cottage – a derelict farmstead of probable 18th/19th century date that appears to have been occupied up until the 1960s.	Local

Previous Archaeological Investigations within the Study Area

5.3.47 There has not been a large amount of archaeological work undertaken within Maybole and the surrounding area. Works that have been undertaken have not discovered notable finds to date although the investigations have been concentrated within the historic core of Maybole, and not within the area of the proposed options.

Table 5.3.30 – Results from Previous Archaeological Investigations

A No	SMR Number	Site Name and Description
61	WoSAS SMR Event 21187	Trial Excavation at School Vennel, Maybole - Four trenches were excavated to the south of School Vennel. A number of cut features were encountered in the subsoil but none are thought likely to be older than 18th century. A foundation trench of a pre-1857 building was identified in the southern corner of the site. (Headland Archaeology 1996)
70	WoSAS SMR Event 413	Watching Brief on Girvan reinforcement gas main. Modern agricultural remains recorded, nothing of archaeological interest encountered. (GUARD, 2002)
71	WoSAS SMR Event 1248	Archaeological evaluation in advance of proposed housing development. Nothing of archaeological interest encountered.
72	WoSAS SMR Event 52134	Archaeological evaluation in advance of proposed development on Alloway Road encountered nothing of archaeological interest. (Rathmell Archaeology, 2004)
73	WoSAS SMR Event 251 & 402	Evaluation and Watching brief south of Carnegie Library encountered nothing of archaeological interest.(Addyman & Kay, 2001)

Potential Archaeological Remains within the Study Area

5.3.48 The area to the north of Maybole has not been subject to any extensive archaeological investigations in the past, and therefore there is little known about its archaeological potential. However this absence of evidence does not preclude the potential for buried archaeological remains to survive. It is acknowledged that the lack of large-scale development in the area means that there is not a large corpus of archaeological information available.

5.3.49 Sites recorded on the WoSAS SMR indicate that there is some potential for prehistoric funerary and settlement activity close to the St Murray plantation (A Nos. 68 & 69), and the wider area exhibits extant remains from the Neolithic period, Lyonston standing stone (A No. 1) and recorded Neolithic finds from Lochlands (A No. 64). The relatively undisturbed nature of much of the land to the north of Maybole suggests that there is the possibility for the survival of buried archaeological remains of an ephemeral nature representing small-scale settlement and funerary activities, as well as scatters of the remnants of human activity such as stone tools, pottery and animal bone.

5.3.50 Evidence for medieval and later activity within the area to the north of Maybole may also survive in undisturbed areas and comprise the remains of rig and furrow[18], find scatters from human activity, from manuring of the land, and possibly for dispersed small-scale medieval and post-medieval settlements and farmsteads.

Archaeological Sites identified during Site Visit

5.3.51 A site visit was undertaken by a heritage consultant in January 2007 to assess the survival of sites identified on the WoSAS SMR and to identify any sites not currently included on the SMR. The visit was successful in identifying one site of interest, a derelict building recorded on the 1st edition OS map as *Kirklandhill Cottage* (A No. 79) (NS 2990 1062).

5.3.52 The remains of Kirklandhill Cottage survive fairly well and from an analysis of historic maps and aerial photographs it would appear to have been occupied up until the mid-1960s.

Historic Landscape

5.3.53 The remnants of historic settlement patterns, based upon rig and furrow fields, enclosed by turf dykes and centred on large individual farmsteads, are still evident in areas that are unsettled and uncultivated today. The elevation of such field systems indicates that they date back to the periods of milder climate that prevailed around the 16th century.

5.3.54 Surrounding Maybole are the remnants of open field systems that probably date to before the 18th century, although those fields that are located just to the north of the town appear to have been formed during later post-medieval enclosure.

Consultation

5.3.55 The West of Scotland Archaeology Service (WoSAS) was contacted during the process of data collection to gauge their opinions in relation to the proposed routes in view of their capacity as advisors to South Ayrshire Council. The WoSAS Service Manager suggested that following completion of the Stage 2 Assessment, the selected route should be evaluated (potentially comprising a selection of non-intrusive and intrusive fieldwork techniques) by an appropriately qualified archaeological contractor as part of the preparation of the final cultural heritage ES chapter. Thereafter, following any grant of consent, the route should be subject a mix of both intrusive (e.g. trial trenching) and non-intrusive (e.g. geophysical survey, field-walking) evaluation techniques, which should take place in advance of the roads contract being let to allow time to deal with any material identified.

5.3.56 Initial consultation with Historic Scotland was undertaken during the Stage 1 assessment. Further consultation will be undertaken with them in the future.

[18] Rig and furrow is a type of cultivation practiced in upland areas of the British Isles which differs slightly from the more common ridge & furrow in that it appears to have been created through excavation by spade rather than plough.

Impacts (Opening Year 1) without Mitigation

5.3.57 Refer to Figures 5028091_HER_001 & 002 in Appendix A for an outline of impacts in terms of Cultural Heritage

Tie-In Junctions

5.3.58 The impacts for all the Blue, Red and Yellow route options at the Broomknowes Junction are the same. Similarly, the impacts of the Blue, Red and Yellow route options at the Smithston Bridge Junction are the same.

5.3.59 At both the Broomknowes Junction and Smithston Junction the following applies:

- There will be no change to any Scheduled Monument, Listed Building, Conservation Area or Historic Garden & Designed Landscape.
- There will be no change to known non-designated cultural heritage assets recorded on the WoSAS SMR.
- The archaeological potential of the area is not currently known, and therefore potential impacts on as yet unknown buried archaeological remains cannot be ascertained. Further archaeological evaluation fieldwork would be required to assess the nature, extent and significance of any buried archaeological remains within the area of the junction.

Blue Base Route – S2 without Roundabout

5.3.60 There would be no adverse effects on Scheduled Monuments, Conservation Areas or Historic Gardens & Designated Landscapes. However the reduction in the volume of traffic would give the current setting of the Maybole Conservation Area, the Listed Buildings within the town and the Lyonstone Standing Stone a major/moderate beneficial impact on their setting.

5.3.61 There could be a medium negative change on the setting of the locally important Covenanters Memorial (A No. 4). The monument is located on the northern verge of the current road and the alteration of the line of the road here could change the monument's setting resulting in a minor adverse effect.

Photo 5.2 – The Covenanter's Memorial with Views to the East

5.3.62 There could be a small-scale negative change on the setting of the regionally important East Enoch House (A No. 3), resulting in a minor adverse effect.

5.3.63 The archaeological potential of the area is not currently known, and therefore potential impacts on as yet unknown buried archaeological remains cannot be ascertained. Further archaeological evaluation fieldwork would be required to assess the nature, extent and significance of any buried archaeological remains within the area of the junction.

Additional Impacts of Roundabout added to S2

5.3.64 The roundabout could increase the magnitude of change on the setting of the regionally important East Enoch House (A No. 3) to medium, resulting in a moderate adverse effect.

Additional Impacts of WS2+1

5.3.65 No further additional impacts identified.

Additional Impacts of Roundabout added to WS2+1

5.3.66 No further additional impacts identified.

Yellow Base Route – S2 without Roundabout

5.3.67 There would be no adverse effects on Scheduled Monuments, Conservation Areas or Historic Gardens & Designated Landscapes. However the reduction in the volume of traffic would give the current setting of the Maybole Conservation Area, the Listed Buildings within the town and the Lyonstone Standing Stone a major/moderate beneficial impact on their setting.

5.3.68 There is a potential moderate negative change on the setting of the locally important Kirklandhill Farmhouse (A No. 5), resulting in an overall minor adverse effect.

5.3.69 There will, potentially, be a substantial negative change on the setting of the remains of Kirklandhill Cottage (A No. 79), which whilst not being recorded on the WoSAS SMR could be considered to be locally important resulting in a moderate / slight adverse effect.

5.3.70 There is, potentially, a small-scale negative change on the setting of the regionally important East Enoch House (A No. 3), resulting in a slight adverse effect.

5.3.71 The archaeological potential of the area is not currently known, and therefore potential impacts on as yet unknown buried archaeological remains cannot be ascertained. Further archaeological evaluation fieldwork would be required to assess the nature, extent and significance of any buried archaeological remains within the area of the junction.

Additional Impacts of Roundabout added to S2

5.3.72 The roundabout could increase the magnitude of change on the setting of the regionally important East Enoch House (A No. 3) to medium, resulting in a moderate adverse effect.

Additional Impacts of WS2+1

5.3.73 No further additional impacts identified.

Additional Impacts of Roundabout added to WS2+1

5.3.74 No further additional impacts identified.

Red Base Route – S2 without Roundabout

5.3.75 There would be no adverse effects on Scheduled Monuments, Conservation Areas or Historic Gardens & Designated Landscapes. However the reduction in the volume of traffic would give the current setting of the Maybole Conservation Area, the Listed Buildings within the town and the Lyonstone Standing Stone a large/moderate beneficial impact on their setting.

5.3.76 There could be a potential medium negative change on the setting of the locally important Kirklandhill Farmhouse (A No. 5), resulting in an overall slight adverse effect.

5.3.77 There could be a small-scale negative change on the setting of the regionally important East Enoch House (A No. 3), resulting in a slight adverse effect.

5.3.78 There could be a substantial negative change on the setting of the remains of Kirklandhill Cottage (A No. 79), which whilst not being recorded on the WoSAS SMR could be considered to be locally important resulting in a moderate / slight adverse effect.

5.3.79 The archaeological potential of the area is not currently known, and therefore potential impacts on as yet unknown buried archaeological remains cannot be ascertained. Further archaeological evaluation fieldwork would be required to assess the nature, extent and significance of any buried archaeological remains within the area of the junction.

Additional Impacts of Roundabout added to S2

5.3.80 The roundabout could increase the magnitude of change on the setting of the regionally important East Enoch House (A No. 3) to medium, resulting in a moderate adverse effect.

Additional Impacts of WS2+1

5.3.81 No further additional impacts identified.

Additional Impacts of Roundabout added to WS2+1

5.3.82 No further additional impacts identified.

Mitigation Measures

General

5.3.83 In practice, a combination of possible mitigation measures to reduce the adverse effects of a scheme on cultural heritage assets is used. These could include:

- Locating the development or specific areas of ground disturbance away from known buried archaeological remains and elements of the built heritage and their settings;
- Providing for the excavation and recording of buried archaeological remains or elements of the built heritage or historic landscape before the start of earth-moving or other construction works that would affect them;
- Providing for an archaeologist to be "on call" so that any buried archaeological remains discovered during construction can be recorded (although this may not be the most effective solution);
- Reducing the impact on the Listed Buildings and the wider historic landscape by utilising appropriate designs and introducing suitable screening to reduce the impact on the setting of listed buildings and other visible cultural heritage assets.

5.3.84 At the current stage of scheme development mitigation proposals for impacts on as yet unknown buried archaeological remains cannot be put forward, and will be dependent on the undertaking of archaeological field evaluation. The scope and nature of all works would then need to be agreed with the West of Scotland Archaeology Service, and Historic Scotland.

5.3.85 Once the results of the archaeological evaluation are provided:

- In the event of archaeological remains of regional or national importance being encountered during archaeological evaluation fieldwork consider preserving in situ using appropriate designs. If this is not deemed to be feasible undertake full archaeological excavation to preserve by record; or
- In the event of archaeological remains of local importance being encountered during archaeological evaluation fieldwork ensure an archaeological watching brief is maintained during initial construction works in the area of buried remains.

Blue Route

5.3.86 Explore solutions that could assist in the reduction of the size of the embankment next to the Covenanters Memorial, or putting the road into a cutting if feasible.

5.3.87 Explore screening options that would reduce the visual impacts of the route on the setting of the East Enoch House that would fit in with the surrounding landscape.

Yellow Route

5.3.88 Explore the possibility of putting the route in a cutting between Kirklandhill farmhouse and Kirkland cottage.

5.3.89 Explore screening options that would reduce the visual impacts of the route on the setting of the East Enoch House that would fit in with the surrounding landscape.

Red Route

5.3.90 No further mitigation identified for this route from that above.

Impacts (Design Year 15)

5.3.91 There are no additional impacts for the Design Year (15) to those outlined for the Opening Year scenario. However, the visual impact associated with the construction of the bypass may be reduced with the mitigation measures implemented.

Conclusions

5.3.92 All three routes could potentially have moderate / slight adverse effects on regionally and locally important listed buildings, and on a locally important historic building. All these buildings are integral elements of the historic character of the area and consideration should be given towards the preservation of this character. The Covenanters Memorial also represents a surviving, tangible relationship between the modern town of Maybole and its past and consideration should be given towards ensuring the memorial retains its attractive and prominent position.

5.3.93 Importantly, it should be noted that the reduction in the volume of traffic through Maybole will have an overall moderate to large beneficial effect on the Maybole Conservation Area, and on a large number of Listed Buildings, including the Category A Collegiate Church (also a Scheduled Monument) (A No. 2 & 29) and Maybole Castle (A No. 38). The proposed bypass could also have a moderate beneficial effect on the setting of the Lyonston Standing Stone (A No. 1).

5.3.94 Mitigation to reduce the adverse effects of the routes on the setting of the buildings could comprise the provision of appropriate screening; such as placing the road within a cutting; or consider rerouting the proposed route away from the buildings.

5.3.95 All three routes could potentially have adverse effects on as yet unknown buried archaeological remains. The area to the north of Maybole is relatively undisturbed by development, and comprises a mix of arable and pastoral use without much intensive ground disturbance, suggesting that there is some potential for the presence of as yet unknown buried archaeological remains. In particular the presence of recorded prehistoric burials and possible enclosures at St Murray indicates that similar remains could be present elsewhere in the area.

5.3.96 In view of the amount of land take required for all the options, it is likely that a programme of archaeological field evaluation, using non-intrusive and intrusive survey methods, would be required to assess the nature, extent and significance of any buried archaeological remains. Once this has been undertaken a mitigation strategy can be devised.

5.3.97 In all cases, a suitable mitigation strategy would need to be prepared and agreed in close consultation with the West of Scotland Archaeology Service, and Historic Scotland.

5.3.98 From a cultural heritage perspective the least preferred route is the Blue option as this has impacts on a greater number of designated cultural heritage assets. The impacts of the Red and Yellow routes are the same although the Red route is slightly longer and therefore requires additional landtake and earthworks thereby increasing the potential for disturbing unknown archaeological features. Therefore the Yellow route is the preferred route. Within each route the alignment requiring the least amount of landtake, and therefore disturbance, is preferred.

5.3.99 The preferred alignment from a heritage perspective is the Yellow 3.1 with Blue 1.4 being the least preferred alignment.

5.4 Disruption Due to Construction

Introduction

5.4.1 This section identifies and assesses in broad, general terms, the disruption effects of operations required for the construction of a bypass on the surrounding environment.

5.4.2 The potential impacts of the construction of each of the options along each of the corridors have been identified and the sensitivity of adjacent or nearby properties and sites to any proposed construction activities has also been considered.

Methodology

5.4.3 This section of the assessment has been carried out in accordance with the guidance included in TD37 of the DMRB for Stage 2 Assessment Reporting.

5.4.4 The identification of properties within 100m of the centreline of the route options and the approximate amount of earth moving associated with the route options is assessed. The assessment comments on the effect and potential mitigation where disruption and/or disturbance are likely to occur.

5.4.5 For the purposes of assessment, typical construction methods have been assumed.

5.4.6 It is anticipated that most construction works will be “offline” where possible and this approach will limit the extent of traffic management measures and reduce any delays associated with construction.

Key Issues

5.4.7 The issues relating to the proposed route options, from a disruption due to construction perspective, include:

- Temporary localised increases in noise and dust (Noise and Air);
- Loss of amenity due to traffic management or use of the local roads by construction traffic (Pedestrians, Equestrians, Cyclists and Community Effects);
- Potential impacts on property accesses (Land Use);
- Delays to traffic caused by construction operations;
- Potential impacts on water quality, channel stability, habitats as well as potential for increased risk of flooding (Road Drainage and the Water Environment);
- Disturbance to flora and fauna (Ecology and Nature Conservation);
- Disturbance due to material haulage to and from the site (Geology and Soils); and
- The effect of surplus or deficit earthworks materials (Geology and Soils).

5.4.8 However, it is considered likely that the significance of these issues would be reduced as a result of the existing influence of the A77 and associated traffic.

Baseline Conditions

5.4.9 The following summarises the key baseline conditions of those environmental media considered to be particularly relevant to the issue of Disruption Due to Construction.

Air Quality

5.4.10 Air quality in the vicinity of Maybole is currently good and concentrations of all pollutants are below their respective Air Quality Standard (AQS) objectives.

5.4.11 Refer to Section 5.2 for detailed baseline air quality information.

Cultural Heritage

5.4.12 There are a number of cultural heritage assets within the vicinity of the route options including two Scheduled Monuments, four Listed Buildings, one Conservation Area, one Garden & Designed Landscape and three undesignated sites of archaeological remains.

5.4.13 East Enoch House is a Category B Listed Building situated to the north-west of Maybole and has direct access to the B7023 Culzean Road. It lies within 100m of the Red and Blue route options and may require some re-routing of the access track.

5.4.14 Kirklandhill is a Category C(S) Listed Building situated to the north of Maybole on Kirklandhill Path and within 100m of the Red and Yellow Routes.

5.4.15 Refer to Section 5.3 for detailed baseline information.

Ecology and Nature Conservation

5.4.16 There are no statutorily designated sites within the study area. However there are five non-statutory sites listed by the Scottish Wildlife Trust (SWT) and South Ayrshire Council.

5.4.17 Other features that require consideration during the construction period include:

- Potential impacts on the burns in the area which support fisheries and otters;
- Damage to habitats causing their temporary or permanent loss;
- Disturbance to species in the area due to noise and vibration.

5.4.18 Refer to **Section 5.5** for detailed baseline information.

Land Use

5.4.19 All routes predominantly cross open farmland and are remote from the main settlement of Maybole. There are relatively few properties lying within the study area and most of these are isolated farmhouses and associated outbuildings.

5.4.20 The Ranch Holiday Park has 65 static caravans and space for 30 additional tourers/mobile caravans. It is situated to the north-west of Maybole with access off the B7023 Culzean Road and falls within 100m of the Red and Blue route options.

5.4.21 Cargilston and Cargilston Cottage are situated to the north of Maybole and fall within 100m of the Blue route options.

5.4.22 St Murray is located to the north-east of Maybole and falls within 100m of the Blue route options.

5.4.23 A recent housing development has seen the footprint of Maybole expand northwards into the land shaded yellow in **Figure 5.4.6** below. These new properties lie within 100m of the Yellow route.

Figure 5.4.6 – South Ayrshire Council Planning Applications

Noise and Vibration

5.4.24 There are two residential properties within 100m of the Blue route, one residential property within 100m of the Yellow route and one residential property within 100m of the Red route. In addition to this Ranch Caravan Park is within 100m of both the Red and the Blue routes. There are a further 37 residential properties within 300m of the Blue route, 164 within 300m of the Red route and 278 within 300m of the Yellow route. Gardenrose Primary School is within 200m of both the Red and the Yellow route options and Carrick Academy is within 300m of the Yellow route.

5.4.25 Refer to Section 5.8 for detailed baseline information.

Pedestrians and Community

5.4.26 The only route of significance in the area is the National Cycle Route (NCR) 7 which runs north-south through Maybole.

5.4.27 Routes in the area that include footways for pedestrian use are B7023 Culzean Road, B7024 Alloway Road and the road that links B7023 and B7024. There are two further roads and a bridle path in the area without footways.

5.4.28 Refer to Section 5.9 for detailed baseline information.

Road Drainage and the Water Environment

5.4.29 There are four small watercourses that would be crossed or are close to the proposed route options. These include an unnamed burn that runs close to Cultezeoun Farm and crosses the existing A77; a small watercourse to the east of Ladycross Wood; an unnamed burn close to Nether Culzean Farm and the Brockloch Burn.

5.4.30 Refer to Section 5.11 for detailed baseline information.

Geology and Soils

5.4.31 The drift geology beneath the route options is predominantly Glacial Till. The solid geology of the site is dominated by Devonian aged Lower Old Red Sandstone Strata. The majority of land within the route options is classified as Grade 3_2 agricultural land.

5.4.32 Refer to Section 5.12 for detailed baseline information.

Consultation

5.4.33 No specific further consultation was carried out for this section of the assessment.

Key Impacts

Air Quality

5.4.34 The main issue during construction from an air quality perspective is the control of dust from earthworks, stockpiles and debris on the roads. The air quality effects of construction will be assessed in detailed at Stage 3 of assessment and will be included in Construction Management Plans to be prepared by the Contractor.

Cultural Heritage

5.4.35 It is possible that the route options may disturb unknown buried archaeological remains. The setting of some designated and undesignated cultural heritage assets may also be impacted on during construction.

Ecology and Nature Conservation

5.4.36 During construction there is potential for impacts on watercourses in the area, protected species and in particular otters. These potential impacts are outlined below:

- Loss of semi-natural woodland north of smithston bridge and disturbance of woodland at Ladycross/Black Wood, St Murray's Plantation and Brockloch Wood;
- Possible contamination or pollution incidents to Brockloch Burn, Abbymill Burn tributary, Chapelton Burn tributary and the temporal burns at north of Black Glen and Nether Culzean (dependent on the alignment); and
- Noise disturbance to species in the area.

Land Use

5.4.37 Both the Blue and Red route options pass within 100m of The Ranch Holiday Park, situated just off the B7023 Culzean Road. This property may be impacted on due to the scale of earthworks required as the road would be in excess of 10m of cut at this location.

5.4.38 The impact is more severe where the options incorporate the roundabout with the B7023 and it is likely that some properties could be directly affected by the earthworks required to accommodate this junction.

Noise and Vibration

5.4.39 Noise issues during construction have not been assessed at this stage of the assessment. However, it will be necessary to assess in detail the potential impacts arising from construction noise at a later stage of the assessment, and within Construction Management Plans produced by the Contractor.

Pedestrians, Cyclists, Equestrians and Community Effects

5.4.40 It is unlikely that the construction of any of the route options would have a major impact on the movement of pedestrians, cyclists or equestrians since the routes are remote from the settlement area of the town and no key community facilities exist beyond the outskirts of the town. The exception to this is potential for short-term disruption where grade-separated junctions are to be constructed including the National Cycle 7.

5.4.41 Please refer to Section 5.9 for more detailed information.

Water Quality and Drainage

5.4.42 There are several areas within the proposed schemes that will require burns to be diverted or culverted. These works are likely to cause disruption to the burn as they are undertaken. As with any construction work there is also an inherent risk of surface water and groundwater contamination. Potential contaminants include fuel oils from mechanical plant, high sediment loads in run-off from the site, cement, site disturbance within the water channel and general debris from the construction site.

Geology & Soils

5.4.43 A major factor with all of the bypass options is the volume of excavation required to construct the mainline, however the deepest cuts are relatively remote from the built-up areas of the town.

5.4.44 It is proposed at this stage that the fill requirements for the construction of embankments and the various landscape mitigation measures will be met from site won material, where possible. Preliminary quantities of cut and fill for each of the route options can be seen below in Table 5.4.31. These quantities are based on preliminary information and it is likely that fine-tuning of the preferred option could further minimise any imbalance and thus the need to import additional material to site or remove excess material to landfill.

Table 5.4.31 – Earthworks Quantities

Route Option	Cut (m^3)	Fill (m^3)	Difference (m^3)
1.1 Blue S2	391,551	435,400	- 43,849
1.2 Blue S2 + B7023 R'bout	339,061	441,922	- 102,861
1.3 Blue WS2+1	413,677	460,598	- 46,921
1.4 Blue WS2+1 & B7023 R'bout	362,823	468,149	- 105,326
2.1 Red S2	595,198	192,430	+ 402,768
2.2 Red S2 + B7023 R'bout	526,900	203,041	+ 323,859
2.3 Red WS2+1	623,953	198,427	+ 425,526
2.4 Red WS2+1 R'bout	556,092	210,696	+ 345,396
3.1 Yellow S2	282,140	263,557	+ 18,583
3.2 Yellow S2 + B7023 R'bout	285,011	278,723	+ 6,288
3.3 Yellow WS2+1	294,331	267,077	+ 27,254
3.4 Yellow WS2+1 & B7023 R'bout	296,930	283,257	+13,673

Mitigation Measures

General

5.4.45 Through reference to the baseline conditions and assessment, mitigation measures to reduce the significance of disruption due to construction are likely to use the following approach:

- Minimise the impact on traffic using the A77;
- Minimise the impact on local traffic on adjoining local roads;
- Restrict contracted working hours to socially accepted periods;
- Take cognisance of seasonal constraints;
- Take appropriate measures to minimise vibration, noise dust and mud; and
- Ensure the most sustainable re-use of site won material.

Air Quality

5.4.46 Mitigation measures to control dust during reclamation and construction would be required in order to undertake a DMRB Stage 3 assessment, and would typically be enforced through contract documentation. However, some typical measures likely to be appropriate have been outlined at this stage in Section 5.2.

Water

5.4.47 The risk of pollution can be significantly reduced by the adoption of good working practices and strict adherence to the appropriate SEPA Guidelines. The key guidelines to adhere to are outlined in further detail in **Section 5.11.68**.

5.4.48 Further mitigation measures may include:

- On-site availability of oil spill clean up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak;

- Use of drip trays under mobile plant; and
- Sediment trapping.

5.4.49 Any material imported for use in construction should be from the most local, available resource and should be inert and free from contaminated material, so as to avoid any potential contamination of the watercourse or groundwater.

5.4.50 Effective pollution prevention measures for siltation, hydrocarbonates, other chemicals and concrete / cement / tar will be incorporated in the scheme design. Risk assessments for possible pollutants should be provided by the contractor's Construction Method Statement (CMS) prior to carrying out any work on site.

5.4.51 Any works close to watercourses, or that may lead to impacts within watercourses, should be timed to avoid any interference with spawning fish and breeding seasons for mammals.

Conclusions

5.4.52 The key factors in distinguishing between the impacts of the proposed schemes in regard to disruption due to construction include the following:

- Impacts on East Enoch and potential rerouting of the access track;
- Impacts on the Caravan Park;
- Impacts on St Murray
- Impacts on the Whitefaulds residential area; and
- The cut to fill earthworks balance.

5.4.53 The Blue and Red routes have the greatest potential impacts on East Enoch, the Caravan Park and St Murray, all being within 100m of the proposed routes.

5.4.54 The Yellow route has the greatest potential impact on the Whitefaulds residential development which is within 100m of the proposed route

5.4.55 The Yellow route, followed by the Blue route, provides the best cut to fill ratios. The Red route provides the worst cut to fill ratios.

5.4.56 Based on the impacts outlined above the route preferences, from a disruption due to construction perspective are as follows:

- Yellow 3.2, followed by 3.4, 3.1, 3.3
- Red 2.2, followed by 2.4, 2.1, 2.3
- Blue 1.1, followed by 1.3, 1.2, 1.4

5.5 Ecology and Nature Conservation

Introduction

5.5.1 This section describes the ecological baseline conditions and provides a comparative assessment of the potential impacts of the options for the proposed A77 Maybole bypass on habitats and nature conservation interests. The proposed options run from near Broomknowes Farm southwest of Maybole to north of the Smithston Bridge.

5.5.2 The level of assessment undertaken here is given in accordance with the Stages of Ecological Assessment as described in the Design Manual for Roads and Bridges (DMRB) 11:3:4. This Stage 2 assessment has enabled a preferred route option (from an ecological and nature conservation perspective) to be identified and has identified further ecological surveys that will be necessary to complete the assessment of potential ecological impacts to DMRB 11:3:4 Stage 3 level.

5.5.3 At Stage 1 the assessment considered several routes located both north and south of Maybole town. These route options have since been refined and all southern routes removed from further assessment. All alignments considered at Stage 2 are, located within a corridor to the north of Maybole Town. There are currently three main bypass routes under consideration. Each of the three options is split into four sub-options, giving a total of 12 different options. For further specific route option details, see **Section 3**.

Key Issues

5.5.4 From an ecological and nature conservation perspective, the key issues relating to the proposed bypass options as they are currently understood are:

- Direct and permanent loss of habitats which provide foraging, breeding and commuting grounds for a range of species, including bats, badgers (*Meles meles*), otters and breeding birds. Key habitats that would be lost include semi-natural broad-leaved woodland, agricultural grassland, hedgerows and tree lined field boundaries;
- Potential impacts on water quality and hydrology of the Abbeymill Burn tributary, Brockloch Burn, Chapelton Burn tributary and the smaller unnamed burn at Ladycross. These burns have the potential to support fisheries and are known to support otters (*Lutra lutra*), a European protected species;
- Temporary disturbance to species in vicinity of the working corridor through noise, vibration, and interference during construction;
- Permanent disturbance to species using adjacent habitats during operation of the new bypass;
- Habitat severance between areas of ancient and semi-natural ancient woodland (especially between St Murray Plantation, Ladycross Wood and Brockloch Wood) resulting in an increased vulnerability to road casualty for fauna commuting between these habitats, and;
- Cumulative ecological impacts associated with town infill as specified in the South Ayrshire Local Plan19.

[19] South Ayrshire Council- Interactive Local Plan: http://www.gis.south-ayrshire.gov.uk/website/viewerLocalPlan

Methodology

5.5.5 This Stage 2 Assessment follows a Stage 1 desk study and survey. Consulation and survey carried out for the Stage 1 Assessment has been augmented by consultation and survey from the Stage 2 Assessment. Refer to **Section 5.5.53 to 54** and Appendix E for further details of the consultation process.

Data Gathering

5.5.6 A desk study was undertaken to gather information on statutory and non-statutory nature conservation designations using a search area of 2 km either side of the bypass corridor (i.e. a 4km search corridor) following planning guidance (National Planning Policy Guidance NPPG 14 – Natural Heritage).

5.5.7 In order to gather information on the presence of notable species of flora and fauna a search area of 1 km surrounding the route corridor was adopted. The search area was extended as appropriate for these species[20].

5.5.8 Statutory and non-statutory groups and organisations were consulted regarding their views on the Maybole bypass proposals as well as requesting information which would assist with the ecological assessment. A list of consultees and a summary of their responses is shown in the register in Appendix E.

5.5.9 In addition an internet search was conducted to find records of notable species including legally protected species, Species of Conservation Concern (SOCC) and Biodiversity Action Plans (BAP) species within the Maybole area. This involved examination of species data held on the National Biodiversity Network (NBN) Gateway and the South Ayrshire County Council website.

Field Survey

5.5.10 An ecological walk-over survey of the route corridor was conducted on the 5th-6th September 2006 and between the 31st October and the 2nd November 2006. The study area is illustrated in Appendix A and was defined by the location of the route options and likely activities associated with construction. This resulted in a possible zone of influence which was established to include key features in the surrounding environment and totalled an area of approximately 6 km^2.

5.5.11 Definition of the study area also considered the following factors:

- Activities associated with the proposal e.g. scale and distribution (considering the likely duration of activities including construction and operation);
- Ecological features present within and adjacent to the footprint of works and their vulnerability to change and disturbance; and
- Ecological factors e.g. distribution of habitats, location of key features, ecological linkages and likely exposure to the proposed activities.

[20] Notable species include legally protected species, species rare at a district/city level or at a national level and species listed as priorities for nature conservation action in the UK and local South Ayrshire Biodiversity Action Plans (BAP). For further details see Appendix E.

5.5.12 The survey followed the extended Phase 1 Survey methodology[21],[22] (this includes best practice survey references for all species listed in 1.1.13) and updated records obtained during the initial Stage 1 assessment to provide further information on habitats and the potential for notable flora and fauna to occur in or adjacent to the study area. The survey also targeted areas likely to support legally protected species or plants subject to legal control (e.g. Japanese knotweed *Fallopia japonica* and giant hogweed *Heracleum mantegazzianum*).

5.5.13 The information is presented on a suitably scaled Phase 1 habitat map (refer to 5028091_ECO_001 in Appendix A). The main habitat types and important feature are described by Target Notes, which are referred to in the text as follows, (TN1). A full list of target note records is provided in Appendix E. All plant nomenclature is provided according to the *New Flora of the British Isles*, 2nd Edition[23] and scientific (Latin bi-nomial) is given when first mentioned in the text but not thereafter.

5.5.14 Preliminary investigations were undertaken in respect of the presence of the following legally protected species, those asterisked were also recommended for survey by SNH (See Appendix E):

- Otter* (*Lutra lutra*): searches for potential holts, feeding remains, prey availability and spraints along watercourses. Road Traffic Accident (RTA) data was also sought through consultation;
- Bats*: searches for potential roost sites, particularly in mature trees or local buildings within the scheme area;
- Badger* (*Meles meles*): activity including setts, tracks, snuffle holes and latrines. RTA data was also sought through consultation;
- Water vole (*Arvicola terrestris*): activity such as the presence of burrows, feeding stations, faeces, lawns and latrines along suitable water courses;
- Barn owls (*Tyto alba*): potential roosting or nesting sites particularly in mature trees or suitable buildings within the scheme area, identification of linear features that may be used during patrol of the territory and suitable hunting grounds, and;
- Search for other suitable bird nesting habitat.

Survey Constraints

5.5.15 This Stage 2 ecological survey has not tried to produce a comprehensive list of plants and animals for the survey area, as any ecological survey will be limited by factors which affect the presence of plants and animals such as the time of year, migration patterns and behaviour. All surveys were completed during optimal period for the species and the results have allowed an assessment of the significance of potential impacts that may arise from the proposed route options, and consideration of appropriate mitigation measures as appropriate for a Stage 2 DMRB assessment.

Evaluation and Assessment

5.5.16 The assessment of potential impacts arising from each of the 12 route options has been undertaken using the ecological baseline information and by comparing the sensitivity of a feature against the proximity to, and effect of, a particular route option. Where possible, generic impacts associated with road schemes have also been considered. These impacts can include some or all of the following (Adapted from Roads & Nature Conservation):

[21] Handbook for Phase 1 Habitat Survey (JNCC, 2003)
[22] Guidelines for Baseline Ecological Assessment (Institute of Environmental Assessment, 1995)
[23] Stace, (1997) The New Flora of the British Isles ed. 2.

Table 5.5.32 – Potential Types of Impact

Impact
Direct loss or damage to wildlife habitats (e.g. permanent landtake, increase in vulnerability or reduction in biodiversity).
Direct or indirect loss of protected species or species of nature conservation importance; (either individuals or populations, including genetic resource).
Landscape level impacts resulting in disturbance and barrier effects to the movement of species, fragmentation, deterioration and isolation of habitats or the removal of wildlife corridors.
Modification to ecosystem processes (e.g. local hydrology, ground conditions, soil chemistry and/or water quality including ground or surface waters and pollution).
Cumulative or synergistic impacts (whereby an impact may result in a future impact, or the combined effect of a number of impacts is greater than each individual impact).

5.5.17 Standard assessment is also based on the phase of the project in which the impact is predicted to occur and includes on-site impacts as well as those on adjacent features of ecological value. With the information available at this stage (Stage 2, DMRB) it is not possible to provide a comprehensive assessment of impacts associated with the construction phase of the preferred scheme, neither is it appropriate to assume specific mitigation without the more detailed survey information usually gathered at Stage 3.

5.5.18 Therefore the impact assessment is limited by the level of ecological information available and as such follows a precautionary approach whereby a "worst case scenario" is envisaged. The precautionary principle is also addressed in National Planning Guidance (PAN 58) regarding EIA[24] It should be noted that some standard construction mitigation has been assumed where stated in the text.

Nature Conservation Value

5.5.19 The evaluation of ecological features is undertaken within a defined geographical context. The criteria are broadly consistent with the Guidelines for Ecological Impact Assessment[25] and "A Nature Conservation Review"[26] which include concepts of integrity, sensitivity, diversity, rarity and naturalness.

[24] The Precautionary Principle (PAN 58) "The principle that authorities should act prudently to avoid the possibility of irreversible environmental damage in situations where the scientific evidence is inconclusive but the potential damage could be significant."

[25] Institute of Ecology and Environmental Management (2006) Guidelines for Ecological Impact Assessment in the United Kingdom (version 7 July 2006). http://www.ieem.org.uk/ecia/index.html

[26] Ratcliffe, D.A. (1977) A Nature Conservation Review, Cambridge University Press

Table 55.5.33 – Geographical Context for Nature Conservation Value

Status	Description
INTERNATIONAL	Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar Sites.
NATIONAL	Sites of Special Scientific Interest (SSSI).
REGIONAL	Viable areas of key habitat identified in Natural Heritage Futures (Scottish Natural Heritage, 2002[27]).
DISTRICT	e.g. South Ayrshire, Local Nature Reserves, and also included Sites of Importance for Nature Conservation SINCS, Wildlife Sites, Raised Bog and Ancient Woodlands.
LOCAL	Ecological features such as hedgerows, woodlands, watercourses, ponds within 2km of the site.
SITE	Site and immediate environs e.g. arable field patchworks.
NEGLIGIBLE	Site and immediate environs: Habitats that are considered unlikely to contribute to the ecological function of a site such that their loss would not have adverse impacts on the ecology of the site. E.g. hard standing and existing metalled roads.

Impact Significance and Magnitude

5.5.20 The significance of an adverse or beneficial impact is the product of the magnitude of impact and the conservation value/sensitivity of the ecological feature affected. For example high levels of significance will generally be ascribed to large impacts on features of high nature conservation value. Whilst low levels of significance will generally be ascribed to small impacts on features of high nature conservation value or larger impacts on features of low nature conservation value.

5.5.21 The following criteria, presented in **Table 5.5.34** can be used to assess the significance of adverse or beneficial ecological impacts is based on a seven-point scale from negative major to positive major.

[27] SNH, 2002 Natural Heritage Futures. West Central Belt: http://www.snh.org.uk/futures/Data/pdfdocs/West_Central_Belt.pdf

Table 5.5.34 – Criteria for Impact Assessment

Impact	Atkins Standard Definitions: Example Impacts
1. Negative Major	Loss of, permanent damage to or adverse impact on integrity of any part of a site of international or national importance; Loss of a substantial part or key feature of a site of regional importance; Loss of favourable conservation status (FCS) of a legally protected species; Loss of or damage to a population of nationally rare or scarce species.
2. Negative Moderate	Temporary disturbance to a site of international or national importance, but no permanent damage; Loss of or permanent damage to any part of a site of district importance; Loss of a key feature of local importance; A substantial reduction in the numbers of legally protected species such that there is no loss of FCS but the population is significantly more vulnerable; Reduction in the amount of habitat available for a nationally rare or scarce species, or species that are notable at a district or city level.
3. Negative Minor	Temporary disturbance to a site of district value, but no permanent damage; Loss of, or permanent damage to, a feature with some ecological value in a local context but that has no nature conservation designation; A minor impact on legally protected species but no significant habitat loss or reduction in FCS; A minor impact on populations of nationally rare or scarce species or species that are notable at a district level

Impact	Atkins Standard Definitions: Example Impacts
4. No Impact ***(Neutral Magnitude)***	No impacts on sites of international, national or district importance; Temporary disturbance or damage to a small part of a feature of local importance; Loss of or damage to land of nature conservation value within a site context; No reduction in the population of legally protected, nationally rare, nationally scarce or notable (district level) species on the site or its immediate vicinity.
5. Positive Minor	A small but clear and measurable gain in general wildlife interest, e.g. small-scale new habitats of wildlife value created where none existed before or where the new habitats exceeds in area the habitats lost.
6. Positive Moderate	Larger scale new habitats (e.g. net gains over 1 ha in area) created leading to significant measurable gains in relation to the objectives of biodiversity action plans
7. Positive Major	Major gains in new habitats (net gains of at least 10 ha) of high significance for biodiversity being those habitats, or habitats supporting viable species populations, of national or international importance cited in Annexes I and II of the Habitats Directive or Annex I of the Birds Directive

Baseline Conditions

Desk Study Information

5.5.22 There are no statutory designated sites within the 2km radius search area. However, there are five non-statutory sites as listed by the Scottish Wildlife Trust (SWT) and South Ayrshire Council. These sites include provisional Wildlife Sites (pWS) designated by the SWT. $_{P}$WS sites are considered of the greatest ecological value beneath statutory sites in the designation hierarchy. No details regarding the first four sites listed below could be found through data search or consultation with the SWT apart from Mochrum Loch (as provided by the SWT). Figure 5028091_ECO_002 (Constraints Map) in Appendix A, shows the location of the sites listed below:

- Blairbowie Pond/Flushes Provisional Wildlife Site,
- Heart Loch Provisional Wildlife Site,
- Chapelton Loch Provisional Wildlife Site;
- Chapelton Burn Provisional Wildlife Site; and
- Mochrum Loch Provisional Wildlife Site – a species-rich upland loch, with adjoining mire and wet heath. Site includes uncommon plant species and a good variety of breeding and wintering birds.

5.5.23 The SWT supplemented this information with details regarding an additional three sites located outside of the 2 km radius search area, as given below:

- Mochrum Hill provisional Wildlife Site – a volcanic hill with a variety of plant and mammal communities;
- Rancleugh Burns provisional Wildlife Site – a steep-sided valley with long-established semi-natural woodland, important for breeding mammals and birds; and
- Garryhorn Burn provisional Wildlife Site – a wooded valley, a lowland extension of the upland Carrick Hills Provisional Wildlife Site.

5.5.24 Other features important to nature conservation within the vicinity of Maybole include both ancient woodland and semi-natural ancient woodland listed on Scottish Natural Heritage's (SNH) Ancient Woodland Inventory (AWI) (see Figure 5028091_ECO_001 in Appendix A). Ancient woods of semi-natural origin (ASNO) appear as semi-natural woods on maps from 1750 or the mid-1800s and have been continuously wooded to the present day. ASNO are generally the most valuable for conservation. Semi-natural ancient woodland consists predominantly of native trees and shrubs that have not obviously been planted but have arisen from natural regeneration or coppice regrowth. These woodlands include Gallowhill Plantations, Black Wood, Ladycross Wood, St Murray's Plantation and Brockloch which are all within 1 km of the route corridor (See Appendix A for Map).

Protected Species

5.5.25 As part of the Stage 1 Assessment (refer to **Section 5.5.13**), a desk study was conducted for protected and UKBAP species within 2km of the extended route corridor. These species are listed below and species asterisked were observed or evidence found during the Stage 1 or 2 surveys.

- Pipistrelle bats (*Pipistrellus pipistrellus* and *P. pygmaeus*)
- Otter *
- Badger *
- Brown hare (*Lepus europaeus*)*
- Water vole
- Farmland birds including yellowhammer (*Emberiza citrinella*)*, tree sparrow (*Passer montanus*)*, reed bunting (*Emberiza schoeniclus*)* skylark (*Alauda arvensis*)*
- Wildfowl including whooper swan (*Cygnus cygnus*), white fronted goose (*Anser albifrons*), barnacle goose (*Branta leucopsis*), pink footed goose (*Anser brachyrhynchus*)
- Other protected birds including marsh harrier (*Circus aeruginosus*), merlin (*Falco columbarius*), kingfisher (*Alcedo atthis*), barn owl, black-tailed godwit (*Limosa limosa*) and wood sandpiper (*Tringa glareola*).

5.5.26 For a full explanation of the legislation relating to their protection, refer to Appendix E.

5.5.27 SNH holds no protected species data for the area of search. However, data was provided by Rosemary Green, Scottish Badgers and Scottish Bats (refer to Appendix E).

Field Survey Results

Habitats and Flora

5.5.28 The survey area is situated adjacent to a rolling landscape north of Maybole within 5 km of the west coast on the Firth of Clyde. The landscape is characterised by a mosaic of grazing pasture of varying quality, interspersed with numerous arable fields. The majority of these fields are bordered by either small stands of trees or defunct hedgerows. Low lying pastures are likely to become waterlogged during the winter months and support an array of wintering bird species. There are several small burns and temporary issues which connect a series of small lochs and water bodies in the adjacent valleys. There are a few small patches of woodland located within the study area together with occasional mature elm trees

5.5.29 The Phase 1 Habitat types and survey boundary are shown in Appendix A - Phase 1 Habitat Map. The main habitats present within the ecological survey area are:

- Running water
- Woodland
- Grassland including arable/improved and semi-improved
- Hedgerows and bordering features

5.5.30 Detailed descriptions of these habitats, including site specific details including dominant, notable or protected species present are provided below.

Table 5.5.35 – Summary Table of Habitats and Associated Conservation Value

Habitat	Summary of Habitat Character and Composition	Conservation Value
Running Water	Abbeymill Burn tributary (TN 1 & 2) is a small burn which supports a marginal community dominated by soft rush (*Juncus effusus*). The burn passes through two culverts including one large pipe culvert below the existing A77. The other smaller culvert is situated below a further disused road section. During the Stage 1 survey, evidence of otter was found on the section of this burn southwest of the existing A77. No evidence of water vole was discovered.	**Local**
	A small burn at Ladycross (TN 33). Channel undefined often permeates to subsurface flow leading to marshy conditions. Where channel is present this is bordered by mature beech trees (*Fagus sylvatica*) and scattered scrub. This could provide cover for mammal species although no evidence was found to confirm otters or water voles. Bats and owls are likely to use the tree line as a foraging/commuting corridor.	**Local**
	Brockloch Burn (TN 30) is a well managed drainage channel which discharges into the fishing loch at Holmes Farm and it may support fish species. Otter evidence was confirmed beneath Slateford bridge.	**Local**
	The Unnamed tributary of Chapelton Burn (TN 7-9, 13) has diverse marginal and in-channel plant communities. The burn was found to support otter (TN 10-12). However, no water vole evidence was discovered.	**Local**
Semi-natural (ancient origin) and plantation woodland	Three woodlands within the route corridor are listed on the Ancient Woodland Inventory (AWI); St Murray's Plantation (TN 6), Ladycross/Black Wood (TN27 & 23 respectively) and Brockloch Wood (TN 34) which is also listed as semi-natural ancient woodland. Both St Murray's Plantation and Ladycross/Black Wood are highly modified with young Sitka spruce (*Picea sitchensis*) plantation. Brockloch Wood and Ladycross wood support more developed ground flora indicative of ancient woodland in comparison to that recorded in St Murray's plantation.	St Murray's Plantation, Brockloch Wood and Ladycross/ Black Wood are of **District** value
	The remaining woodlands of importance within the route corridor include areas of broadleaved plantation and semi natural woodland at "Lover's Lane" (TN 5), Black Glen (TN 29), Smithston Bridge (TN 35) and Nether Culzean (TN 16). These relic woodlands retain many mature wych elm (*Ulmus glabra*), and lime (*Tilia europaea*) trees. Limited evidence of mammal activity was found within these woodlands and no specific evidence of protected species was discovered during this survey	"Lover's Lane" Wood, Black Glen, Smithston Bridge and Nether Culzean are of **Local** value

Habitat	Summary of Habitat Character and Composition	Conservation Value
Hedgerow & border features	Hedgerows although old, were predominantly defunct and species poor, dominated by hawthorn (*Crataegus monogyna*), with occasional gorse (*Ulex europaeus*) and beech. Some hedgerows were however of increased value, particularly at the Broomknowes Junction and where large numbers of UKBAP species of birds were present (TN 4). Mature standard trees within some hedges enhances the ecological value and structure of the hedgerow habitat and some standard trees have potential for bat roosts. Species included beech, wych elm (TN 28), ash (*Fraxinus excelsior*) (TN 5), oak and sycamore. Of particular significance are the group of mature beech and oak trees TN37 and further veteran wych elms situated at TN 28 and the group of English elm (*Ulmus minor* var. *vulgaris*) north of the railway at Nether Culzean.(TN16) and also the large mature ash tree at TN 5.	**Local**
Grassland	The landscape to the north of Maybole town is largely improved/semi-improved pasture grazed by sheep, cattle and horses, interspersed with numerous arable fields sown primarily with barley (*Hordeum* sp.). The species composition within the sward varies according to the intensity of grazing pressure or treatment. Some of the improved grassland fields are cropped for silage or hay and these displayed the least species richness, with perennial ryegrass (*Lolium perenne*) the dominant, and sometimes the only species in the sward. Generally forb species diversity was poor with white clover (*Trifolium repens*) and buttercups (*Ranunculus repens* and *R. acris*) dominant.	**Site** **Site**

Protected Species

5.5.31 No detailed species surveys have been undertaken as part of this Stage 2 assessment. However, during the extended Phase 1 survey, specific searches were undertaken for field signs indicating the presence of protected species. The walkover also identified the requirements for further survey, these are listed below and will form part of the Stage 3 assessment.

Otters

5.5.32 The presence of otters was discovered in several locations throughout the route corridor:

- Slateford Bridge (TN 31),
- Bankend Bridge over the Chapelton Burn tributary (TN 10-12) where otter spraints and footprints were discovered, and;
- A small temporal burn north of the railway line at Nether Culzean (TN 18).

5.5.33 Otter evidence was also found outwith the scheme west of Maybole on the Rancleugh Burn at a road bridge leading to Old Trees Farm (TN 32).

5.5.34 Of these sites the evidence discovered along the Chapelton Burn tributary near Bankend Bridge (TN 7-9) is considered to be of greatest significance, as field signs were present at several locations within a small area. A number of these signs demonstrated recent activity and included a spraint and a footprint (TN10-12). This evidence suggests the burn is within an active otter territory and was located within 100m of two known otter RTAs on the A77 between August 2005 and May 2006 (Consultation - Appendix E) Significantly a further RTA was recorded only 1km away from this known sprainting site.

5.5.35 No otter holts were discovered within the study area, although woodland at Bankend Bridge in particular displayed habitat with potential to provide holt sites. The composition of the spraint evidence suggests these burns may provide a feeding resource of small fish, amphibians and wildfowl.

Badgers

5.5.36 Badger evidence was discovered (in the form of hairs on a barbwire fence) located at the pumping station north of Ladycross Wood (TN 21). Although this site is outside of the survey area, this confirms badger presence with the vicinity and it is therefore likely that habitats within the route corridors may be utilised by this species.

5.5.37 One badger RTA record was provided for the survey area (see Appendix E). The record was located at Baltersan Mains on the A77 and dated 2003.

5.5.38 Further searches of the woodland areas at Ladycross/Black Wood (TN 23,27), St Murray's Plantation (TN6), Black Glen (TN29), Nether Culzean (TN16) and Brockloch Wood (TN34) found no evidence of badgers. Burrows (TN 27) and mammal paths were located although the size and nature of the field signs indicated that they were likely to be used by species other then badger such as fox and rabbit.

5.5.39 The pastoral and woodland landscape within the refined route corridor is likely to provide an ideal foraging resource for badgers and they are likely to range widely throughout the landscape.

Water Vole

5.5.40 No evidence of water vole was found during the survey, although habitat with the potential to support the species was identified. Two main areas were concentrated on during this survey; along the Abbeymill Burn tributary at Parish March Bridge and along the unnamed burn between Ladycross and Craigliston (TN 1, 2 & 33 respectively).

5.5.41 Both areas provided occasional evidence of field vole (Microtus agrestis), but no signs of water vole. Given that field signs for field vole were recorded it is considered that if water vole had been present within the area then evidence of the species would have been detected.

Bird Species

5.5.42 Various bird species were observed during the survey and a full species list can be found in Appendix E. Habitat likely to be used for nesting was present throughout the study area and although no nests were observed, this could be attributed to the timing of the survey outside of the main breeding period (between the 5th-6th September 2006 and between the 31st October and the 2nd November 2006). Potential nesting habitat included hedgerows, woodland, scrub, tree borders and low intensity agricultural land. One area which appeared to be of particular importance for bird species (including all the passerines listed below) was a mosaic of habitat providing a variety of habitat for foraging and roosting. This area included an arable field filled with thistle species (*Cirsium* sp.), large standard trees (wych elm and ash) with hawthorn border located at TN 4.

5.5.43 Notable species observed during the survey included redwing (*Turdus iliacus*), fieldfare (*Turdus pilaris*) and peregrine falcon (*Falco peregrinus*), which are all fully protected Schedule 1 birds (refer to Appendix E for details of protected birds). Hunting territory for peregrine falcons is likely to extend throughout the survey area, although no suitable nesting sites are present within the footprint of works. Redwing and fieldfare occurred in large groups although they are only present in the area as winter visitors. Linnet (*Carduelis cannabina*), yellowhammer (*Emberiza citrinella*), bullfinch (*Pyrrhula pyrrhula*), skylark (*Alauda arvensis*) and tree sparrow (*Passer montanus*) which are all Red listed species were also observed during the survey. (Bullfinch, skylark, tree sparrow and linnet are also all UKBAP species, See Appendix E for details). These species are all known to breed in the area (See Appendix E).

5.5.44 In addition the habitats within the refined route corridor are likely to support high numbers of small mammals such as field voles, these species are important prey items for raptors, such as barn owl, which are known to breed within the vicinity of Maybole (See Appendix E). Other raptors including buzzard (*Buteo buteo*), kestrel (*Falco tinnunculus*) and sparrow hawk (*Accipiter nisus*) were all seen during the survey.

5.5.45 No positive evidence of wintering wildfowl was obtained during this assessment and no records were received during consultation. However these areas of arable land do have the potential to be used for feeding and the vicinity of known roost sites at Drumore Loch, Mochrum Loch and Blairbowie Pond (See Appendix E) make these habitats ideal.

Bats

5.5.46 No specific evidence of bats was recorded during the survey. However, several mature trees (TN 5, 28, 37) and one bridge (TN 17) are located within the refined route corridor, which provide suitable sites for bat roosts. The network of hedgerows and scattered trees are also likely to provide excellent commuting and foraging routes. This is especially true of the tree lined burn which joins Ladycross Wood with Craigliston (TN 34).

5.5.47 Within the scheme area other burns are also likely to be used for foraging and commuting, these include Brockloch Burn, the burn at Ladycross, and Chapelton Burn including its tributaries. Woodland areas within the scheme also have potential to provide foraging habitat and these areas include Ladycross/Black Wood, St Murray's Plantation, Brockloch Wood, Lover's Lane Wood, Black Glen, Holmes Farm, Drumellan Wood and Nether Culzean.

5.5.48 Within the wider agricultural environment surrounding Maybole there are a large number of farms and other buildings which potentially provide further valuable roosting sites and in particular the farm at Cargilston.

5.5.49 From the initial desk study two species were found to be present within the Maybole area. However, after further consultation with the Scottish Bat Group (For details see Appendix E) six species were found within Ayrshire and these species are likely to be present within the Maybole area as it provides ideal habitat for bat foraging and roosting.

Other Mammal Species

5.5.50 Two brown hares (which are a UKBAP priority species) were sighted during the Stage 1 walkover survey close to St Murray and Kirklandhill Farms. The mixed agricultural landscape is ideal habitat for this species with fields providing suitable breeding forms and lay-cover for young leverets.

5.5.51 Other species recorded during the Stage 1 and 2 walkover surveys include stoat (*Mustela erminea*), fox (*Vulpes vulpes*) (TN24,25) field vole (TN 2,9), roe deer (*Capreolus capreolus*) (TN 23) and rabbit (*Oryctolagus cuniculus*) (TN 24).

Summary

5.5.52 From the surveys undertaken at Stage 1 & 2 the survey area is known to support or has the potential to support the following species;

- Otter - presence confirmed in September 2006 on Brockloch Burn, Chapelton Burn tributary and Rancleugh Burn. Otter RTA records for both 2005/2006 from just north of the Smithston Bridge;
- Badger – presence confirmed in November 2006 north of Ladycross Wood at the Scottish Water pumping station. No setts or evidence found within the refined route corridor;
- Important bird species - including sky lark, reed bunting, linnet and yellowhammer, tree sparrow, bullfinch and barn owl;
- Deer- presence confirmed throughout the footprint of works;
- Bats – potential usage of corridors along Brockloch Burn and unnamed burn leading from Ladycross Wood and potentially roosting in buildings and trees within and surrounding the refined route corridor;
- Water vole –low potential as no evidence was located during surveys at Stage 1 or subsequently at Stage 2, although suitable habitat is present;
- Fisheries in watercourses especially Brockloch Burn which joins a fishing loch at Holmes Farm.

Table 5.5.36 – Nature Conservation Evaluation

Geographical Area	Description
INTERNATIONAL/ NATIONAL	There are no international (SPA/SAC) or national (SSSI) sites of importance for nature conservation within the refined route corridor. The closest site is the Maidens – Doonsfoot SSSI located 4.7km to the west.
REGIONAL	Three habitats listed in the SNH Futures Area of the West Central Belt are present within the refined route corridor at Maybole. These habitats include broadleaved woodland, mixed woodland and scrub (Appendix E). Because these habitats are found to be of such small size in comparison with those of regional importance and as they display limted biodiversity value and low quality they have been evaluated at a lower level in the conservation hierarchy. (See District level below)
DISTRICT	Woodland listed on the Ancient Woodland Inventory (AWI), Semi-natural Woodland Inventory and non-statutory designated sites including provisional wildlife sites have been assessed as being of value within a district context. Sites include; Ladycross/Black Wood, St Murray's Plantation and Brockloch Wood. Outside of the road corridor, but within 2km of the site are five provisional Wildlife Sites: Chapelton Burn, Blairbowie Flushes/Pond, Heart Loch, Chapelton Loch and Mochrum Loch.
LOCAL	Permanent watercourses throughout the study area including the unnamed burn at Ladycross, the Chapelton Burn tributary and Brockloch Burn, Whilst predominantly of low quality these are of significance within a local context due to their intrinsic conservation value in supporting otter (a European protected species). Woodland at Lover's Lane, Nether Culzean, Smithston Bridge and Black Glen are not listed on the AWI but are of value within a local context, due to the quality of the habitat and their function within the wider landscape as wildlife corridors. These woodlands may also support nesting birds and bats. Hedgerows and tree lined field boundaries are also important within a local context as they provide important nesting and feeding grounds for UK BAP species of birds.
SITE	Farmland including semi-improved grasslands and arable fields are generally of value within a site context. Other small scrub areas and temporary burns are also included in this category. It should be noted that these habitats contribute in supporting UKBAP bird species and brown hare, another UKBAP species. Temporary watercourses may also be used periodically by protected mammal species such as otters.
NEGLIGIBLE	Areas of hard standing and buildings are present throughout the survey area and are generally of negligible nature conservation value.

Consultation

5.5.53 Consultation took place with a number of statutory and non-statutory consultees as part of the on-going planning process. A summary table of the consultee responses which have been received in relation to ecology are summarised in Appendix E. These responses and comments have been taken into account, either within the survey method or mitigation proposals.

5.5.54 The key responses include;

- A recommendation by SNH for survey of otters, badgers and bats (but not breeding bird surveys);
- Three otter RTA records for both 2005-2006 from just north of the Smithston Bridge;
- Badger RTA records for 2003 in the vicinity of the proposed Broomknowes Junction;
- Presence of important bird species within the survey area including passerines; reed bunting, linnet, yellowhammer, tree sparrow and bullfinch, together with skylark and barn owl.

Impacts (Opening Year 1) without Mitigation

5.5.55 The impacts associated with each of the route options should be read in conjunction with the Constraints Map in Appendix A.

Tie-In Junctions

Broomknowes Junction

Blue and Red Route

5.5.56 The Abbeymill Burn tributary at the south west extent of the scheme would be affected by both the Blue and Red options. At this design stage both routes require a new crossing of the tributary while the Red route may also require an extension to the existing culvert as part of the roundabout development. These crossings would result in permanent habitat loss and disturbance, of Abbeymill Burn which supports otters (a European protected species). Therefore any possible pollution or disturbance of sediments could reduce the quality of the habitat and may affect fish prey availability. Other habitats within the vicinity of the junction include species-poor semi-improved grassland and marshy grassland surrounding the burn. The construction of the roundabout will also result in the permanent loss and fragmentation of ten species poor boundary hedgerows.

5.5.57 It is also notable that the roundabout option is located in the vicinity of the badger RTA record on the existing A77. This could potentially increase the vulnerability of badgers to road casualty. However, the lack of field evidence and the single RTA record suggests that badger activity in the area is generally low. Therefore the level of impact on badgers is anticipated to be minimal.

5.5.58 Without taking into account detailed mitigation, the impact of the Broomknowes Junction for the Blue and Red routes is likely to be minor negative due to direct impacts on habitat supporting otter and the permanent loss and severance of habitats of local value which are known to support UKBAP species of birds. This impact is not considered to be significant in terms of ecological integrity or biodiversity. Although standard mitigation such as otter ledges, bridge design and following standard Pollution Prevention Guidance (PPG 5, 6) can be applied to reduce construction impact and the occurrence of pollution incidents in the tributary of Abbeymill Burn, the residual impacts are likely to remain minor negative, due to landtake, permanent habitat loss and modification as described above.

Yellow Route

5.5.59 Unlike the previous options the Yellow route would not require a new crossing of the Abbeymill Burn tributary as the junction would be situated over an existing access track (The old A77). However, the junction would result in the permanent loss of an arable field and fragmentation of seven species poor boundary hedgerows hedgerow.

5.5.60 As with the Red and Blue options the roundabout junction of the Yellow route is located in the vicinity of the badger RTA record on the existing A77. This could potentially increase the vulnerability of badgers to road casualty. However, the lack of field evidence and the single RTA record suggests that badger activity in the area is generally low. Therefore the level of impact on badgers is anticipated to be minimal.

5.5.61 Without taking into account detailed mitigation, the impact of the Broomknowes Junction for the Yellow route is likely to be minor negative due to the direct loss and fragmentation of habitat of local value which are known to support UKBAP species of birds. With a careful mitigation plan to avoid construction impacts on breeding birds and a sensitive planting schedule the impacts associated with fragmentation and habitat loss could reduce the residual impacts of this option from minor negative to neutral.

Smithston Bridge Roundabout

5.5.62 The proposal for the Smithston Bridge junction tie-in into the northern section of the existing A77 is the same for all three options and the effects will therefore be identical:

- The roundabout would result in the loss of a section of a small ephemeral burn which is of site value.
- The junction will impact on the Chapleton Burn tributary in two ways. Firstly, assuming this section will be culverted, there would be permanent modification and loss of a section of the burn habitat. Secondly, there could be a permanent impact on otters utilising the burn through habitat fragmentation, noise disturbance and potential pollution events. The risk of otter RTAs may also be predicted to increase exacerbating the problems experienced at the location of an existing otter accident black spot (refer to consultation Appendix E).
- An unnamed burn would be crossed south of the Smithston Bridge Junction. This is a temporary burn and is considered to have minimal wildlife conservation interest.
- The junction would result in the loss of a field of species-poor semi-improved grassland, marshy grassland and fragmentation of existing four hedgerows.
- The slip road leading to the roundabout would result in the loss of an area of semi-natural broadleaved woodland to the northwest of the Smithston Bridge.

5.5.63 Without taking into account mitigation, the impact of the Smithston Bridge Junction is likely to be minor negative due to the direct loss and severance of habitat supporting otter and permanent loss of the woodland north of the Smithston Bridge. Although standard mitigation can be applied to reduce construction impacts and the occurrence of pollution incidents in the local watercourses, the residual impacts are likely to remain minor negative, due to landtake, permanent loss of woodland (that cannot be readily mitigated) and habitat modification.

Blue Base Route – S2 without Roundabout

5.5.64 The Blue base route would require an area of landtake amounting to 22.2 hectares (ha) over a length of 5.4 km. and would result in the following impacts:

- The permanent loss of grassland of varying quality, fragmentation of hedgerows (with a total of 29 crossings) and the loss of standard trees along field boundaries. These features support UKBAP species and are important for breeding birds which are protected under UK law;
- Construction and operational disturbance of woodland of district importance including Ladycross/Black Wood, St Murray's Plantation and Brockloch Wood;
- Permanent habitat loss and modification, fragmentation and water quality issues assuming there would be a culvert installed on the unnamed burn at Ladycross. The burn is also lined with mature beech trees and may be used as a wildlife corridor for protected species including bats. If the road corridor is to be lit, this could result in a permanent impact on bat species through habitat loss or severance. Preliminary design advice suggests that the roundabouts will be the only lit section of the road corridor (refer to **Table 3.1**), and more detailed appraisal on the effects on species would be considered at the Stage 3 DMRB Assessment when detailed design information is available.
- Severance of the agricultural landscape linking three woodlands Ladycross/Black Wood, St Murray's Plantation and Brockloch Wood. These woodlands are of district value and form an important network of habitats for fauna in the area. The road corridor could result in fragmentation of species populations and potentially increase fauna RTA.;
- Possible construction or operational impacts on the Brockloch Burn from contamination or pollution incidents;
- Loss of a small group of mature broadleaved trees located north of the railway (TN 37);
- Severance and isolation of grassland and agricultural habitats from the wider rural landscape around Maybole. This is likely to reinforce and extend the barrier posed to wildlife by the existing A77 and rail networks and sever habitat linkages outside of the proposed bypass option (both to the north and south). As a result the area will experience an increased level of disturbance.

5.5.65 Without taking into account mitigation, the impact of the Blue route (including all sub-options) is likely to be moderate negative due to the direct loss and severance of habitat supporting otter, permanent loss of the woodland north of the Smithston Bridge, landscape fragmentation and permanent impact on sites of district importance (woodland at Ladycross and St. Murray's Plantation).

5.5.66 If standard mitigation measures are assumed during construction; such as the observation of current Pollution Prevention Guidance (PPG) and Controlled Activities Regulations (CAR) guidance, then the level of temporary impact could be reduced or avoided. However, this option may still result in permanent impacts such as potential for pollution events, permanent noise disturbance, increased risk of fauna RTAs and a permanent modification of existing habitats. This includes watercourses known to support otters and potential impacts on birds and bats. These factors, together with habitat severance are considered to maintain the evaluation of moderate negative and are unlikely to be reduced without detailed mitigation measures that cannot be provided at this stage of the assessment.

Additional Impacts of Roundabout added to S2

5.5.67 The inclusion of the roundabout to the Blue route with single carriageway will require an additional 0.1 ha land at the crossing point of the B7023. The main features adversely affected will be hedgerows and trees bordering the B7023, of local and site value.

Additional Impacts of WS2+1

5.5.68 An additional 0.8 ha would be required for the Blue 2+1 option, to increase the carriageway width from 7.3 m to 10 m along the entire length of the scheme.

Additional Impacts of Roundabout added to WS2+1

5.5.69 An additional 1.1 ha would be required for the additional roundabout, adversely affecting hedgerows and trees of local and site value bordering the B7023.

Yellow Base Route – S2 without Roundabout

5.5.70 The Yellow base route would require an area of landtake amounting to 18.2 hectares over a length of 5.2 km. and would result in the following impacts:

- The loss of grassland, hedgerows (with a total of 27 crossings) and standard trees;
- Crossing of ephemeral burns north of Black Glen and Nether Culzean;
- Loss of a mature ash tree which has low potential to support a bat roost due to its lack of suitable cavities (which was checked by an Atkins bat specialist);
- Loss of English elm trees north of Black Glen. These trees are not found elsewhere within the study area and are uncommon nationwide due to Dutch Elm disease.
- Loss of a small group of mature broadleaved trees located north of the railway (TN 37);
- Severance and isolation of grassland and agricultural habitats from the wider rural landscape around Maybole. This is likely to reinforce and extend the barrier posed to wildlife by the existing A77 and rail networks and sever habitat linkages outside of the proposed bypass option (both to the north and south). As a result the area will experience an increased level of disturbance.

5.5.71 Without taking account of mitigation, the impact of this route is likely to be minor negative due to the possible direct loss and severance of habitat supporting otter and permanent loss of the woodland north of Smithston Bridge. Effects of habitat fragmentation are minimal due to the shorter length and close proximity of the route to the town. Impacts to bats are thought to be limited to habitat fragmentation and severance of commuting corridors potentially increasing the risk of bat RTAs.

5.5.72 If standard mitigation measures are assumed during construction; such as the observation of current Pollution Prevention Guidance (PPG) and Controlled Activities Regulations (CAR) guidance, then the level of temporary impact could be reduced or avoided. However, this option may still result in permanent impacts such as potential for pollution events, permanent noise disturbance, increased risk of fauna RTAs and a permanent modification of existing habitats. This includes watercourses known to support otters and potential impacts on birds and bats. These factors, together with habitat severance are considered to maintain the evaluation of minor negative and are unlikely to be reduced without detailed mitigation measures that cannot be provided at this stage of the assessment.

Additional Impacts of Roundabout added to S2

5.5.73 The addition of the roundabout to the Yellow route will require an additional 1.0 ha. The main habitats likely to be adversely affected will be hedgerows and trees bordering the B7023, of local or site value. This includes the loss of a line of beech trees which extends from the site of the roundabout to the edge of the town.

Additional Impacts of WS2+1

5.5.74 The 2+1 option will require an additional 0.5 ha, increasing the carriageway width from 7.3 m to 10 m along its entire length. The embankments and cuttings will be less steep compared to the base route for this option which will require a reduced temporary disturbance to these areas.

Additional Impacts of Roundabout added to WS2+1

5.5.75 An additional 1.6 ha will be required with the addition of the roundabout, adversely affecting hedgerows and trees of local and site value bordering the B7023.

Red Base Route – S2 without Roundabout

5.5.76 The Red base route would require an area of landtake amounting to 20.6 hectares over a length of 5.3 km. and would result in the following impacts:

- The loss of grassland, hedgerows (with a total of 23 crossings) and standard trees;
- Crossing of temporal burns north of Black Glen and Nether Culzean;
- Loss of important habitat for UKBAP bird species, including the arable field and hedgerow borders close to the southern roundabout surrounding it;
- Loss of mature ash tree which may support a potential roost;
- Loss of English elm trees north of Black Glen. These trees were not found elsewhere within the study area and are uncommon nationwide due to Dutch Elm disease.
- Loss of the entire 200m section of hedgerow located close to the Smithston junction (refer to Constraints Map, Figure 5028091_ECO_002 in Appendix A).
- Severance and isolation of grassland and agricultural habitats from the wider rural landscape around Maybole. This is likely to reinforce and extend the barrier posed to wildlife by the existing A77 and rail networks and sever habitat linkages outside of the proposed bypass option (both to the north and south). As a result the area will experience an increased level of disturbance.

5.5.77 Without taking account of mitigation, the impact of this route is likely to be minor negative due to the possible direct damage to habitat supporting otter (a European protected species) and permanent damage that will occur at the woodland north of Smithston Bridge.

5.5.78 If standard mitigation measures are assumed during construction; such as the observation of current Pollution Prevention Guidance (PPG) and Controlled Activities Regulations (CAR) guidance, then the level of temporary impact could be reduced or avoided. However, this option may still result in permanent impacts such as potential for pollution events, permanent noise disturbance, increased risk of fauna RTAs and a permanent modification of existing habitats. This includes watercourses known to support otters and potential impacts on birds and bats. These factors, together with habitat severance are considered to maintain the evaluation of minor negative and are unlikely to be reduced without detailed mitigation measures that cannot be provided at this stage of the assessment.

Additional Impacts of Roundabout added to S2

5.5.79 The addition of a roundabout will require further landtake at the crossing point of the B7023, this is an area of 20.80 hectares, 0.2 hectares larger then the above base route. The main features adversely affected will be hedgerows and trees bordering the B7023. These will be of local or site value. The embankments and cuttings required for this option will be reduced in comparison to the base route, leading up to and away from the roundabout.

Additional Impacts of WS2+1

5.5.80 There is no marked difference between the base route and the 2+1 option, however due to the wider carriageway for the 2+1 option of 10m as opposed to 7.3m for the entire length of the scheme, the landtake is greater at 21.5 hectares, 0.9 hectares larger then the base route.

Additional Impacts of Roundabout added to WS2+1

5.5.81 More land will be required for the roundabout taking the total area required up to 21.8 hectares, 1.2 hectares larger then the base route. The main features adversely affected will be hedgerows and trees bordering the B7023 at the site of the roundabout. These are of local or site value.

Comparative Impact Assessment

5.5.82 A comparison of the three main route options (Blue, Red and Yellow) with regard to impact on ecological features is presented in **Table 5.5.37**.

Table 5.5.37 – A77 Bypass Route Comparative Impact Assessment Table

A77 Maybole By-pass Base Route Comparative Impact Assessment			
Feature or effect	**Yellow Bypass Route**	**Red Bypass Route**	**Blue Bypass Route**
Landtake and Length of scheme	Landtake for the four Yellow sub-options is between **18.2** hectares and **19.8** hectares, **5.1** km in length: **Minor Negative**	Landtake for the four Red sub-options is between 20.6 hectares and **21.8** hectares, **5.2** km in length: **Minor Negative**	Landtake for the four Blue sub-options is between 22.2 hectares and **23.2** hectares, **5.3** km in length: **Minor Negative**
Habitat and landscape Severance	As the route is located close to Maybole the degree of severance is considered to be lowest of the three options: M**inor negative**	As the route is located close to Maybole (but further away than the Yellow option) the degree of severance is considered to be greater than the Yellow option resulting in a **Minor negative**	As the route is located furthest away from Maybole the degree of severance is considered to be high resulting in a **Moderate negative** impact, the greatest impact of the three options.
Woodland Sites	Permanent loss of semi-natural woodland north of Smithston Bridge. Disturbance of ancient woodland sites including Ladycross Wood and St Murray's Plantation located within 1km of the proposed route: **Minor negative**	Permanent loss of semi-natural woodland north of Smithston Bridge. Disturbance of ancient Woodland sites including Ladycross Wood and St Murray's Plantation located within 1km of the proposed route.: **Minor negative**	Permanent loss of semi-natural woodland north of Smithston Bridge. Disturbance of woodland sites of district value including Ladycross Wood, St Murray's Plantation and Brochlock wood located within 500m of the proposed route: **Moderate negative**
Protected Species (e.g. otters, badgers & bats)	Likely to affect to otters on Chapelton Burn, potential for increased risk of RTAs. Loss of trees with potential to support bats: **Minor Negative**	Likely to affect otters on Chapelton Burn, potential for increased risk of RTAs. Loss of trees with potential to support bats: **Minor Negative**	Likely to affect otters on Chapelton Burn, potential for increased risk of RTAs. Potential to affect badgers with increased risk of RTAs and possible impacts to bats foraging on the burn at Ladycross: **Moderate Negative**
Watercourses	Crossing and possible modification /habitat loss of **2** watercourses; Chapelton Burn tributary and the temporal burn north of Black Glen: **Minor Negative**	Crossing and possible modification/habitat loss of **3** watercourses; Chapelton Burn tributary, Abbeymill Burn tributary and the temporal burn north of Black Glen: **Minor Negative**	Crossing and possible modification/habitat of **3** watercourses. Including Chapelton Burn tributary, Abbeymill Burn tributary, unnamed burn at Ladycross and potential damage to Brockloch Burn: **Moderate Negative**
Notable Species (e.g. Brown Hare, UK BAP birds)	Removal of hedgerow and grassland habitat supporting UKBAP bird species and mammals: **Minor Negative**	Removal of hedgerow and grassland habitat supporting UKBAP bird species and mammals **Minor Negative**	Removal of hedgerow and grassland habitat supporting UKBAP bird species and mammals. Effects of habitat severance and overall impact with degree of disturbance, impact level is likely to be greater than Yellow and Red routes: **Moderate Negative**
Features of nature conservation importance	Loss of a mature ash tree (with low potential to support bats), a group of English elm and a small area of broadleaved woodland of local importance: **Minor Negative**	Loss of a mature ash tree (with low potential to support bats), a group of English elms of local importance: and an extensive hedgerow close to Smithston junction: **Minor Negative**	Loss of a small area of broadleaved woodland: **Minor Negative**
Overall Impact	**Minor negative – Preferred option.**	**Minor negative**	**Moderate negative- Least Preferred option**

Comparative Impact Assessment Summary

5.5.83 The landscape that the route options pass through is predominantly of site value, with a network of habitats of local conservation value. These habitats and the species that they support will be directly and permanently affected by construction and operational disturbance of any of the route proposals. **Table 5.5.37** identifies the key impacts arising from the assessment.

5.5.84 While all three options have the potential to impact on protected species including breeding birds, otters, bats and badgers, the Blue option will result in the greatest impacts to these species. This option has been assessed as potentially having a Moderate Negative impact. By comparison the Yellow and Red Routes would result in a Minor Negative impact on legally protected species.

5.5.85 With regard to habitats, the Blue route will result in the greatest amount of landtake over the longest distance and will isolate the largest amount of habitat to the north of Maybole. This has been assessed as a Moderate Negative impact on the nature conservation interests of the site. By comparison of these effects both the Red and Yellow routes would result in a Minor Negative impact.

Sub options

5.5.86 There is limited difference in the impact of each sub-option as these follow the same alignment as the base route and therefore they affect the same ecological receptors. However, the main difference is in relation to the amount of landtake required.

5.5.87 For the Blue and Red routes the assessment finds that the best option is the single carriageway option followed by the single carriageway with roundabout then the 2+1 option and finally the worst sub-option is the 2+1 with roundabout.

5.5.88 Due to the landtake required for the construction of the roundabout, the Yellow route differs in assessment from those given above. In this case the best option is the single carriageway followed by the 2+1, then the single carriageway with roundabout and finally, the worst sub-option is the 2+1 with roundabout.

5.5.89 The Yellow route is the preferred option with regard to biodiversity and nature conservation while the Blue route is the least preferred.

5.5.90 Regarding the sub-options; the single carriageway without roundabout is the preferred option from a nature conservation perspective, whilst the least preferred option is the 2+1 with roundabout.

Mitigation Measures

General

5.5.91 Mitigation can be based on:

- Avoidance; through re-location, re-design or changes in construction programme;
- Reduction; involving reducing the severity of an impact which cannot be avoided;
- Compensation; through habitat creation or enhancement.

5.5.92 Due to the variety of options under consideration at this time, few specific mitigation measures have been recommended. However the following generic mitigation has been proposed and assumed in order to provide a comparative assessment. Considering the nature of the by-pass proposals, direct avoidance of habitats may not be possible. However construction impacts on fauna can often be avoided by careful timing of works.

5.5.93 At this stage of the assessment compensation measures have not been proposed and therefore these mitigation recommendations focus on generic operations to reduce the level of impact on habitats and species.

Watercourses

5.5.94 Where watercourses are crossed this will require a bridge or culvert. With regard to retaining ecological integrity, bridges rather than culverts should be used wherever possible. However, when this is not possible box culverts or bottomless arch culverts, will be preferable to closed, cylindrical style culverts. The length of culvert should be kept to an absolute minimum to reduce physical modification to the channel and reduce impacts on species such as fish, water vole and otter. At this stage of the assessment it is not clear to what extent the watercourses will require crossing for each option. As such appraisal is restricted to a high level assessment detailing only whether there will be a crossing or not.

5.5.95 Retention of adjacent riparian habitats and the existing channel substrate should also be included in the design. Under the Water Environment and Water Services (WEWS) Act (Scotland) 2003[28] culverting of a watercourse is a Controlled Activity and authorisation must be obtained from Scottish Environmental Protection Agency (SEPA) for the works. In addition, the use of a closed culvert would have to be fully justified under the terms set out in Controlled Activities Regulations (CAR)[29] prior to authorisation from SEPA.

5.5.96 The inclusion of Sustainable Urban Drainage Systems (SUDs) ponds should be considered, as part of the drainage design. This system employs a range of techniques to reduce the likelihood of flooding incidents (e.g. through flood water attenuation) and improve water quality (e.g. through slow release into a watercourse or through the ground, which allows contaminated sediments to settle or become trapped in the SUDs pond). In addition, SUDs ponds can provide added biodiversity value for a range of aquatic flora and fauna.

5.5.97 Construction within or adjacent to watercourses should follow best practice and adhere to all relevant SEPA Pollution Prevention Guidelines (PPGs)[30]. This will be in order to reduce potential impacts from water pollution and may include silt traps, oil interceptors and site compound specifications.

5.5.98 Where fisheries interests are deemed to be important then construction should be timed to be outside of the main fish spawning/migrating period generally accepted to run between May and October.

[28] Scottish Executive, 2003
[29] Scottish Environmental Protection Agency (SEPA), 2006
[30] Scottish Environmental Protection Agency (SEPA), 2005

Woodland

5.5.99 The semi-natural broadleaved woodland north of the Smithston Bridge is of local importance and will be lost to enable the construction of a slip road which is part of the tie-in junction. In this instance repositioning the alignment would be preferable. However, if this is not possible or if only minor alignments adjustments can be made, it is advised that a sizeable area of woodland is planted in compensation. It should be noted that replacement is not considered a complete compensation for woodland habitat as many soil or fungal associations are lost and the age and structure of woodland habitats cannot be easily replicated.

5.5.100 The semi-natural broadleaved woodland north of the Smithston Bridge is of local importance and will be lost to enable the construction of a slip road which is part of the tie-in junction. In this instance repositioning the alignment would be preferable. However, if this is not possible or if only minor alignments adjustments can be made, it is advised that a sizeable area of woodland is planted in compensation. It should be noted that replacement is not considered a complete compensation for woodland habitat as many soil or fungal associations are lost and the age and structure of woodland habitats cannot be easily replicated.

5.5.101 There are several areas located between the railway and the new route corridor which have potential to support woodland planting, although these will be largely isolated between the transport corridors. This area is outwith the railway boundary so is unlikely to conflict. Where woodland areas are planted as part of the landscape proposals or as compensation measures then the potential for translocation should be considered. Planting schedules should use native species and reflect the composition of woodlands either lost to the scheme or found within the vicinity of Maybole.

Grassland, Hedgerows and Boundary Features

5.5.102 All options will result in the loss and fragmentation of areas of grassland and associated hedgerows. Where possible, mitigation should aim to retain or reinstate connectivity of the field boundary network. Hedgerows lost to the scheme should be replaced, either by gapping up defunct hedgerows or planting new ones along existing fence lines. Ideally, and with local landowner consent, this mitigation could be conducted both within and outwith the Compulsory Purchase Order (CPO) boundary, providing habitat enhancement within both a local and wider context. Reinstatement of working areas and the new road verges should use a species rich grass mix to enhance biodiversity and compensate for the loss of any areas of grassland. This may also mitigate for habitat loss that affects the available foraging resource for small birds and mammals.

5.5.103 Further compensation for the loss of habitats could include habitat creation proposals for the field area located between the railway and the bypass to the north of the scheme. This area is likely to be of reduced quality for farming due to the smaller size of the field patchwork.

Protected Species

Otters

5.5.104 Due to the confirmed presence of otter within the route corridor, it should be noted that otters may be affected by all of the route options and an application may be required for an otter development licence from the Scottish Executive.

5.5.105 Much of the practical mitigation regarding otters, such as construction safeguards (e.g. covering pits and excavations, fencing works areas etc.) is also applicable to other mammal species. However specific mitigation relating to the species will be required with regard to culvert and bridge design:

- Where possible, bridges should be provided in preference to culverts. Bridges should be surrounded by an area of riparian habitat on either bank of the burn/river to permit mammal crossings during spate flows. If this is not possible, the bridge design should include a mammal ledge situated above the height of the highest flood conditions on each support.
- The number of culverts installed should be minimised as they can limit otter movement and result in road casualty where they are impassable (especially during spate conditions); and,
- Where culverts are required, these should be a standard box-type design with ledges. Cylindrical culverts should be avoided as they represent a danger to otters; inhibiting passage of the species during flood (DMRB, 10:1:9[31]).

Badgers

5.5.106 Although evidence of badgers was only found in one place (approximately 500 m northwest of Ladycross) there is suitable habitat for foraging along the hedgerow network and sett building within the woodlands at Ladycross, Brockloch and St. Murray's Plantation. Badger territories are often extensive and all routes have potential to affect badgers through habitat fragmentation, severance of wildlife corridors and possible RTAs.

5.5.107 At this stage of the assessment signs of badgers were minimal and as such there may be limited requirement for tunnels and fencing. However, consideration will need to be given to this requirement following further survey and assessment and upon announcement of the preferred route.

Bats

5.5.108 Bats are likely to be affected by any lighting of the new bypass especially at sites between woodland areas and close to habitat corridors which may be used for commuting and foraging. Lighting should be avoided wherever possible to reduce impacts to bat species and this will benefit other mammal species and birds. However, if lighting is required then it should be situated away from likely bat flight corridors such as the railway and between Cargilston and Ladycross.

5.5.109 Bat boxes could be placed on bridges or on mature trees to provide valuable roosting habitat.

Terrestrial mammals

5.5.110 Brown hares were observed and evidence of foxes and roe deer were found within the route corridor. These species could be affected by landscape fragmentation and severance of wildlife corridors. Consideration will need to be given to the provision of safe access to both sides of the road for all mammals by providing dedicated crossings and fencing where appropriate. Fencing should also be considered to prevent animal casualties which may cause a danger to human health through vehicle strike.

Birds

5.5.111 All vegetation clearance in which birds may be nesting, should where possible be undertaken outside of the breeding season which is generally taken to extend between the **1 February and 31 August** (in practice, it is usually March to July but is subject to a number of geographical and seasonal factors).

[31] Highways Agency, 1993

5.5.112 Any bird breeding habitat that is lost should be replaced as part of the landscape design.

Blue Route

5.5.113 The Blue route passes between three woodlands listed on the ancient woodland inventory and semi-natural woodland inventory. If this route is taken forward, specific mitigation will be required to maintain wildlife corridors and reduce the level of disturbance.

Yellow Route

5.5.114 As it presently stands this route option will require the removal of an ash tree of local nature conservation value. This tree is situated at the top of the 'Lover's Lane' Wood. A further woodland area north of Black Glen, which has a group of English elm, would also be affected by this alignment. The only measure to avoid these impacts would be to move the alignment further north. If this is not possible or if only minor adjustments can be made, then compensation will be required although it is impossible to truly compensate for the loss of mature trees.

Red Route

5.5.115 Mitigation for the Red route is identical to the measures recommended for the Yellow route (above) and the generic measures described previously. No additional mitigation measures are proposed for this route option.

Impacts (Design Year 15)

5.5.116 Any of the bypass options under consideration will result in residual impacts due to the location of the bypass within rural habitat to the north of Maybole town. The effects of the Blue route option are particularly pronounced as its alignment passes the furthest away from Maybole town severing the greatest amount of habitat. As such it provides the largest opportunity for cumulative impacts (such as future development and town infill).

5.5.117 With all of the bypass options the modification to the environment, such as ambient noise levels, disturbance, habitat fragmentation and potential for mammal RTAs, are likely to continue beyond design year 15.

5.5.118 Although common throughout the survey area, grassland habitat and arable fields will be lost and fragmented, This will permanently alter the character of the existing environment. As the level of agricultural intensification varies from field to field it is difficult to assess the nature conservation value of these habitats and what species may be permanently affected by residual impacts. However, it is likely that birds including tree sparrow and skylark (which are both UKBAP species) may be affected by the increased disturbance of the road, risk of bird strike, reduction in foraging area and also nesting habitat for skylark. Brown hare, (another UKBAP species) is known to use the pastoral landscape north of Maybole and is also likely to be affected by road casualty.

5.5.119 Hedgerow and boundary habitats will also be directly affected by each of the options. However as the existing hedgerows are largely species poor and defunct, any replacement hedgerows and boundary features can be designed to mitigate their loss and by design year 15 may provide an enhancement to the present situation. Although the individual trees and shrubs will not be as mature as those lost to the scheme their overall function and integrity is likely to be successfully achieved. This includes providing buffer habitat, bird nesting and foraging resources and a wildlife corridor.

5.5.120 In time, beyond year 15 and with a fully functioning hedgerow network, it is likely that birds and small mammals will populate the new habitats and will be generally habituated to the presence of the by-pass. As the bordering habitats achieve maturity and gain height their conservation value is likely to increase and may reduce the probability of bird strike by encouraging individuals to fly above the height of traffic.

5.5.121 The residual impacts on watercourses will be minimal if all relevant SEPA and CAR regulations discussed in the mitigation section are strictly adhered to and design of crossings follows best practice. This will also include the use of bridges where possible and box culverts with otter ledges when a bridge cannot be used. Undoubtedly there will be long term noise disturbance of the watercourses which will continue for the lifespan of the road. However, most animals are likely to become habituated to traffic noise in the adjacent environment, to such a degree that they do not recognise it as a threat. The Chapelton Burn tributary in particular (which will be crossed by way of a bridge or culvert) is known to support otters. Their use of this burn already includes sections adjacent to the present A77 which demonstrates that they are accustomed to the road environment- such that it does not disturb or inhibit their movements. However with increased crossing of the watercourses in the area there is a potential for increases in otter RTA's, exacerbating an existing problem on and around the A77 especially at the Smithston Bridge RTA black spot. In this instance the level of residual impact will be wholly dependant on the correct design and implementation of mitigation for watercourses and otters.

5.5.122 Cumulative impacts of the bypass after design year 15 are difficult to predict as the future development plans for the Maybole area may vary markedly from the present ones. It is likely that the new bypass will facilitate development and infill on the town-ward side as outlined in the South Ayrshire Council Local Plan. This is already taking place at Whitefaulds off the B7023.

5.5.123 Through the application of a sensitive and successful mitigation package it is likely that residual ecological impacts can be reduced to an acceptable level. By design year 15 there is likely to be a minor impact on the habitat connectivity and quality of the Maybole area, but limited impact on individual features or species of conservation importance. Effects of severance, ecological disruption and habitat loss will be most pronounced if the Blue route (S2+1 with Roundabout) is chosen as the preferred scheme.

Further Survey

5.5.124 Further detailed survey of habitats and flora would be required to provide sufficient data necessary to inform the DMRB, Stage 3 assessment (timing of surveys can be seen in Appendix E). Surveys should include an update of the Phase 1 habitat survey and an accurate appraisal of the final route option in order to develop mitigation proposals. Further surveys will also include specialist ecological survey for legally protected species to establish presence, location and activity. The following surveys are required:

- **Otter survey**: This survey will record otter activity in the study area and locate holts or other resting sites. It is usual for such surveys to cover approximately 1 km of watercourse and/or the entire length of the corridor within the study area. It is recommended that four surveys are completed at different times of year (following SNH guidance[32]) to provide an interpretation of otter movements and levels of activity throughout the seasons.

[32] Strachan, R. (2007). National survey of otter *Lutra lutra* distribution in Scotland 2003–04. Scottish Natural Heritage Commissioned Report No. 211 (ROAME No. F03AC309).

- **Bat survey**: Potential roost sites will be further investigated by initial daytime inspections. Where relevant this will be followed by emergence surveys at dusk and dawn to establish if bats are present. Other daytime investigation of buildings and habitats within or adjacent to the final route corridor will be conducted. Where applicable, key bat flight lines will also be investigated to find where bats may cross the proposed carriageway.
- **Badger surveys**: A walkover survey should be conducted to identify badger activity and any potential setts and update status of badger activity in the study area. The survey should identify key habitats for badgers and should locate setts that could be affected by the proposed options. This survey should also identify the requirement for additional surveys such as bait marking.
- **Bird surveys**: Further survey should be conducted to establish the level of importance of identified hedgerow habitats for UKBAP species of birds. The level of usage of barn owls within the route corridor should also be identified.

Conclusions

5.5.125 There are no statutory designated sites within the study area that will be affected by the bypass proposals. Therefore it is considered that there will be no need for an Appropriate Assessment.

5.5.126 There are five non-statutory, provisional Wildlife Sites of district value present within the study area. Further sites of district value include St Murray's Plantation, Ladycross/Black Wood and Brockloch Wood (which are listed on the Ancient and Semi-Natural Woodland Inventory respectively). None of these areas will be directly affected by the proposals. However they are likely to result in disturbance during construction and operation of the new carriageway.

5.5.127 The majority of the habitat within the survey area is arable and grassland of site value which supports UKBAP bird species. Other habitats of local value include burns, hedgerows, boundary features and semi-natural woodland. Many of these features will be permanently affected by the bypass options.

5.5.128 Legally protected species that may be directly affected, include otters, badgers breeding birds, bats, barn owl and other mammals such as brown hare and roe deer.

5.5.129 All of the options under consideration will have a limited negative impact on the nature conservation interests of the site. The Blue option (including all sub-options) will have the greatest impact on existing habitats and species resulting in a Moderate negative impact due to effects of severance, habitat modification and loss. The two other routes (including all sub-options) are likely to result in a Minor Negative impact to features of nature conservation value.

5.5.130 Of all the route options under consideration the Yellow option is the preferred route while the Blue option is the least preferred route. There is limited difference in the impact of each sub-option as these follow the same alignment as the base route and therefore they affect the same ecological receptors. The level of impact will increase slightly in proportion with the amount of landtake required. As such for the Yellow route, the single carriageway without roundabout is the preferred option, whilst the least preferred option is the 2+1 with roundabout.

5.5.131 In summary, the Yellow option is the shortest of all the routes and passes closest to Maybole town, while the Blue option is the longest is furthest away from the urban conurbation. Given this the blue option will result in greater habitat severance. In addition, the Yellow option crosses fewer watercourses then the other two options and it has the least impact on woodland areas while the Blue option has the greatest impact through destruction and disturbance.

5.5.132 Due to the variety of options under consideration at this time, few specific mitigation measures have been recommended. Considering the nature of the by-pass proposals, direct avoidance of habitats may not be possible. However construction impacts on fauna can often be avoided by careful timing of works.

5.5.133 At this stage of the assessment, mitigation focuses on generic operations to reduce the level of impact on habitats and species. Recommendations comprise further detailed surveys as part of the Stage 3 assessment (including otter, badgers and bats).

5.5.134 Given the low level of initial impact assessment and through the application of sensitive and successful mitigation such as mammal tunnels and fencing, ecologically designed culverts, replanting of hedgerows and woodlands (where applicable) and the following of all relevant CAR guidance and PPGs, it is likely that residual ecological impacts can be reduced to an acceptable level. By design year 15 there is likely to be a minor impact on the habitat connectivity and quality of the Maybole area, but limited impact on individual features or species of conservation importance. Effects of severance, ecological disruption and habitat loss will be most pronounced if the Blue route (S2+1 with Roundabout) is chosen as the preferred scheme.

5.6 Landscape Effects

Introduction

5.6.1 This section considers landscape and visual impacts. This includes impacts on the fabric and character of the landscape and impacts on the visual amenity of people who live, work in the area, or use it for recreation.

5.6.2 The assessment of landscape character and visual amenity are two distinct but related areas:

- Landscape character assessment is the systematic description, analysis and classification of the features within the landscape, such as landform, vegetation cover, settlement, transport patterns and land use.
- Visual amenity assessment is the description of the impact to viewers of the landscape from locations inhabited and frequented by people.

Key Issues

5.6.3 The key issues relating to the route options, from a landscape and visual perspective, include:

- Direct loss or alteration of key landscape elements, such as landform, mature trees and woodland.
- Loss of designated landscape elements such as Ancient Woodland.
- Indirect impacts on the wider landscape character including designated sites, such as Historic Gardens & Designed Landscapes.
- Changes in the perception of the wider landscape character as a result of the construction of the preferred scheme and associated loss of vegetation.
- Changes in views obtained by the adjacent visual amenity receptors as a result of the construction of the preferred scheme and associated loss of vegetation.

Methodology

5.6.4 The objective is to undertake a Stage 2 level of assessment as defined in the Design Manual for Roads and Bridges (DMRB) (Volume 11, Section 3, Part 5, Sections 9.6-9.7) in order to identify the landscape and visual factors and the effects upon them, which are, to be taken into account in developing and refining the Route Options described in Section 3 of this report.

5.6.5 The landscape and visual assessment was undertaken by a Chartered Landscape Architect in accordance with the following documents:

- The Design Manual for Roads and Bridges (DMRB) (Volume 11, Section 3, Part 5) taking into account the Supplementary Guidance for Landscape & Visual Assessment (LVASG) [33]
- Guidelines for Landscape and Visual Impact Assessment (GLVIA) [34]
- Cost Effective Landscapes: Learning from Nature (CEL:LfN) [35]
- South Ayrshire Finalised Local Plan [36]

[33] Scottish Executive, 2002
[34] The Landscape Institute/ Institute of Environmental Management and Assessment, 2002
[35] The Scottish Office, 1998
[36] South Ayrshire Council, 2006

- Ayrshire Joint Structure Plan 2025 (July 2000[37] and April 2006[38])
- Scottish Natural Heritage, Review Series: No.111 Ayrshire Landscape Assessment [39]
- Ancient Woodland Inventory & Semi-Natural Woodland Distribution [40]
- Ordnance Survey Map: Explorer 326, Ayr & Troon (Girvan & Maybole), Scale 1:25,000 [41]

5.6.6 Data collection was by way of familiarisation (principally on foot and by car from the surrounding roads), desk study and field survey. Since landscape and visual impact assessments are closely related, the data collected has been used for both, as appropriate.

Study Area

5.6.7 The scale and complexity of proposed improvements and receiving landscape has required the definition of the study area as a corridor approximately 2 km wide along the proposed route (refer to route drawings in Appendix A and **Section 3**). As there are several route options under consideration, this corridor has been dictated by a 1km offset to the north of the northernmost option (Blue), and a 1km offset to the south.

Landscape Methodology

5.6.8 The four main steps in the landscape assessment process were:

- Description;
- Classification; and
- Evaluation; leading to
- Impact assessment.

5.6.9 Landscape assessment consists initially of the collection of baseline data relating to the components, character and scenic quality of the landscape, and an assessment of the sensitivity of the landscape to change. In undertaking the assessment, consideration is given to the following:

- Experience of the landscape is not only visual, but involves all five senses;
- Data relating to the components of the landscape, its character and quality will include reference to baseline information presented in separate related sections (e.g. Ecology and Nature Conservation, Cultural Heritage);
- The value placed on an area is dependant not only on its inherent scenic quality but on its situation, rarity and usage;
- Historical and cultural associations may contribute to the value placed on a landscape not generally considered to be of visual or other importance; and
- Where landscapes are not of a quality to warrant national or regional designation, they may still be of great local value.

[37] The Ayrshire Joint Structure Plan Committee, 2000
[38] The Ayrshire Joint Structure Plan Committee, 2006
[39] Scottish Natural Heritage, 1998
[40] Scottish Natural Heritage, 2005
[41] Ordnance Survey, 2001

Landscape Character

5.6.10 Scottish Natural Heritage (SNH) has identified broad national Landscape Character Areas (LCAs), which are used as a baseline for policy and considering the forces of change in the Scottish landscape. These national LCAs are based on general characteristics, such as landform, geology and land use. Within these national landscape character areas, SNH have identified Landscape Types. These are generic areas, which exhibit a unity of character.

5.6.11 This information was used during the assessment to aid the identification of detailed landscape character areas at a local scale within the study area. The detailed landscape character areas were assessed for their landscape quality.

Landscape Quality

5.6.12 The landscape quality assessment was based on a review and analysis of the relevant landscape and cultural heritage designations outlined in the Local Plans and on the SNH landscape character descriptions.

5.6.13 Landscape quality may not always coincide with the LCA classification but contributes towards the assessment of both value and susceptibility and hence landscape sensitivity. The assessment of landscape quality concerns the public perception of aesthetic and visual attractiveness of the landscape, and considers the following:

- Visual factors (proportion, scale, enclosure, texture, colour, views);
- Pattern and composition of features;
- Purity of character; and
- Degree of tranquillity.

5.6.14 The landscape quality descriptions are outlined in **Table 5.6.38** below.

Table 5.6.38 – Criteria Used to Assess Landscape Quality *

Quality	Criteria
Poor	Land use dominates and includes industrial development with no aesthetic value. The area is lacking in a positive character and there is much scope for positive enhancement. No landscape designations apply.
Ordinary	Primarily a functional area including roads, isolated housing, vegetation and open countryside resulting in an area of mixed character. Not of high attraction but includes areas that exhibit a positive character that are potentially sensitive to inappropriate change. Land may have a local landscape designation.
Good	There is a large area of vegetation and the overall view of the area is pleasant. Isolated settlements may be present within extensive areas of open space. Landscape or other designations of cultural or historic value may be present.
Very Attractive	Areas may include ancient woodlands or designed landscape. There is an extensive distribution of mixed vegetation including woodland, high proportion of trees, hedges and shrubs. Attractive landscape features are present including unpolluted water corridors i.e. streams or brooks. Several landscape and other designations may apply.
High	Includes the most aesthetically attractive landscape considered to be of particular importance to conserve and which is extremely sensitive to change. Areas of particular natural beauty are identified in this category. Nationally designated landscapes of national scenic value and other designations of cultural or historic value are likely to be present.

**This table has been compiled by Atkins through reference to GLVIA and DMRB 11:3:5*

Sensitivity of Landscape

5.6.15 Evaluation of the sensitivity to change combines a review of 'value' of the main elements, which together comprise each character area together with their 'susceptibility' to change due to the type of proposed development.

5.6.16 "Value" as defined by LVASG is "the importance ascribed to the landscape by public perception, value to the community or professional judgement." In this study, informal public use of open spaces, roads and footpaths as observed during the course of the landscape and visual assessment survey together with professional judgement on landscape quality (see above) was used to ascertain the value of the landscape and whether this was considered to be of local, regional or national importance.

5.6.17 "Susceptibility", as defined by LVASG, is "the ability to accommodate changes arising from the proposal without adverse effect." This in turn is equivalent to "vulnerability to degradation", described in DMRB as the capacity of the landscape to accept change of the type and scale proposed...through the introduction of new features or the loss of existing components." In order to arrive at this evaluation, using professional judgement, the following aspects were considered:

- Landscape character and context;
- Landscape quality;
- Current and future likely landscape trends;

- The nature and extent of landscape components and their importance and positive or negative contribution to the landscape character area within which they are situated and also to the wider landscape; and
- Rarity.

5.6.18 The criteria used to evaluate the overall landscape sensitivity are outlined in **Table 5.6.39**:

Table 5.6.2 – Landscape Sensitivity Criteria

Sensitivity	Criteria
High	Landscape or landscape elements of particular distinctive character, highly valued and considered susceptible to relatively small changes.
Medium	A landscape of moderately valued characteristics considered reasonably tolerant of change.
Low	A landscape of generally low valued characteristics considered potentially tolerant of substantial change.

Magnitude of Change

5.6.19 An evaluation of the magnitude of the proposed changes on the elements of the landscape through which the proposed road corridors pass, was carried out through a review of the nature and scale of the change, together with its duration and degree of permanence, using the criteria outlined in **Table 5.6.40**. Note that each magnitude band can incorporate a range of change in landscape characteristics, from negligible at the lower end to very high at the top end. For convenience in the tabulation of this evaluation, however, only the three values are listed.

Table 5.6.40 – Landscape Magnitude of Change Criteria

Magnitude	Criteria
High	Notable change in landscape characteristics over an extensive area ranging to very intensive change over a more limited area.
Medium	Minor changes in landscape characteristics over a wide area ranging to notable changes in a more limited area.
Low	Minor to virtually imperceptible change in any area or landscape components.

Significance of Landscape Impact

5.6.20 Landscape impacts are changes in the fabric, character and quality of the landscape as a result of development. Landscape impact assessment is concerned with:

- Impacts on acknowledged and recognised areas of interest or value, such as designated landscapes;
- Direct impacts on specific landscape elements, such as the loss of woodland;
- Indirect effects on the overall pattern of elements that give rise to landscape character and regional and local distinctiveness.

5.6.21 Landscape impacts change over time as mitigation, such as planting and restoration of habitat types, included as part of the proposals, establish and mature, and as existing landscapes external to the development evolve. The assessment acknowledges change and impacts were assessed during construction, for winter year of opening and summer fifteen years after opening.

5.6.22 An initial indication of impact significance (adverse or beneficial) was gained by combining sensitivity and magnitude in accordance with the matrix provided in **Table 5.6.41**. Given that the criteria low/medium/high represent levels on a continuum or continuous gradation, professional judgement and awareness of the relative balance of importance between sensitivity and magnitude were also required.

5.6.23 The matrix provided in **Table 5.6.41** has been adapted from LVASG to accommodate a seven point scale to enable a consistent use of impact significance criteria. Impact ratings adopted comprise Substantial, Moderate, Slight or Negligible as adverse or beneficial. A rating of negligible has been applied where there is no discernible impact.

5.6.24 Impacts of Moderate and above are considered significant, as this is the level at which the changes to the landscape will be clearly perceived.

Table 5.6.41 – Impact Significance Criteria for Landscape

Sensitivity	Magnitude of Change		
	High	Medium	Low
High	Substantial	Substantial	Moderate
Medium	Substantial	Moderate	Slight
Low	Moderate	Slight	Slight

Visual Methodology

Receptors

5.6.25 For there to be visual impact there is the need for a viewer (receptor). Receptors include residential properties, workplaces, recreational facilities, road users, pedestrians and other outdoor sites used by the public which will be likely to experience a change in existing views as a result of the construction and operation of the proposed road improvements.

Field Assessment of Affected Receptors

5.6.26 A combination of desk study and field survey was used to indicate, for each possible route option, how receptors in the area could be affected by the proposed improvements. In accordance with DMRB Stage 2 methodology, using information gathered during the landscape assessment and desktop information the number of properties which are likely to experience visual changes has been estimated. This assessment is only indicative and further on-site survey work to look specifically at visual impacts on property will take place following the selection of a preferred route.

Visual Evaluation and Impact Assessment

5.6.27 The evaluation and impact assessment involves consideration of the extent to which the proposals will change the composition of the existing view (magnitude of change) and the sensitivity to change based on the information gathered through site survey and analysis of the proposals. Both criteria are represented utilising thresholds of magnitude or sensitivity: High, Medium, Low and Negligible (magnitude only).

Sensitivity to Change

5.6.28 Sensitivity to change considers the nature of the receptor; for example a residential dwelling is generally more sensitive to change than a factory unit. The importance of the view experienced by the receptor also contributes to an understanding of how sensitive that receptor is to change. Scenic quality and value of the view are therefore considered. It has been generally assumed that the closer views that individual properties currently have of the A77, the less sensitive to further transport infrastructure construction they become due to their proximity to existing road.

5.6.29 In this assessment sensitivity is ranked as follows:

Table 5.6.42– Visual Sensitivity to Change Criteria

Sensitivity	Criteria
High	Where the changed landscape is an important element in the view (e.g. occupiers of residential properties)
Medium	Where the changed landscape is a moderately important element in the view (e.g. users of outdoor recreational facilities including public rights of way)
Low	Where the changed landscape is a less important element in the view (e.g. people at their place of work; people travelling through or past the affected landscape).

Magnitude of Change

5.6.30 Magnitude of change considers the extent of development visible, the influence of the development within the view and viewing distance from the receptor to the development. In accordance with DMRB guidance, a full on-site visual impact assessment survey has not been undertaken at this stage to determine the precise extent of the road likely to be visible to each receptor. Therefore a reasoned assessment has been undertaken using the potential influence of the development within the view and viewing distance as the principal factors dictating the probable magnitude of change.

5.6.31 In this assessment magnitude is ranked as follows (as derived from reference to GLVIA and DMRB by Atkins):

Table 5.6.43 – Visual Magnitude of Change Criteria

Magnitude	Criteria
High	Where the development will cause a significant change in the existing view
Medium	Where the development will cause a noticeable change in the existing view
Low	Where the development will cause a barely perceptible change in the existing view
Negligible	Where the development will cause no discernible change in the existing view

Impact Criteria

5.6.32 A visual impact rating for each receptor/groups of receptors is derived from consideration of the magnitude of change and sensitivity to change. Impact ratings adopted comprise major, moderate or minor and negative or positive. A rating of negligible can be applied where there is no discernible impact. At this stage the assessment will report on the potential impacts fifteen years after construction and assuming mitigation measures (in line with the broad principles outlined further in this section) have been completed.

5.6.33 The broad connections between the sensitivity of the receptor, the magnitude of change and the significance of impacts are outlined in **Table 5.6.44** below. Impacts are graded from slight to substantial.

Table 5.6.44 – Impact Criteria: Relationship Between Sensitivity and Magnitude

Magnitude of Change	Sensitivity of Receptor		
	High	**Medium**	**Low**
High	Major	Major / Moderate	Moderate / Minor
Medium	Major / Moderate	Moderate	Moderate / Minor
Low	Moderate / Minor	Moderate / Minor	Minor / Neutral
Negligible	Neutral	Neutral	Neutral

5.6.34 Explanation of the impact ratings is provided in **Table 5.6.45**

Table 5.6.45: Visual Impact Criteria*

Rating	Visual Impact
Major positive	Where the proposal will cause a very noticeable improvement in the existing view. In the urban context this will typically apply where the proposals lead to the removal of a significant eyesore such as a derelict site or buildings and incorporate townscape improvements which substantially remodel and enhance the outlook for a large number of people.
Moderate positive	Where the proposal will cause a noticeable improvement in the existing view. This will typically apply where the proposed development incorporates landscape improvements which will largely reduce the impact of the proposals and enhance the outlook for a moderate number of people.
Minor Positive	Where the proposal will cause a barely perceptible improvement in the existing view.
Neutral	Where there is no discernible improvement or deterioration in the existing view.
Minor negative	Where the proposal will cause a barely perceptible deterioration in the existing view. This will typically occur where the receptor is at some distance from the proposals and the proposals newly appear in the view but not as the point of principal focus. It will also occur where the proposals are closely located to the viewpoint but are seen at an acute angle and at the extremity of the overall view.
Moderate negative	Where the proposal will cause a noticeable deterioration in the existing view. In an urban context this will typically apply where the proposals involve the removal of existing property or boundary walls/planting thereby exposing the property to the proposals, but with views limited to bedrooms or rarely occupied rooms.
Major negative	Where the proposal will cause a very noticeable deterioration in the existing view. This will typically occur where the proposals close an existing view of local landscape and the new proposals will dominate the future view.

(TABLE DERIVED FROM REFERENCE TO GLVIA AND DMRB BY ATKINS)

5.6.35 Impacts of moderate and above are considered to be significant, as this is the level at which changes will be clearly perceived.

5.6.36 In terms of ratings for sensitivity, magnitude and impacts the thresholds represent points on a continuum, and, where appropriate, intermediate ratings are used to indicate impacts at the higher or lower end of a particular threshold.

Landscape Baseline

Topography

5.6.37 The study area sits within a broad valley formed by the high ground of Mochrum Hill (270m AOD), Knoweside Hill (280m AOD) and Cairn Hill (163m AOD) to the north, and Kildoon Hill (175m AOD) and the southern uplands to the south. Maybole is located on a south facing incline, with the flattest and lowest ground (60m AOD) occupying an area to its south which then extends north east parallel with the A77.

5.6.38 To the north of Maybole, beyond the crest of the slope on which the town sits, is a belt of higher undulating ground (120-145m AOD). This landform enables predominantly open and extensive views in all directions. Figure 5028091_LAN_001 in Appendix A illustrates the variety of topography in the study area.

Areas of Poor Quality Landscape & Visual Detractors

5.6.39 An area of light industry is situated adjacent to the B7024 on the north-east edge of Maybole. However, it is effectively part of the town fabric and therefore has little impact on the visual amenity of the surrounding countryside and is unlikely to be affected by the route options.

Vegetation of Significant Landscape Value

5.6.40 A small area of Semi-natural Ancient Woodland is located around the remains of Brockloch Castle, south east of East Brockloch farmstead. Larger areas of Ancient Woodland are located at St. Murray's Plantation and Ladycross Wood; Black Wood; and, Gallowhill Plantation. Further isolated areas are to be found in two small pockets at Drumellan and High Smithston.

5.6.41 In addition to the Ancient Woodland identified above, there are also scattered areas of established woodland between the B7024 and Lovers Lane (north east of Maybole), Black Glen (1km east of Maybole adjacent to the A77), around Nether Culzean Farm (1.6km north east of Maybole), in the vicinity of Holmes and High Grange (2.5km north east of Maybole), adjacent to the A77 north of Smithston Bridge; north of Myremill farm; and, west of High Smithston.

5.6.42 Although evident, hedgerows do not form a significant landscape component in the study area. Field boundary hedgerows are generally defunct, although there are a number of good intact examples that are mostly associated with roadside verges.

5.6.43 The areas of vegetation described above are illustrated on Figure 5028091_LAN_001 in Appendix A.

Settlements & Communications

5.6.44 The town of Maybole is the only settlement in the study area. Various, largely isolated farms and residential properties are located throughout the remainder of the area.

5.6.45 No rights of way have been identified within the study area. However, National Cycle Network (NCN) Route 7 travels northwest out of Maybole on Gardenrose Path, through the centre of Ladycross Wood and north towards Heads of Ayr (refer to Appendix A for the location of this cycle route).

5.6.46 The A77 bisects Maybole in a north east / south west direction, following the contours of the general landform, and is the only major road in the study area.

5.6.47 The land to the north of Maybole is bisected by four minor roads that radiate out of the town: the B7023 Culzean Road travels in a north-west-west direction; Gardenrose Path travels to the north-west; Kirklandhill Path to the North; and, the B7024 to the north-east. Another minor road runs parallel with the A77, 600m north of Maybole, in a broadly east-west direction between Enoch Lodge and Cassillis View. There are also various smaller access tracks linking these roads to isolated farm and residential properties.

5.6.48 The Stranraer-Glasgow railway line enters the study area from the south, travelling north to the south west corner of Maybole before swinging east to pass through the centre of the town. It then exits Maybole in its north-east corner, before travelling through the north of the study area in a SW-NE direction, parallel to the A77.

5.6.49 The settlements and communications described above are illustrated on Figure 5028091_LAN_002 in Appendix A.

Landscape Designations

5.6.50 The following landscape designations are all illustrated on Figure 5028091_LAN_003 in Appendix A.

National Designations

5.6.51 Historic Scotland and SNH maintain the Inventory of Historic Gardens and Designed Landscapes of outstanding historic, architectural or landscape significance. The objective is that the interest and character of these gardens and landscapes should be respected or restored if the opportunity arises. The study area contains one landscape, Culzean Castle Garden and Designed Landscape, of sufficient importance to have been included in the Inventory.

5.6.52 The South Ayrshire Local Plan recognises the value of Historic Gardens and Designed Landscapes in relation to the environment of South Ayrshire, and identifies the Culzean Castle Garden and Designed Landscape as one of eight such sites of conservation value in South Ayrshire. Policy ENV10 seeks to safeguard historic gardens and designed landscapes, stating that "proposals affecting these areas will be considered in terms of landscape impact" amongst other qualities (refer to Policies and Plans **Section 5.13** for further details).

5.6.53 Drumellan Country House is located south of the A77, 800m north east of Maybole. It is designated as a "Country Estate" in the South Ayrshire local plan. Although the gardens of Drumellan are not identified by SNH as being of conservation value the gardens contain areas of designated Ancient Woodland, and the Garden History Society has identified them as being of importance, albeit not remaining in their original form.

Regional Landscape Designations

5.6.54 The route options pass through or close to two designated landscape areas:

- Green Network (Ayrshire Joint Structure Plan) / Rural Protection Area (South Ayrshire Local Plan) – the immediate environs of Maybole; all route options pass through this area. Strategic Policy STRAT3 in the South Ayrshire Local Plan states that whilst the Greenbelt covers closely defined areas and protects sensitive environments susceptible to development pressure, some areas outwith the Greenbelt are also under pressure for development, especially those areas within a short travel time from major towns. The designation of the Rural Protection Area is recognition of these pressures and the need to protect the area from inappropriate non rural - based uses or sporadic development.

- Sensitive Landscape Character Area (Ayrshire Joint Structure Plan) / Scenic Area (South Ayrshire Local Plan) – 1km north west of Maybole; although none of the routes actually travel through this area, the Blue route passes within 250m of its boundary. Strategic Policy ENV8 identifies the Carrick Hills and mainly upland area of South Carrick (amongst others), and has afforded them Scenic Area status in the Plan. It should however be noted that in general, potential impacts on the environment and landscape will be considered even if the area is not specifically identified as being within a designated Scenic Area (refer to Policies and Plans **Section 5.13** for further details).

Local Designations

5.6.55 No Tree Preservation Orders were identified within the study area.

5.6.56 Areas of Ancient & Semi-natural Ancient Woodland have been identified in the study area and are described above under 'Areas of Significant Vegetation'. Local Plan policy ENV12 recognises that mature trees in urban areas, together with areas of ancient and semi-natural woodland, are particularly valuable resources. In assessing development proposals involving loss of, or works to, trees the Council will consider the extent of any adverse impact on the locality and will include as part of its assessment of such development proposals measures to safeguard trees (refer to Policies and Plans Section 5.13 for further details).

5.6.57 The following Scheduled Ancient Monuments were identified within the study area: Crossraguel Abbey, 2.1km south west of Maybole; Standing Stone, 200m east of Maybole, opposite St John's Cottage and St Mary's Church / Collegiate Church, Maybole town centre.

5.6.58 St John's Cottage is an A Listed building, located 200m east of Maybole, as are the Collegiate Church and Maybole Castle, which are both in Maybole town centre. B Listed buildings identified in the study area included: Enoch Lodge, 1.6km north-west of Maybole; East Enoch, 500m north-west of Maybole; and, Nether Culzean, 1.4km north east of Maybole. West Enoch, 1.2km north west of Maybole; East Brockloch, 1.2km north of Maybole; Covenanter's Memorial, 500m north of Maybole; Kirklandhill, 300m north of Maybole; are all C Listed buildings situated within the study area.

5.6.59 The Scheduled Ancient Monuments and Listed Buildings referred to above are highlighted on Figure 5028091_HER_001 and Figure 5028091_HER_002 in Appendix A, and are referred to in further detail in **Section 5.3** of this report.

5.6.60 A local recreational site, currently used as a football pitch, is located on the north-west corner of Maybole, to the rear of Enoch Road. Maybole War Memorial Park and Golf Course is located to the south east of Maybole.

Landscape Character

5.6.61 The study area is covered by the SNH LCA of Ayrshire, and sits within the 'Carrick Hills and Valleys' Regional Character Area. This is described as a complex area of hills and valleys, forming an area of transition between the higher ground of Dumfries and Galloway and the lowlands of the Ayrshire Basin, where valleys tend to be small scale, settled and pastoral in character, while intervening hills comprise moorland and forestry.

5.6.62 This Regional Character Area has been further subdivided by SNH into 'Landscape Types', which "are tracts of countryside which have a unity of character due to particular combinations of landform, landcover and a consistent and distinct pattern of constituent elements" [42]. All but one of the route corridors is contained within the 'Foothills' Landscape Type. Although predominantly situated within the Foothills Landscape Type, the Blue route also encroaches within the boundary of the 'Coastal Headlands' landscape type.

5.6.63 Five 'detailed landscape character areas' were identified and these are described below. Broad existing landscape conditions and the location of detailed landscape character areas are illustrated on Figure 5028091_LAN_004 in Appendix A. Photographs of each of the detailed character areas are also shown on Figures 5028091_LAN_005, 5028091_LAN_006 and 5028091_LAN_007 in Appendix A:

A. Maybole townscape
B. Kirklandhill Ridge
C. Carrick Rolling Hills
D. Hillside Woodland & Pasture
E. Maybole Plain

Detailed Landscape Character Area A: Maybole Townscape

5.6.64 Maybole sits astride the strong linear features of the A77 and railway line on a southern facing slope. It is an historic town dating back some 900 years and contains a notable High Street with many fine historic buildings (refer to Cultural Heritage **Section 5.3** for further details on the Designated Conservation Area).

[42]Scottish Natural Heritage, Ayrshire Landscape Assessment, 1998, p.74

Table 5.6.46 – Landscape Character Summary for Area A

Landscape Attributes	Description
Positive character	Historic buildings: Grade A listed Maybole Castle; Town Hall; Parish Church etc Recreational space: Memorial Park Southerly outlook with extensive views to Southern Uplands Compact town with defined boundaries
Negative character	Large volumes of traffic along historic high street Post-war and new housing developments out-of-scale and use inappropriate materials
Sensitivity	Medium
Quality	Ordinary
Likely landscape trends	Continued development of housing sites around the town periphery; Rejuvenation of the historic high street with a reduction of traffic following completion of A77 by-pass
Likely landscape trends ('do minimum')	Continued development of housing sites around the town periphery; Increasing road traffic on A77 leading to continued degradation of the high street and associated historic buildings
Public perception, visibility and use	A busy historic urban core and commercial centre, heavily used by through-traffic travelling between Stranraer and Glasgow.

Detailed Landscape Character Area B: Kirklandhill Ridge

5.6.65 This character area is a ridge of pastoral land sitting above Maybole and below the southern slopes of the Carrick Hills. The land is fragmented by four minor roads that radiate out from the north of Maybole at regular intervals. Vegetation is limited to remnant hedgerows, hedgerow trees and a line of mature beech trees associated with the burn running through the area, with the majority of field boundaries being formed by post and wire fencing. Fields are irregular in shape and size, ranging from small to medium, and settlement is limited to scattered, infrequent farmsteads.

Table 5.6.47 – Landscape Character Summary for Area B

Landscape Attributes	Description
Positive character	Traditional rural architecture - Grade C Listed Buildings Extensive views Agricultural land with ongoing farming practices
Negative character	Encroachment of urban forms (telecommunication masts) Isolated caravan dwelling
Sensitivity	Medium
Quality	Ordinary
Likely landscape trends	Increasing pressure for development
Likely landscape trends ('do minimum')	As above
Public perception, visibility and use	Farmland retaining rural character, despite proximity to residential areas of the town.

Detailed Landscape Character Area C: Carrick Rolling Hills

5.6.66 Character Area C is dominated by the southern extent of the Carrick Hills - a series of rolling hills and slopes which include Knoweside Hill and Cairn Hill. Enclosed pastures prevail on the lower slopes, with rough grazing on more exposed, higher areas. Vegetation in this area is characterised by lines of outgrown field boundary trees and pockets of semi-natural woodland on some of the more sheltered slopes. Field boundaries are predominantly post and wire fence or a combination of post and wire fence and defunct hedgerow. Settlement is scarce, limited to a handful of white farmsteads on the hills' lower slopes.

Table 5.6.48 – Landscape Character Summary for Area C

Landscape Attributes	Description
Positive character	Traditional rural architecture - Grade B & C Listed Buildings Panoramic extensive views Agricultural land with ongoing farming practices
Negative character	None
Sensitivity	High
Quality	Good
Likely landscape trends	Increasing pressure for development (communications masts)
Likely landscape trends ('do minimum')	As above
Public perception, visibility and use	Rural farmland, giving way to an almost semi-natural character on the upper, exposed slopes and summits.

Detailed Landscape Character Area D: Hillside Woodland and Pasture

5.6.67 Character Area D is defined by the dominant topographical feature of the study area, Mochrum Hill, and is enhanced by the policies woodland (i.e. areas of woodland that form part of a Designed Landscape) of Culzean Castle, some 5km to the east. This woodland however rapidly gives way to pastoral farmland on the southern slopes of Mochrum Hill, at the foot of which a number of minor valleys cut into the slopes, creating a dissected landform of incised valleys between rounded ridges and small summits such as Gallows Hill (AOD 135m) and Piper's Hill (AOD 102m). In addition to the policies of Culzean, further areas of mature trees are associated with the small valleys and watercourses, together with outgrown field boundary trees. Settlement is scarce, limited to a caravan site and a handful of farmsteads on the hill's lower slopes and adjacent to the A77.

Table 5.6.49 – Landscape Character Summary for Area D

Landscape Attributes	Description
Positive character	Designated scenic area (South Ayrshire Local Plan) Traditional rural architecture - Grade B & C Listed Buildings Extensive views Agricultural land with ongoing farming practices Culzean Castle policies woodland
Negative character	Caravan site A77 road corridor
Sensitivity	High
Quality	Very Attractive
Likely landscape trends	Increasing noise and intrusion from traffic on A77 Development pressures - tourism
Likely landscape trends ('do minimum')	As above
Public perception, visibility and use	Woodland associated with Culzean Castle estate, giving way to rural farmland and main transportation corridor.

Detailed Landscape Character Area E: Maybole Plain

5.6.68 The Maybole Plain detailed character area mirrors Area B, the Kirklandhill Ridge, occupying a relatively low, undulating belt of land between the base of the southern facing slope on which Maybole is built and the higher, rolling land of the Southern Uplands to the south-west. Significant vegetation is generally limited to roadside trees and small areas of woodland associated with farmsteads and other buildings, and its low-lying position has contributed to various areas of water and associated wetland wildlife habitats. Settlement is scattered and varied, ranging from small holdings at the eastern end of the area, to Maybole Cemetery and the grade-A listed St John's Cottage. Like the Kirklandhill Ridge character area, it is similarly fragmented by road and rail links which radiate out of Maybole across the area in a north-east / south-west direction.

Table 5.6.50 – Landscape Character Summary for Area E

Landscape Attributes	Description
Positive character	Wetland wildlife habitats Grade A Listed Building / Scheduled Ancient Monument / Cultural components (Maybole Cemetery) Agricultural land with ongoing farming practices
Negative character	Sewage works / industrial units Poorly defined edge to urban form in areas, with poor quality housing
Sensitivity	Medium
Quality	Ordinary
Likely landscape trends	Land is generally unsuitable for development, and so is unlikely to be subject to any considerable pressures of change
Likely landscape trends ('do minimum')	As above
Public perception, visibility and use	Farmland retaining rural character, although this does degrade with proximity to the residential / light industrial areas of the town.

Visual Amenity Baseline

5.6.69 The following visual amenity receptors have been identified and their existing views described. Their locations are shown in Figures 5028091_LAN_008 to 010 in Appendix A.

5.6.70 There are a variety of visual amenity receptors within the study area ranging from new residential estates on the edge of Maybole, to Caravan Holiday Parks and farmsteads accessed via private tracks. Receptors identified within the study area have varying degrees of visibility of the existing A77 road corridor and descriptions of the receptors and associated views are outlined in **Table 5.6.51** below:

Table 5.6.51– Visual Amenity Receptors

Ref.	Name	Type	Existing view outline summary
1	Baltersan Castle	Ruin (Grade A listed)	Open rolling farmland; A77 corridor
2	Baltersan Mains	Farmstead	Open rolling farmland; A77 corridor
3	Thornebroke	Farmstead	Open rolling farmland; A77 corridor and Maybole in distance
4	Broomknowes	Farmstead	Orientated away from adjacent A77; Open rolling farmland and riparian vegetation
5	Cultezeoun	Farmstead	Extensive, elevated, open views to south over A77 (road minor element in view due to topography)
6	Maybole Group A	School / Residential	[Carrick Academy plus 4 cottages] – A77 and farmland beyond to south
7	Maybole Group B	Residential	[Macadam Way estate; 56+ properties (construction of further properties underway)] – Urban residential fabric; intermittent views of farmland to west through gaps between buildings; Those buildings positioned on the outer edge of the town have open views of hillside farmland to west.
8	Caravan Site	Residential / Recreation	Approximately 50 caravans; Elevated views of farmland to south, heavily filtered by boundary vegetation.
9	Maybole Group C	Residential	[Macadam Place; Gallowhill Avenue; McCrae Court; Queens Terrace; Chesney Grove; Kincraig Avenue – approximately 115no. Residences] - Urban residential fabric; intermittent views of farmland to north, south, & west through gaps between buildings; Those buildings positioned on the outer edge of the town have open views of hillside farmland to west.
10	East Enoch	Farmstead / Residential	[Includes 'Ardenlea'] – Elevated, open, rolling farmland and western fringes of Maybole
11	Maybole Group D	Residential / Play area	[Enoch Road; Glenalla Road; Minnoch Crescent – approximately 165no. Residences] - Urban residential fabric; intermittent views of farmland to west along streets; Playground and those buildings positioned on the outer edge of the town have open views of hillside farmland to west.
12	Bogside	Residential	Elevated, open views across valley farmland, minor road and policy woodland towards Mochrum Hill

Ref.	Name	Type	Existing view outline summary
13	West Brocklock	Farmstead	Elevated, open views over woodland and minor road to farmland of ridge above Maybole
14	Maybole Group E	Residential / School	[Fineview; Gardenrose Primary School; Ashgrove Avenue – approximately 35 residences] - Urban residential fabric; intermittent views of farmland on ridge crest to north through gaps between buildings; Those buildings positioned on the outer edge of the town have open views of farmland to the north as far as the ridge crest.
15	Kirklandhill	Farmstead	Extensive, open views east and west of farmland along ridge
16	Cargilston	Farmstead	Extensive, open views east and west of farmland along ridge, filtered through boundary trees and vegetation
17	Mid Brockloch	Farmstead / Residential	[Includes 'Barncroft'] - Elevated, open views over woodland and minor road to farmland of ridge above Maybole
18	Maybole Group F	Residential	[Kilhenzie View; Elms Crescent; Elms Drive; Cairnhill Court – approximately 25 residences] - Urban residential fabric; intermittent views of farmland on ridge crest to north and hillside northeast through gaps between buildings; Those buildings positioned on the outer edge of the town have open views of farmland to the north and east as far as the ridge crest.
19	Maybole Group G	Residential	[Elms Way; Laurel Bank – approximately 8 residences] – Urban fabric and railway corridor to south
20	Maybole Group H	Residential / Industry / School	[Viewfield; Lumsden School; Depot/Works] - Urban fabric and railway corridor to south; Viewfield has open views up pasture hillside to north; Lumsden School enclosed by Lovers Lane woodland
21	Brockloch House	Farmstead	Elevated, open and extensive panoramic views to east over rolling farmland, minor roads and woodland belts
22	Hillcrest	Residential	Elevated, open and extensive panoramic views to east over rolling farmland, minor roads and woodland belts
23	Cargilston Cottage	Residential	Open views north over minor road to rising farmland and Cairn Hill, including isolated buildings
24	Fair Field	Residential	Elevated, open and extensive panoramic views to east over rolling farmland, minor roads and woodland belts

Ref.	Name	Type	Existing view outline summary
25	Cassillis View	Residential	Elevated, open and extensive panoramic views to east over rolling farmland, minor roads and woodland belts
26	St Murray Cottages	Residential	Minor road, steep hillside pasture rising to west
27	Slateford Cottages	Residential	Minor road, steep hillside pasture rising to west
28	St Murray	Farmstead	Open, rolling farmland and woodland in all directions from relatively low lying position
29	High Grange	Farmstead	Elevated, open and extensive panoramic views to east over rolling farmland, minor roads and woodland belts
30	High Grange Cottage	Residential	Elevated, open and extensive panoramic views to east over rolling farmland, minor roads and woodland belts
31	Holmes	Residential	Enclosed, woodland and water body from relatively low lying position
32	Myremill	Farmstead	Elevated open view, mostly to the southwest across low lying agricultural land to the south of Maybole. Views towards A77 and rolling hills to north west partially screened by trees and vegetation along the property's boundary
33	Myremill Cottage	Residential	Open, elevated view of surrounding farmland and A77 to north west. Views to south west obstructed by receptor 32.
34	Blairbowie	Farmstead	Elevated open view, to the northwest across low lying agricultural land and Chapelton Loch wetland. Views extend over the A77 to the rolling hills to north west
35	Nether Culzean	Farmstead	Heavily screened by woodland to the north west, views over the adjacent A77 and low lying agricultural land and Chapelton Loch wetland to the south east are restricted by boundary trees and vegetation.
36	Nether Culzean Cottage	Farmstead	Adjacent to the A77 with views of the road corridor and rising pasture and railway line to the north west.
37	Laigh Woodston	Farmstead	Main view from property orientated over a narrow valley to rolling farmland to north west. Elevated open view also available to the south east across low lying agricultural land and Chapelton Loch wetland.

Ref.	Name	Type	Existing view outline summary
38	High Smithston Cottages	Residential	Adjacent to the A77 with views of the road corridor and rising pasture and railway line to the north west. Views restricted to east by woodland
39	Laigh Smithston	Farmstead	Adjacent to the A77 with views of road corridor partially filtered by site vegetation. View to east and north restricted by topography and railway line / bridge respectively.
40	Glen Marie	Residential	Main views orientated across minor road to wooded rising land to north. Views partially available to lower land to east and A77 corridor
41	Knoweholm	Farmstead	Rolling farmland and A77 corridor heavily filtered by trees and vegetation around property boundary.

Consultation

5.6.71 Consultation took place with South Ayrshire Council Planning Department in July 2006 as part of the Stage 1 Assessment to gain baseline data and preliminary advice on designated sites, impacts and design. They confirmed that there are currently no Tree Preservation Orders in the study area. This was repeated in January 2007 to confirm the currency of the baseline data and whether any new landscape areas had been designated in the meantime.

5.6.72 Statutory consultation was undertaken in January 2005 as part of the A77 Maybole Transport Study[43]:

- Scotways confirmed in January 2005 that no Rights of Way exist around Maybole.
- Sustrans confirmed the location of National Cycle Network Route 7 in January 2005.
- Scottish Natural Heritage confirmed in February 2005 that there are no Sites of Special Scientific Interest, no non-statutory designated sites, and provided maps illustrating the distribution of Ancient and Semi-natural Woodland.

Landscape Impacts (Opening Year 1) without Mitigation

5.6.73 The Landscape impacts associated with the various aspects of the route options are described below and summarised in **Table 5.6.52** and in Figures 5028091_LAN_011 to 013 in Appendix A. It should be noted that all the options are located within the designated 'Rural Protection Area' and will cause negative impacts upon it - to avoid repetition this aspect is not mentioned separately under the separate route options below.

Tie-In Junctions

Broomknowes Roundabout

Blue and Red Route

[43] Atkins, 2005

5.6.74 The proposed junction will involve construction of a new roundabout offset approximately 80m to the north of the existing A77. The existing site is a relatively flat area of rough pasture, with an access track to Cultezeoun Farm (that is traversed by the original alignment of the Girvan road, which is still clearly visible yet partly overgrown).

5.6.75 The proposed junction will be approximately 6m above existing ground levels, causing a direct impact on the natural landform of this area. No significant vegetation will be affected, although hedgerows associated with the access track to Cultezeoun Farm and the old Girvan road will be lost. The re-alignment of the A77 trunk road has already fragmented the field pattern in this locality, and the introduction of the new junction is likely to exacerbate this situation further, whilst severing the current access track to Cultezeoun Farm.

5.6.76 This particular area is already heavily influenced by the presence of the existing A77, and given that the key features and characteristics of the wider Hillside Woodland & Pasture LCA are unlikely to be significantly affected by the junction, impacts on the character of the area are likely to be minor.

Yellow Route

5.6.77 The Yellow routes' junction at Broomknowes will consist of a new roundabout offset approximately 60m to the north of the A77, opposite the existing access to Broomknowes Farm. The area is relatively flat and semi-derelict in appearance, consisting of old hardstandings (presumably relating to the original road alignment and associated access track to Broomknowes), rusting storage containers and small stockpiles of subsoil and building debris.

5.6.78 The proposed junction will be approximately 6.5m above existing ground levels, causing a direct impact on the natural landform in this particular location. No significant vegetation will be affected, although hedgerows associated with the old access track to Broomknowes Farm and the old Girvan road will be lost. The realignment of the A77 trunk road has already fragmented the field pattern here, and the introduction of the new junction is likely to aggravate this condition.

5.6.79 This particular area is already heavily influenced by the presence of the existing A77, and given that the key features and characteristics of the wider Hillside Woodland & Pasture LCA are unlikely to be significantly affected by the junction, impacts on the character of the area are likely to be minor.

Smithston Bridge Roundabout

5.6.80 The proposed junction at Smithston Bridge will tie all route options back into the existing A77 at their northern extent. The roundabout junction is proposed approximately 40m east of the existing A77 alignment in an area of rough pasture, consisting of marshy ground and remnant hedgerow. Spurs off this roundabout will link to a minor road leading to Laigh Grange in a northwest direction, the A77 (north east) and the A77 (south east), with a final connection to the south west which will link into the proposed bypass. The spur connecting to the A77 in a south easterly direction will cross the existing A77 before turning south across pastureland and down through a wooded embankment to rejoin the A77 approximately 70m north of the existing railway bridge.

5.6.81 This latter spur will cause the greatest landscape impacts associated with the Smithston Bridge junction. This road will require considerable cutting into the existing embankment on the eastern side of the A77, with resultant direct impacts upon the landform and up to half of the mature trees associated with the embankment being lost as a result. Similarly, two field boundary hedgerows to the north of here will also need to be partially removed to accommodate the proposals.

5.6.82 The proposed roundabout junction and three of its spurs are confined to one relatively small field and the longer spur generally follows the perimeter of the fields to the east of the A77, so impacts of the general field pattern will be relatively minor.

5.6.83 Although this particular area is already heavily influenced by the presence of the existing A77 and railway line, the impacts on the significant vegetation and landform in the area immediately north of Smithston Bridge are likely to have a negative impact on its current enclosed, confined character. This will become more open following re-grading of the wooded embankment and the resulting loss of trees.

Blue Base Route – S2 without Roundabout

5.6.84 The base Blue route will cause significant direct impacts upon the landform of the area in the following locations:

- Gallow Hill / B7023 junction – Cutting of up to 10m (chainage44.180-950), with embankment of up to 6m at the Broomknowes junction
- Gardenrose Path junction – Cutting of up to 10m (chainage.1100-1550)
- Covenanters' Memorial to St Murray's Plantation – Embankment of up to 6m (chainage.1600-3150)
- St Murray Farm – Embankment of up to 15m
- Smithston Bridge – Cutting of up to 7m, followed by embankment of up to 6m

5.6.85 All these earthworks will be at significant variance with the existing landform, and in the case of the junctions with the B7023, Gardenrose Path, the unnamed road that links the B7023 and B7024, and B7024, will require new bridge structures to be introduced into the landscape.

5.6.86 No significant areas of vegetation will be impacted upon, although several hedgerows and associated hedgerow trees will be lost (particularly the field boundary northeast of Smithston Bridge). Trees and scrub allied to the watercourse south of the Covenanters' Memorial, and a woodland copse adjacent to the railway line at Ch.4500 will also be lost.

5.6.87 The proximity of the road to East Enoch Farm, a Grade-B listed building, will result in a negative impact on its setting. Although this route also passes within 250m of the Culzean Castle Designed Landscape boundary, this is its far south-eastern extent and as such any impact upon it will be negligible.

5.6.88 The majority of the route is at variance with the existing land pattern, with considerable field fragmentation as a result.

5.6.89 The base Blue route will have significant impacts on the Hillside Woodland & Pasture, Kirklandhill Ridge and Carrick Rolling Hills Landscape Character Areas, where the introduction of such a linear feature with its attendant bridge structures, noise and movement will be at considerable odds with their calm, quiet, and rural character aspects.

Additional Impacts of Roundabout added to S2

5.6.90 Any additional impacts associated with the roundabout being added to the Blue route's junction with the B7023 will be relatively minor, being limited to the effect of the greater land take required in order to construct the roundabout. This will result in more of the existing roadside vegetation (hedgerow and hedgerow trees) being lost, whilst also impacting upon the access road to Ardenlea (residence) and East Enoch farm.

[44] Chainage is the distance along the route starting from a base point, in this instance Broomknowes.

5.6.91 However, it is likely that any additional impacts associated with this option will be more than offset by the fact that this option will not require the introduction of the bridge structure required by the base Blue option. Therefore, although the overall landscape impact of this option is likely to be slightly reduced, it is unlikely however, given the scale and nature of the scheme, that this would be of a sufficient enough magnitude to warrant a lesser impact significance than the base option.

Additional Impacts of WS2+1

5.6.92 Additional impacts associated with this option over and above those associated with the Blue base route will relate to the additional 0.8ha land-take requirement, which will result in more roadside and field boundary vegetation being lost.

5.6.93 It is unlikely, however, given the scale and nature of the scheme that such additional impacts would be of a magnitude sufficient enough to warrant greater impact significance than the base option.

Additional Impacts of Roundabout added to WS2+1

5.6.94 This option will involve the greatest land take, requiring 1.1ha more than the Blue base route, which is likely to result in more roadside and field boundary vegetation being lost than any of the other Blue route options. Once again, the impact of this option will be partially reduced by the lack a bridge structure at the B7023, but it is similarly unlikely that given the scale and nature of the scheme that such additional (or reduced, in the case of the Hillside Woodland & Pasture LCA) impacts would be of a magnitude sufficient enough to warrant a change in the impact significance compared to the base option.

Yellow Base Route – S2 without Roundabout

5.6.95 The base Yellow route will cause significant direct impacts upon the landform of the area in the following locations:

- Gallow Hill / B7023 junction – Cutting of up to 10m (ch.100-600)
- B7023 junction – Embankment of up to 9m (ch.600-1000)
- Gardenrose Path junction – Cutting of up to 10.5m (ch.1000-1550)
- Lover's Lane – Embankment of up to 7.5m (ch.2200-2400)
- Nether Culzean – Embankment of up to 2m (ch.3500-4000)
- Smithston Bridge – Cutting of up to 7m, followed by embankment of up to 6m

5.6.96 All these earthworks will be at significant variance with the existing landform, and in the case of the junctions with the B7023, Gardenrose Path, Kirklandhill Path and B7024, will require new bridge structures to be introduced into the landscape.

5.6.97 No significant areas of vegetation will be impacted upon, although several hedgerows and associated hedgerow trees will be lost (particularly just north of the junction of B7024 and Lover's Lane, and a prominent field boundary running parallel with the railway line southwest of Smithston Bridge), together with trees and scrub allied to the watercourse northwest of Black Glen.

5.6.98 The proximity of the road to Kirklandhill Farm, a Grade-C listed building, will result in a negative impact on its setting.

5.6.99 Although sections of the route are at variance with the existing land pattern, a large portion is generally more sympathetic to the form and shape of the landscape. Despite this, the base Yellow option will still result in considerable field fragmentation due to its alignment.

5.6.100 This route will have significant impacts on the Hillside Woodland & Pasture, and Kirklandhill Ridge Landscape Character Areas, where the introduction of such a linear feature with its attendant bridge structures, noise and movement will be at considerable odds with their calm, quiet, and rural character aspects. The impact on the Carrick Rolling Hills Landscape Character Area will however be slightly less, due to route's parallel alignment with the existing railway line - an existing linear component.

Additional Impacts of Roundabout added to S2

5.6.101 Any additional impacts associated with the roundabout being added to the Yellow route's junction with the B7023 will be relatively minor, being limited to the effect of the greater land take required in order to construct the roundabout. This will result in more of the existing roadside vegetation (hedgerow and hedgerow trees) being lost.

5.6.102 However, it is likely that any additional impacts associated with this option will be more than offset by the fact that this option will not require the introduction of the bridge structure required by the base Yellow option. Therefore, although the overall landscape impact of this option is likely to be slightly reduced, it is unlikely however, given the scale and nature of the scheme, that this would be of a sufficient enough magnitude to warrant a lesser impact significance than the base option.

Additional Impacts of WS2+1

5.6.103 Additional impacts associated with this option over and above those associated with the Yellow base route will relate to the additional 0.5ha land-take requirement, which will result in more roadside and field boundary vegetation being lost.

5.6.104 It is unlikely, however, given the scale and nature of the scheme that such additional impacts would be of a magnitude sufficient enough to warrant greater impact significance than the base option.

Additional Impacts of Roundabout added to WS2+1

5.6.105 This option will involve the greatest land take, requiring 1.6ha more than the Yellow base route, which is likely to result in more roadside and field boundary vegetation being lost than any of the other Yellow route options. Once again, the impact of this option will be partially reduced by the lack a bridge structure at the B7023, but it is similarly unlikely that given the scale and nature of the scheme that such additional (or reduced, in the case of the Hillside Woodland & Pasture LCA) impacts would be of a magnitude sufficient enough to warrant a change in impact significance compared to the base option.

Red Base Route – S2 without Roundabout

5.6.106 The base Red route will cause significant direct impacts upon the landform of the area in the following locations:

- Gallow Hill / B7023 junction – Cutting of up to 10m (ch.180-950), with embankment of up to 6m at the Broomknowes junction
- Gardenrose Path junction – Cutting of up to 13m (ch.1100-1850)
- Lover's Lane – Cutting of up to 5m (ch.2500-2800)
- Nether Culzean – Embankment of up to 6.5m (ch.3700-4000)
- Smithston Bridge – Cutting of up to 12.6m, followed by embankment of up to 6m

5.6.107 All these earthworks will be at significant variance with the existing landform, and in the case of the junctions with the B7023, Gardenrose Path, Kirklandhill Path and B7024, will require new bridge structures to be introduced into the landscape.

5.6.108 No significant areas of vegetation will be impacted upon, although several hedgerows and associated hedgerow trees will be lost (particularly the northernmost distinctive roadside trees alongside Gardenrose Path at the entry to Maybole, just north of the junction of B7024 and Lover's Lane, and northeast of Smithston Bridge), together with trees and scrub allied to the watercourse northwest of Black Glen, and a woodland copse adjacent to the railway line at Ch.4500.

5.6.109 The proximity of the road to East Enoch Farm, a Grade-B listed building, in addition to the C-listed Kirklandhill Farm, will result in negative impacts on their settings. Although this route also passes within 250m of the Culzean Castle Designed Landscape boundary, this is its far south-eastern extent and as such any impact upon it will be negligible.

5.6.110 Sections of the route are at variance with the existing land pattern, and although its mid-section (ch.1900-3000) is generally sympathetic to the form and shape of the landscape, the base Red option will still result in considerable field fragmentation due to its alignment.

5.6.111 This route will have significant impacts on the Hillside Woodland & Pasture, and Kirklandhill Ridge Landscape Character Areas, where the introduction of such a linear feature with its attendant bridge structures, noise and movement will be at considerable odds with their calm, quiet, and rural character aspects. The impact on the Carrick Rolling Hills Landscape Character Area will however be slightly less, due to route's parallel alignment with the existing railway line - an existing linear component.

Additional Impacts of Roundabout added to S2

5.6.112 Any additional impacts associated with the roundabout being added to the Red route's junction with the B7023 will be relatively minor, being limited to the effect of the greater land take required in order to construct the roundabout. This will result in more of the existing roadside vegetation (hedgerow and hedgerow trees) being lost, whilst also impacting upon the access road to Ardenlea (residence) and East Enoch farm.

5.6.113 However, it is likely that any additional impacts associated with this option will be more than offset by the fact that this option will not require the introduction of the bridge structure required by the base Red option. Therefore, although the overall landscape impact of this option is likely to be slightly reduced, it is unlikely however, given the scale and nature of the scheme, that this would be of a sufficient enough magnitude to warrant a lesser impact significance than the base option.

Additional Impacts of WS2+1

5.6.114 Additional impacts associated with this option over and above those associated with the Red base route will relate to the additional 0.9ha land-take requirement, which will result in more roadside and field boundary vegetation being lost.

5.6.115 It is unlikely, however, given the scale and nature of the scheme that such additional impacts would be of a magnitude sufficient enough to warrant a greater impact significance than the base option.

Additional Impacts of Roundabout added to WS2+1

5.6.116 This option will involve the greatest land take, requiring 1.2ha more than the Red base route, which is likely to result in more roadside and field boundary vegetation being lost than any of the other Red route options. Once again, the impact of this option will be partially reduced by the lack a bridge structure at the B7023, but it is similarly unlikely that given the scale and nature of the scheme that such additional (or reduced, in the case of the Hillside Woodland & Pasture LCA) impacts would be of a magnitude sufficient enough to warrant a change in impact significance compared to the base option.

Table 5.6.52 – Summary Landscape Impacts Comparison Table (Opening Year 1) without Mitigation

Route Option	Landscape Impacts					Overall Landscape Impact **
	Designations	Landform	Vegetation	Land Use / Pattern	Character *	
Blue S2	Slight Adverse	Major Adverse	Slight Adverse	Major Adverse	B. Moderate C. Major D. Major	Major Adverse
Blue S2 + Roundabout	Slight Adverse	Major Adverse	Slight Adverse	Major Adverse	B. Moderate C. Major D. Major	Major Adverse
Blue S2+1	Slight Adverse	Major Adverse	Slight Adverse	Major Adverse	B. Moderate C. Major D. Major	Major Adverse
Blue S2+1 + Roundabout	Slight Adverse	Major Adverse	Slight Adverse	Major Adverse	B. Moderate C. Major D. Major	Major Adverse
Yellow S2	Slight Adverse	Moderate Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse
Yellow S2 + Roundabout	Slight Adverse	Moderate Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse
Yellow S2+1	Slight Adverse	Moderate Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse

Route Option	Landscape Impacts					Overall Landscape Impact **
	Designations	Landform	Vegetation	Land Use / Pattern	Character *	
Yellow S2+1 + Roundabout	Slight Adverse	Moderate Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse
Red S2	Slight Adverse	Major Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate-Major Adverse
Red S2 + Roundabout	Slight Adverse	Major Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate-Major Adverse
Red S2+1	Slight Adverse	Major Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate-Major Adverse
Red S2+1 + Roundabout	Slight Adverse	Major Adverse	Slight Adverse	Moderate Adverse	B. Moderate C. Moderate D. Major	Moderate-Major Adverse

** - Although Detailed Landscape Character Areas A (Maybole Townscape) and E (Maybole Plain) fall within the Study Area they are unaffected by the proposed route options, and therefore have a 'Neutral' Landscape Impact for all options. All impacts shown in the 'Character' column are adverse.*

*** - Professional judgement has been used to define the overall Landscape Impact of each route option, taking into account the relative importance of each component to the overall landscape resource.*

Visual Impacts (Opening Year 1) without Mitigation

5.6.117 Visual impacts relate solely to changes in available views of the landscape and the effects of those changes on people. As with landscape character impacts, any changes in views from identified receptors were compared with the existing views and influence of the A77 where applicable.

5.6.118 The extent of the potential visibility, the Zone of Theoretical Visibility (ZTV), for the options can also be found on Figures 5028091_LAN_008, 5028091_LAN_009 and 5028091_LAN_010 in Appendix A. At this stage of the assessment process this is only indicative, and as the differences between the options within each corridor are relatively minor only one visual envelope has been indicated for each of the three main alignments. The impacts are described below and are also summarised in a tabular format in **Table 5.6.53**.

Tie-In Junctions

Broomknowes Roundabout

Blue and Red Route

5.6.119 The general landform of the area around this junction, low number of potential receptors and presence of the existing A77 in the vicinity will result in its visual impact being relatively minor.

Yellow Route

5.6.120 As with the Blue and Red Route, the landform of the area around this junction, low number of potential receptors and presence of the existing A77 in the vicinity will result in its visual impact being relatively minor. The exception is likely to be Carrick Academy (Nr.6), where the proposed junction will be visible from the playing fields and those houses to the south and west of receptor Nr.7.

Smithston Bridge Junction

5.6.121 Similarly to the Broomknowes Junction, the landform and lack of receptors in the area will result in a minor visual impact. The junction will be noticeable from receptors 40 (Glen Marie) and 41 (Knoweholm), but will not form a significant change in their existing outlook.

Blue Base Route – S2 without Roundabout

5.6.122 The Blue route's alignment, being furthest away from Maybole of all the options, results in it having the least visual impact on the town itself. The exception is receptors Nr.9 and 11, where despite much of the street pattern and prominent views being focussed in a southerly direction in accordance with the underlying landform, their current view of pastoral farmland to the west will be interrupted by the movement of vehicles, road lighting, signage and other infrastructure associated with the road.

5.6.123 The Blue base route will also have similar significant visual impacts on a large number of farmsteads as it passes through the countryside to the north of the town, where receptors 10, 15, 16, 17, 21, 22, 23, 25, 28, 29 and 30 will all have their current, open views of rolling farmland significantly altered by the presence of the proposed road.

5.6.124 A noticeable, if not significant, change in view will be experienced by those receptors situated further away from the Blue route alignment. A combination of natural landform, existing vegetation and distance are likely to reduce the visual impact of the road and movement of vehicles on receptors 3, 5, 8, and 13.

Additional Impacts of Roundabout added to S2

5.6.125 The addition of the roundabout to the B7023 will increase the visual impact of the road in the immediate vicinity by virtue of the increase in land-take and associated traffic movement, signage, lighting etc., affecting receptors Nr.8, 9, 10 and 11. However, given that the visual impact of the base Blue Option on these receptors is already Major Adverse, the addition of the roundabout at the B7023 is not anticipated to increase the overall impact of this option in comparison to the base route.

Additional Impacts of WS2+1

5.6.126 Taking into account the scale and nature of the proposed scheme, no additional perceptible visual impact is anticipated over and above that associated with the base route option.

Additional Impacts of Roundabout added to 2+1

5.6.127 Taking into account the scale and nature of the proposed scheme, additional impacts associated with this option will be broadly perceived to be the same as the roundabout being added to the base option – refer to paragraph above.

Yellow Base Route – S2 without Roundabout

5.6.128 The Yellow route's alignment close to the western fringe of Maybole will inevitably lead to it having a significant impact on those receptors that are located around this area of the town. Although much of the street pattern and prominent views are focussed in a southerly direction in accordance with the underlying landform, their current view of pastoral farmland to the west will be interrupted by the movement of vehicles, road lighting, signage and other infrastructure associated with the road.

5.6.129 Similar significant visual impacts are anticipated to the farmsteads of East Enoch (Nr.10) and Kirklandhill (Nr.15) due to the proximity of the proposed road, existing view and sensitivity of these receptors.

5.6.130 A noticeable, if not significant, change in view will be experienced by those receptors situated around the northern perimeter of Maybole (Nr.14, 18 and 20), where the ridgeline to the north of Maybole is likely to screen much of the proposed road but the movement of high-sided vehicles may still be visible. Moderately significant adverse impacts are also likely to be experienced by some of the more remote farmsteads and residences in the study area, where the introduction of the road into their view of farmland and woodland will be a distant but nevertheless noticeable change.

Additional Impacts of Roundabout added to S2

5.6.131 The addition of the roundabout to the B7023 will increase the visual impact of the road in the immediate vicinity by virtue of the increase in land-take and associated traffic movement, signage, lighting etc., affecting receptors Nr.7, 9, 10 and 11. However, given that the visual impact of the base Yellow option on these receptors is already Major Adverse, the addition of the roundabout at the B7023 is not anticipated to increase the overall impact of this option in comparison to the base route.

Additional Impacts of WS2+1

5.6.132 Taking into account the scale and nature of the proposed scheme, no additional perceptible visual impact is anticipated over and above that associated with the base route option.

Additional Impacts of Roundabout added to 2+1

5.6.133 Taking into account the scale and nature of the proposed scheme, additional impacts associated with this option will be broadly perceived to be the same as the roundabout being added to the base option – refer to paragraph above.

Red Base Route – S2 without Roundabout

5.6.134 The visual impact of the Red base route will be very similar to the Yellow base route in all but two main areas:

- The initial section of the route (up to ch.950) follows the same alignment of the Blue base route, and as such the major adverse visual impacts will relate to receptors 8, 9, 10 and 11.
- In the route's latter section, from ch.4200 to ch.4900, it follows a slightly more elevated alignment across the eastern slope of a small hill, requiring a cutting of between 12 and 13m. This will increase the visual impact of the road (in comparison to the Yellow base route) on receptors 33, 36, and 38.

Additional Impacts of Roundabout added to S2

5.6.135 The addition of the roundabout to the B7023 will increase the visual impact of the road in the immediate vicinity by virtue of the increase in land-take and associated traffic movement, signage, lighting etc., affecting receptors Nr.8, 9, 10 and 11. However, given that the visual impact of the base Blue option on these receptors is already Major Adverse, the addition of the roundabout at the B7023 is not anticipated to increase the overall impact of this option in comparison to the base route.

Additional Impacts of WS2+1

5.6.136 Taking into account the scale and nature of the proposed scheme, no additional perceptible visual impact is anticipated over and above that associated with the base route option.

Additional Impacts of Roundabout added to 2+1

5.6.137 Taking into account the scale and nature of the proposed scheme, additional impacts associated with this option will be broadly perceived to be the same as the roundabout being added to the base option – refer to paragraph above.

Table 5.6.53 – Summary Visual Impacts Comparison Table (Opening Year 1) without Mitigation

Receptors		Route Alignments & Visual Impact *		
Ref.	**Name**	**Blue**	**Yellow**	**Red**
1	Baltersan Castle	Moderate / Minor	Moderate / Minor	Moderate / Minor
2	Baltersan Mains	Moderate / Minor	Moderate / Minor	Moderate / Minor
3	Thornebroke	Major / Moderate	Major / Moderate	Major / Moderate
4	Broomknowes	Moderate / Minor	Moderate / Minor	Moderate / Minor
5	Cultezeoun	Major / Moderate	Moderate / Minor	Major / Moderate
6	Maybole Group A	Moderate / Minor	Major / Moderate	Moderate / Minor
7	Maybole Group B	Major / Moderate	Major	Major / Moderate
8	Caravan Site	Major	Moderate / Minor	Major
9	Maybole Group C	Major	Major	Major
10	East Enoch	Major	Major	Major
11	Maybole Group D	Major	Major	Major
12	Bogside	Neutral	Neutral	Neutral
13	West Brocklock	Major / Moderate	Neutral	Moderate / Minor
14	Maybole Group E	Neutral	Moderate / Minor	Moderate / Minor
15	Kirklandhill	Major	Major	Major
16	Cargilston	Major	Major / Moderate	Major / Moderate
17	Mid Brockloch	Major	Major / Moderate	Major / Moderate
18	Maybole Group F	Neutral	Major / Moderate	Major / Moderate
19	Maybole Group G	Neutral	Neutral	Neutral
20	Maybole Group H	Neutral	Major / Moderate	Major / Moderate
21	Brockloch House	Major	Major / Moderate	Major / Moderate
22	Hillcrest	Major	Major / Moderate	Major / Moderate
23	Cargilston Cottage	Major	Neutral	Neutral
24	Fair Field	Moderate / Minor	Neutral	Neutral
25	Cassillis View	Major	Neutral	Neutral
26	St Murray Cottages	Moderate / Minor	Neutral	Neutral
27	Slateford Cottages	Moderate / Minor	Neutral	Neutral
28	St Murray	Major	Neutral	Neutral

Receptors		Route Alignments & Visual Impact *		
Ref.	**Name**	**Blue**	**Yellow**	**Red**
29	High Grange	Major	Neutral	Neutral
30	High Grange Cottage	Major	Neutral	Neutral
31	Holmes	Moderate / Minor	Neutral	Neutral
32	Myremill	Neutral	Moderate / Minor	Moderate / Minor
33	Myremill Cottage	Moderate / Minor	Moderate / Minor	Major / Moderate
34	Blairbowie	Moderate / Minor	Major / Moderate	Major / Moderate
35	Nether Culzean	Neutral	Moderate / Minor	Moderate / Minor
36	Nether Culzean Cottage	Moderate / Minor	Moderate / Minor	Major / Moderate
37	Laigh Woodston	Moderate / Minor	Major / Moderate	Major / Moderate
38	High Smithston Cottages	Moderate / Minor	Moderate / Minor	Major / Moderate
39	Laigh Smithston	Neutral	Neutral	Neutral
40	Glen Marie	Major / Moderate	Major / Moderate	Major / Moderate
41	Knoweholm	Moderate / Minor	Moderate / Minor	Moderate / Minor
42	Covenanter's Memorial SAM	Major	Major / Moderate	Major / Moderate
43	B7023	Moderate / Minor	Moderate / Minor	Moderate / Minor
44	Gardenrose Path	Moderate / Minor	Moderate / Minor	Moderate / Minor
45	Kirklandhill Path	Moderate / Minor	Moderate / Minor	Moderate / Minor
46	B7024	Moderate / Minor	Moderate / Minor	Moderate / Minor
47	Ladycross Road	Moderate / Minor	Moderate / Minor	Moderate / Minor

** All impacts shown above are adverse unless stated otherwise*

5.6.138 The broad number of visual receptors likely to be affected by each alignment is summarised in **Table 5.6.54** below:

Table 5.6.54 – Summary of Visual Receptors Impacted (Opening Year 1) without Mitigation

Visual Impact	Route Alignments & Number of Receptors		
	Blue	Yellow	Red
Major Adverse	344	339	333
Major / Moderate Adverse	60	43	98
Moderate / Minor Adverse	23	100	52
Neutral	75	20	19

5.6.139 As previously stated, the assessment above is indicative and further on-site survey work to look specifically at visual impacts on property will take place following the selection of a preferred route. Impacts of moderate and above are considered to be significant, as this is the level at which changes will be clearly perceived. In this regard all three alignments will result in similar impacts, with 86% of receptors affected by the Red options, 80% affected by the Blue alignment, and 76% by the Yellow route options. The overall visual impact of all the route options is therefore regarded as Major–Moderate Adverse.

Mitigation Measures

General

5.6.140 Mitigation measures were proposed through reference to the baseline conditions and impact assessment. The mitigation measures aim to:

- Maximise the positive aspects of the route options and their surroundings through creative design and use of local materials, including planting. This will enhance the local sense of place and landscape character, with emphasis on environmental quality and sustainability;
- Replace areas of lost landscape value with measures in character with the surroundings. Similar tree and shrub species found in the wider landscape will be used. Opportunities will be created to add visual interest and quality whilst improving biodiversity;
- Avoid, retain, protect and make best use of existing features, such as designated areas, visual receptors and areas of landscape value such as existing woodlands, including the Ancient Woodlands;
- Minimise the footprint of the new works including construction works to avoid both direct and indirect impacts; and,
- Provide a pleasant environment for the road user, including the retention of an attractive journey with views from the road where possible.

5.6.141 Mitigation of adverse effects through the design process has been ongoing and has been incorporated into the route option selection. However, specific landscape mitigation measures include:

- During construction operations, it is advised that the site compound be located where the least landscape impacts will be experienced with regard to vegetation loss. Where vegetation is to be removed, it will be replaced with similar species following completion;
- The land take directly affected by the proposals either side of the bypass will be minimised as far as practicably possible to reduce both direct and indirect impacts and will be balanced against the need to mitigate long term landscape and vegetation impacts;
- Removal of significant trees and areas of woodland will be minimised where possible to reduce both direct and indirect impacts;
- Replacement planting to compensate for loss of trees and areas of woodland will be provided. Consideration will be given to creating off-site planting schemes to create 'natural' upland woodland;
- Any rock slope required will be as natural as possible and graded and shaped appropriately;
- Replacement vegetation will be of similar species to that present within the surrounding and adjacent landscape to assist in the assimilation and integration of the development in its wider context; and,
- Indigenous seed will be sourced locally to vegetate embankments.

Blue Route

5.6.142 Specific mitigation measures applicable to the Blue route include:

- Integration of the cutting between Gallow Hill and caravan site into the wider landscape via a combination of earthworks and planting – this may require additional sympathetic re-grading of adjacent land to disguise the cutting
- Screen planting to reduce the visual impact of the road between ch.300 and 1300 – extended lengths of linear planting will be avoided in order to maintain views from the road to the wider landscape and opportunities for on and off-line planting will be sought to this end
- Screen planting to reduce the visual impact of the road between ch.1500 and 4000 – opportunities exist to link such planting with existing woodland areas, helping to integrate the scheme into the landscape.
- Woodland planting to the relatively narrow strip of land between the route and railway line between ch.4000 and ch.5000 – this could link the existing woodland at Smithston Bridge and along the rail corridor to that at Nether Culzean, helping to both screen and integrate the road as well as providing biodiversity benefits.

Yellow Route

5.6.143 Specific mitigation measures applicable to the Yellow route include:

- Integration of the cutting between Gallow Hill and western flank of Maybole into the wider landscape via a combination of earthworks and planting – this may require additional sympathetic re-grading of adjacent land to disguise the cutting
- Screen planting to reduce the visual impact of the road between ch.100 and 1300 – extended lengths of linear planting will be avoided in order to maintain views from the road to the wider landscape and opportunities for on and off-line planting will be sought to this end

- Sympathetic earthworks to reduce the visual impact of the road between ch.1400 and 2500, following the characteristics of the existing ridge landform to integrate the mitigation into the landscape
- Woodland planting to the relatively narrow strip of land between the route and railway line between ch.3300 and ch.5000 – this could link the existing woodland at Smithston Bridge and along the rail corridor to that at Black Glen, helping to both screen and integrate the road as well as providing biodiversity benefits

Red Route

5.6.144 Specific mitigation measures pertaining to the Red route include a combination of those described above:

- Integration of the cutting between Gallow Hill and caravan site into the wider landscape via a combination of earthworks and planting – this may require additional sympathetic re-grading of adjacent land to disguise the cutting
- Screen planting to reduce the visual impact of the road between ch.300 and 1300 – extended lengths of linear planting will be avoided in order to maintain views from the road to the wider landscape and opportunities for on and off-line planting will be sought to this end
- Sympathetic earthworks to reduce the visual impact of the road between ch.1400 and 2500, following the characteristics of the existing ridge landform to integrate the mitigation into the landscape
- Woodland planting to the relatively narrow strip of land between the route and railway line between ch.3300 and ch.5000 – this could link the existing woodland at Smithston Bridge and along the rail corridor to that at Black Glen, helping to both screen and integrate the road as well as providing biodiversity benefits.

Impacts (Design Year 15)

Landscape Impacts

5.6.145 Due to the particular landform of this area, although the impacts of each option will be reduced by landscape integration enabled by maturing planting, they will remain moderate adverse for the Blue and Red options and slight adverse for the Yellow options. Generally replacement planting will help to camouflage the engineered embankments with establishing woodland planting connecting with areas of retained semi-natural Ancient Woodland, helping to reduce the vegetation impacts to neutral for all options, and Land Use / Pattern impacts to Moderate Adverse for the Blue options and Slight Adverse for the Yellow and Red routes. These connections, achieved principally through planting, will help to assimilate and integrate the proposed scheme into its wider landscape context.

5.6.146 The residual Landscape Impacts are summarised in **Table 5.6.55** below.

Table 5.6.55: Summary Landscape Impacts Comparison Table (Design Year 15) with Mitigation

Route Option	Landscape Impacts					Overall Landscape Impact **
	Designations	Landform	Vegetation	Land Use / Pattern	Character *	
Blue S2	Slight Adverse	Moderate Adverse	Neutral	Moderate Adverse	B. Moderate C. Major D. Major	Moderate Adverse
Blue S2 + Roundabout	Slight Adverse	Moderate Adverse	Neutral	Moderate Adverse	B. Moderate C. Major D. Major	Moderate Adverse
Blue S2+1	Slight Adverse	Moderate Adverse	Neutral	Moderate Adverse	B. Moderate C. Major D. Major	Moderate Adverse
Blue S2+1 + Roundabout	Slight Adverse	Moderate Adverse	Neutral	Moderate Adverse	B. Moderate C. Major D. Major	Moderate Adverse
Yellow S2	Slight Adverse	Slight Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Slight Adverse
Yellow S2 + Roundabout	Slight Adverse	Slight Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Slight Adverse
Yellow S2+1	Slight Adverse	Slight Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Slight Adverse

Route Option	Landscape Impacts					Overall Landscape Impact **
	Designations	Landform	Vegetation	Land Use / Pattern	Character *	
Yellow S2+1 + Roundabout	Slight Adverse	Slight Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Slight Adverse
Red S2	Slight Adverse	Moderate Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse
Red S2 + Roundabout	Slight Adverse	Moderate Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse
Red S2+1	Slight Adverse	Moderate Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse
Red S2+1 + Roundabout	Slight Adverse	Moderate Adverse	Neutral	Slight Adverse	B. Moderate C. Moderate D. Major	Moderate Adverse

** - Although Detailed Landscape Character Areas A (Maybole Townscape) and E (Maybole Plain) fall within the Study Area they are unaffected by the proposed route options, and therefore have a 'Neutral' Landscape Impact for all options. All impacts shown in the 'Character' column are adverse.*

*** - Professional judgement has been used to define the overall Landscape Impact of each route option, taking into account the relative importance of each component to the overall landscape resource.*

5.6.147 Given the existing attractive, rural character of the receiving landscape, the long-term impacts of the by-pass are difficult to mitigate fully and as such the overall landscape impacts at Design Year 15 are likely to be:

- Blue route options: Moderate Adverse
- Yellow route options: Slight Adverse
- Red route options: Moderate Adverse

Visual Impacts

5.6.148 As outlined above, the established planting will assist in increasing the screening of views from receptors identified along the route and this will reduce the visual intrusion of the proposed scheme.

5.6.149 The residual visual impacts are illustrated in **Table 5.6.56** below, and Figures 5028091_ LAN_008 to 010.

Table 5.6.56 – Summary Visual Impacts Comparison Table (Design Year 15) with Mitigation

Receptors		Route Alignments & Visual Impact *		
Ref.	**Name**	**Blue**	**Yellow**	**Red**
1	Baltersan Castle	Minor	Minor	Minor
2	Baltersan Mains	Minor	Minor	Minor
3	Thornebroke	Moderate / Minor	Moderate / Minor	Moderate / Minor
4	Broomknowes	Minor	Minor	Minor
5	Cultezeoun	Moderate / Minor	Minor	Moderate / Minor
6	Maybole Group A	Minor	Moderate / Minor	Minor
7	Maybole Group B	Moderate / Minor	Moderate	Moderate / Minor
8	Caravan Site	Moderate	Minor	Moderate
9	Maybole Group C	Moderate	Moderate	Moderate
10	East Enoch	Moderate	Moderate	Moderate
11	Maybole Group D	Moderate	Moderate	Moderate
12	Bogside	Neutral	Neutral	Neutral
13	West Brocklock	Moderate / Minor	Neutral	Minor
14	Maybole Group E	Neutral	Minor	Minor
15	Kirklandhill	Moderate	Moderate	Moderate
16	Cargilston	Moderate	Moderate / Minor	Moderate / Minor
17	Mid Brockloch	Moderate	Moderate / Minor	Moderate / Minor
18	Maybole Group F	Neutral	Moderate / Minor	Moderate / Minor

Receptors		Route Alignments & Visual Impact *		
Ref.	**Name**	**Blue**	**Yellow**	**Red**
19	Maybole Group G	Neutral	Neutral	Neutral
20	Maybole Group H	Neutral	Moderate / Minor	Moderate / Minor
21	Brockloch House	Moderate	Moderate / Minor	Moderate / Minor
22	Hillcrest	Moderate	Moderate / Minor	Moderate / Minor
23	Cargilston Cottage	Moderate	Neutral	Neutral
24	Fair Field	Minor	Neutral	Neutral
25	Cassillis View	Moderate	Neutral	Neutral
26	St Murray Cottages	Minor	Neutral	Neutral
27	Slateford Cottages	Minor	Neutral	Neutral
28	St Murray	Moderate	Neutral	Neutral
29	High Grange	Moderate	Neutral	Neutral
30	High Grange Cottage	Moderate	Neutral	Neutral
31	Holmes	Minor	Neutral	Neutral
32	Myremill	Neutral	Minor	Minor
33	Myremill Cottage	Minor	Minor	Moderate / Minor
34	Blairbowie	Minor	Moderate / Minor	Moderate / Minor
35	Nether Culzean	Neutral	Minor	Minor
36	Nether Culzean Cottage	Minor	Minor	Moderate / Minor
37	Laigh Woodston	Minor	Moderate / Minor	Moderate / Minor
38	High Smithston Cottages	Minor	Minor	Moderate / Minor
39	Laigh Smithston	Neutral	Neutral	Neutral
40	Glen Marie	Moderate / Minor	Moderate / Minor	Moderate / Minor
41	Knoweholm	Minor	Minor	Minor
42	Covenanter's Memorial SAM	Moderate	Moderate / Minor	Moderate / Minor
43	B7023	Minor	Minor	Minor
44	Gardenrose Path	Minor	Minor	Minor

Receptors		Route Alignments & Visual Impact *		
Ref.	**Name**	**Blue**	**Yellow**	**Red**
45	Kirklandhill Path	Minor	Minor	Minor
46	B7024	Minor	Minor	Minor
47	Ladycross Road	Minor	Minor	Minor

** All impacts shown above are adverse unless stated otherwise*

5.6.150 The broad number of visual receptors likely to be affected by each alignment is summarised in **Table 5.6.19** below:

Table 5.6.57 – Summary of Visual Receptors Impacted (Design Year 15) with Mitigation

Visual Impact	Route Alignments & Number of Receptors		
	Blue	**Yellow**	**Red**
Major Adverse	0	0	0
Moderate Adverse	344	339	333
Moderate / Minor Adverse	82	142	149
Neutral	75	20	19

5.6.151 As previously stated, the assessment above is indicative and further on-site survey work to look specifically at visual impacts on property will take place following the selection of a preferred route. Impacts of moderate and above are considered to be significant, as this is the level at which changes will be clearly perceived. In this regard all three alignments will result in similar impacts, with 66% of receptors affected by the Red options, 67% affected by the Blue alignment, and 68% by the Yellow route options. The overall residual visual impact of all three route alignments – as far as can be predicted at this stage – is therefore Moderate Adverse.

Conclusions

5.6.152 In terms of landscape impacts, all the route options are located in attractive, rural landscape whose rolling and, in places, hilly landform will not easily accommodate a transportation scheme of this type. As a consequence, the resultant landscape impacts are relatively severe due largely to the earthworks required. Those routes using the Blue alignment are the least preferred as they affect the landscape of the largest area, often conflicting with the existing landscape pattern. Conversely, the Yellow alignments are generally more sympathetic to the existing landform (with one or two notable and unavoidable exceptions) and affect the smallest area of the routes under consideration.

5.6.153 Although the Blue routes will affect the visual amenity of receptors across a wider area, and the Yellow and Red alignments will impact more upon the greater concentration of receptors associated with Maybole, the visual impacts of the different route options are generally similar, with all the options causing a significant, adverse change in the view of approximately the same number of receptors.

5.6.154 Given the scale and nature of the proposal, there is unlikely to be any discernible difference between the landscape and visual impacts of the options within each of the three basic alignments. However, given that the 2+1 and roundabout options are likely to have a marginally greater landscape and visual impacts (due to land-take required and increased number of vehicles using the road) the following ranking can be applied (in order of preference):

1. Yellow S2 (Option 3.1)
2. Yellow S2+1 (Option 3.2)
3. Yellow S2 R (Option 3.3)
4. Yellow S2+1 R (Option 3.4)
5. Red S2 (Option 2.1)
6. Red S2+1 (Option 2.2)
7. Red S2 R (Option 2.3)
8. Red S2+1 R (Option 2.4)
9. Blue S2 (Option 1.1)
10. Blue S2+1 (Option 1.2)
11. Blue S2 R (Option 1.3)
12. Blue S2+1 R (Option 1.4)

5.6.155 The preferred route option, from both a landscape and visual perspective, is the Yellow S2 without the B7023 Roundabout (Option 3.1), closely followed by the other Yellow options as listed above.

5.7 Land Use

Introduction

5.7.1 This land use study assesses and compares the impacts of the Blue, Red and Yellow route options that have been developed for the A77 Maybole Bypass. The route options are in a predominantly agricultural corridor containing commercial dairy, beef and sheep farms. The assessment examines the potential impact of the route options on the small amount of development land and amenity facilities within the route corridors.

Key Issues

5.7.2 The Scottish Executive Development Department's (SEDD) current policy on the protection of agricultural land is set out in Circular 18/1987, as amended by Circular 25/1994[45]. Key issues to be addressed in scheme design are protection of any prime land and mitigation of impacts related to landtake, severance and disruption to farm infrastructure such as buildings, water supplies and drains.

5.7.3 Scheme design should also seek to avoid, or minimise impacts on designated sites, amenity land and land scheduled for industrial, housing and business development.

Methodology

5.7.4 This Stage 2 assessment follows the guidance set out in DMRB 11:3:6[46]. Effects are assessed on the assumption that appropriate mitigation measures will be implemented. These mitigation measures could include major accommodation works for access, water supply and drainage.

5.7.5 DMRB does not have a defined scale of impacts on land use and so the STAG[47] guidance has been adapted to assess the situation at Maybole in order to provide an objective means of comparing the impacts of the options. All scheme impacts will be either neutral or negative (of a minor, moderate or major magnitude) and are defined in **Table 5.7.58**.

[45] Scottish Executive Development Department 1987 and 1994
[46] Highways Agency 1993 (2001 amendment)
[47] Transport Scotland, 2005

Table 5.7.58– Scale of Impacts

Impact	Definition
Neutral	With mitigation, most rural landowners will experience only very minor disruption, or a very small decrease in land area and/or potential profitability. Simple adjustments to the management regime will normally restore income levels.
Minor negative	With mitigation, most rural landowners will experience only minor disruption, and/or small permanent decreases in land area and/or potential profitability.
Moderate negative	Even with mitigation some rural landowners will experience significant disruption, and/or significant permanent decreases in land area and/or potential profitability.
Major negative	Even with mitigation some rural landowners will experience serious disruption and/or very damaging permanent decreases in land area and/or potential profitability.

5.7.6 A site visit was undertaken in December 2006 to examine land uses and management issues. No contact was made with landowners as part of this assessment and the study was informed by observations from roadsides and public rights of way.

Baseline Conditions

5.7.7 Refer to Figure 5028091_USE_001 and the associated land quality legend for an outline of the baseline conitions of the Maybole study area in terms of land use.

5.7.8 Land use in the vicinity of the route options is almost entirely agricultural with scattered livestock farms and some rural dwellings; see **Photo 5.3** below. The only significant non-agricultural land uses potentially affected by the scheme are the caravan park at Gallowhill and the land designated for residential development at Whitefaulds. There are several small commercial woodlands but none of these are directly affected by the route options.

Photo 5.3 – View East from Cassilis View

5.7.9 Most of the route corridor is under grass, with some forage crops and fields of barley grown for animal feed. There are two dairy farms (East Enoch and Mid Brockloch) with the remaining farms in the area producing beef and sheep.

5.7.10 Apart from Lyonston and Myremill Farms, which are on the Register of Scotland land registry, no precise farm ownership information is available. A study of field accesses and farm tracks visible on aerial photographs indicates that the route corridor has up to 14 farmed holdings, but the pattern of ownership and tenancies cannot be determined until farm visits are made (this will be undertaken as part of a Stage 3 Assessment). It appears that some holdings are farmed jointly so the number of actual farm enterprises could be closer to 11.

5.7.11 The only Designated Site close to Maybole is the Heart Loch Provisional Wildlife Site (NS311094) which is 1.5km south of the route corridor and is considered to be unaffected by any of the proposed options.

5.7.12 The Maybole area is within the Soil Survey of Scotland's 1:63,360 Soil Map of Ayr – Sheet 14 and Part of 13[48]. This shows the soils to be developed in Rocky Moraine, Fluvioglacial Sands and Gravels and Till (Boulder Clay), (refer **Photo 5.4**) with Alluvium on the valley floors (see **Section 5.12**, Geology and Soils). The landscape is hummocky with slopes ranging from gentle to steep (refer **Photo 5.5**).

Photo 5.4 – Soil in Glacial Deposit at Gallowhill

[48] Soil Survey of Scotland, 1962

Photo 5.5 – Hummocky Terrain at "Lovers Lane"

5.7.13 Altitudes range from 96m OD on the lowest ground west of Maybole to 144m OD on the ridge between East Enoch and Kirklandhill.

5.7.14 The climate is typical of lowland Ayrshire, being strongly influenced by the Gulf Stream and having mild winters, cool summers and an average annual rainfall of around 1100mm. Soils are typically at field capacity (i.e. replete with moisture) between early October and early March.

5.7.15 The Macaulay Institute's Land Capability for Agriculture Sheet 70[49] classifies most of the land in the vicinity of the route options as Class 32, the principal limitations being steep gradients and adverse soil conditions (see Appendix A). Pockets of wet, low lying ground are in Class 4. There are small areas of prime land within the route corridor. Definitions of the land classes are presented in **Table 5.7.59**.

[49] Macaulay Institute for Soil Research, 1986

Table 5.7.59 – Definition of Land Classes

Class	Class Description	Division Descriptions	Present in Route Corridor
1	Prime Land capable of producing a very wide range of crops		No
2	Prime Land capable of producing a wide range of crops		No
3	Land capable of producing a moderate range of crops	31 Prime Land capable of producing consistently high yields of a narrow range of crops and/or moderate yields of a wider range. 32 Land capable of average production but high yields of barley, oats and grass are often obtained	Yes Yes
4	Land capable of producing a narrow range of crops		Yes
5	Land capable of use as improved grassland		No
6	Land capable of use only as rough grazings		No
7	Land of very limited agricultural value		No

Consultation

Consultation with Land Owners

5.7.16 Landowners and farmers were not consulted during this Stage 2 assessment due to the early stages of consideration of the scheme. Transport Scotland considered it premature to access private property at this stage.

Approved Planning Applications

5.7.17 The South Ayrshire Council website[50] provides information on approved planning applications within or close to the route corridor. Approvals in the past five years are:

- East Enoch Farm (02/00977/FUL) – To erect a slurry storage facility

[50] http://gis.south-ayrshire.gov.uk/viewerplanning/defaultPlanning.asp

- High Smithston Farm (03/00480/COU) – Conversion of farm buildings to farm shop and restaurant
- Cassilis View, KA19 8DG (04/01594/FUL - alteration to dwelling

Literature Review:

5.7.18 The following planning documents were consulted:

5.7.19 The Maybole Local Plan[51] will shortly be replaced by the South Ayrshire Local Plan. The Land Use Development Plan (refer **Section 5.12** and Appendix A) shows land at Whitefaulds, adjacent to the proposed new roundabout on the B7023, to be designated for housing.

5.7.20 The Local Plan recognises, in Chapter 3, The Environment - Agricultural Land that "the predominant land use within the countryside is agriculture, which is of importance in terms of employment, the landscape character and ecological diversity of these areas. Prime quality agricultural land and better quality grazing land/in-bye land is regarded as a national resource which should be protected from development unless there is justification as to why its loss to development is necessary."

5.7.21 The Local Plan also recognises in Chapter 2, Economic Development – The Countryside and Rural Economy, that "….farming is an important industry within the South Ayrshire economy. Changes in the farming industry have led to the loss of many smaller, financially marginal farms - together with an increase in the number of part-time, as opposed to full-time agricultural jobs. For these reasons, the farming community is increasingly seeking new sources of income through a diversification of their activities from food production into tourism and other business ventures. The Council is sympathetic to the process of agricultural restructuring, realising that its resources can be re-used to encourage new enterprise and provide opportunities for economic and employment growth."

5.7.22 The Local Plan includes the countryside around Maybole within a Rural Protection Area (RPA) which offers a lower level of protection than Greenbelt. RPA designation (Chapter 1, Settlement Strategy – Rural Protection Area) recognises that "…whilst the Greenbelt covers closely defined areas and protects sensitive environments susceptible to development pressure, some areas outside the Greenbelt are also under pressure for development, especially those areas within a short travel time from major towns. The designation of the Rural Protection Area is a recognition of these pressures and the need to protect the area from inappropriate non rural based uses or sporadic development."

5.7.23 The Ayrshire Joint Structure Plan 2025[52] recognises the need to regenerate rural communities by encouraging them to adapt to new opportunities and enhance environmental quality.

Impacts (Opening Year 1) without Mitigation

5.7.24 There are several key impacts that all affect each of the route options, albeit to varying degrees, and these have been outlined in general below and summarised in **Table 5.7.60**. The format of this section is slightly different to that of the other sections for ease of reading and to avoid repetition.

Total Landtake

[51] South Ayrshire Council, 1992
[52] East, North and South Ayrshire Councils, 2006

5.7.25 Loss of agricultural land cannot be mitigated and has an adverse effect on the rural economy. The degree of impact on individual farms depends on the proportion and location of the land lost in relation to the whole holding. This cannot be assessed until farm visits have taken place. For the purposes of this Stage 2 assessment the impact of landtake is assessed according to the area of land lost due to each option, based on plan area data that includes earthworks but not additional landscaping and mitigation features such as attenuation ponds. The land area affected by the options varies between 18.2ha to 23.2ha with the Blue route requiring the most land take and the Yellow route the least.

Loss of Prime Land

5.7.26 There are very small parcels of prime land within the Blue route which would be affected. There is no prime land in either the Red or Yellow route corridors.

Severance of Farms

5.7.27 Dairy farms are more adversely affected by severance than other livestock and arable farms. This is because dairy cattle have to walk twice daily from their pastures to the milking parlour. Severance of the pastures from the parlour by a main road necessitates provision of an accommodation underpass or overbridge to maintain the viability of the farm. At East Enoch Farm (refer to **Photo 5.6**), it appears that all options would sever pastures from the milking parlour. At Mid Brockloch the affected land is on the periphery of the holding, away from the main dairy pastures and so milking operations would likely be unaffected.

Photo 5.6 – East Enoch Farm

5.7.28 Severance is less significant for beef and sheep farms as animals remain in fields for long periods and can be transported between fields via road. Arable machinery can likewise reach severed land by road, if alternative access arrangements are provided.

5.7.29 Under all options field accesses and some farm tracks would be severed by the proposed bypass, necessitating the provision of alternatives.

Severance of Main Farm Access

5.7.30 Severance of the main farm buildings from the public highway renders a farm non-viable and necessitates the provision of alternative access arrangements.

5.7.31 All options would sever the main farm accesses of Cultezeoun and the Blue route would sever Mid Brockloch as well.

Disturbance to Rural Dwellings, Buildings and Amenities

5.7.32 No residential properties or farm buildings would need to be demolished by any of the route options. However, the Gallowhill caravan park would lose a small area of one field as a result of the Blue Route.

Impacts on Development Land

5.7.33 Earthworks associated with the Yellow Route options that include a roundabout at the B7023 may impact a small area of the land at Whitefaulds designated for residential development.

Table 5.7.60 – Route Option Land Use Impacts (Opening Year 1)

Option	Plan area (ha)	Loss of prime land	Approx. number of holdings affected	Dairy farm severed	Farm accesses severed	Rural buildings lost	Disruption to drainage and water supplies	Impact on development and amenity land
1.1 - Blue S2	22.1	Very small parcels	14	East Enoch	Cultezeoun Mid Brochloch	None	Yes	Gallowhill caravan park
1.2 - Blue S2R	22.2	Very small parcels	14	East Enoch	Cultezeoun Mid Brochloch	None	Yes	Gallowhill caravan park
1.3 - Blue WS2+1	22.9	Very small parcels	14	East Enoch	Cultezeoun Mid Brochloch	None	Yes	Gallowhill caravan park
1.4 - Blue WS2+1R	23.2	Very small parcels	14	East Enoch	Cultezeoun Mid Brochloch	None	Yes	Gallowhill caravan park
3.1 - Yellow S2	18.2	None	14	East Enoch	Cultezeoun	None	Yes	None
3.2 - Yellow S2R	19.3	None	14	East Enoch	Cultezeoun	None	Yes	Whitefaulds residential building land
3.3 - Yellow WS2+1	18.8	None	14	East Enoch	Cultezeoun	None	Yes	None
3.4 - Yellow WS2+1R	19.8	None	14	East Enoch	Cultezeoun	None	Yes	Whitefaulds residential building land
2.1 - Red S2	20.6	None	14	East Enoch	Cultezeoun	None	Yes	None
2.2 - Red S2R	20.8	None	14	East Enoch	Cultezeoun	None	Yes	None
2.3 - Red WS2+1	21.5	None	14	East Enoch	Cultezeoun	None	Yes	None
2.4 - Red WS2+1R	21.8	None	14	East Enoch	Cultezeoun	None	Yes	None

Mitigation Measures

5.7.34 For ease of reading and to avoid repetition the format of this section is slightly different to that of other sections.

5.7.35 The impact of landtake itself cannot be mitigated and the effects on farming in the affected area will therefore be permanent. Compensation for land take will be required.

5.7.36 Proposed mitigation measures aim to reduce or neutralise the effects of road construction on land management, principally through accommodation works to provide alternative farm and field accesses where these may be disrupted. Minor mitigation measures relate to field drains and water supplies.

5.7.37 Mitigation measures directly associated with the Yellow route options that include a roundabout at the B7023 should where possible include an adjustment of the alignment to avoid the land designated for residential development. Compensation for land designated for residential development is greater than that for agricultural land.

5.7.38 Similarly for the Blue option, ideally the alignment would be adjusted to avoid the caravan park at Gallowhill. However, the current alignment is at the minimum curve radius under the safety standards and therefore any adjustment would require a departure from safety standards. Compensation for commercial/business property is greater than that for agricultural land.

5.7.39 Mitigation measures for each of the route options are summarised in **Table 5.7.61**.

Table 5.7.61 – Mitigation Measures

Option	Dairy farm severed	Mitigation	Farm accesses severed	Mitigation	Disruption to drainage and water supplies	Mitigation	Impact on development and amenity land	Mitigation	Overall impact after mitigation
Blue S2	East Enoch	Provide crossing for walking cattle	Cultezeoun Mid Brochloch	Create alternative access	Yes	Replace, repair or divert	Gallowhill caravan park	Adjust road alignment if possible. Alternative is compensation	Negative Moderate
Blue S2R	East Enoch	Provide crossing for walking cattle	Cultezeoun Mid Brochloch	Create alternative access	Yes	Replace, repair or divert	Gallowhill caravan park	Adjust road alignment if possible. Alternative is compensation	Negative Moderate
Blue WS2+1	East Enoch	Provide crossing for walking cattle	Cultezeoun Mid Brochloch	Create alternative access	Yes	Replace, repair or divert	Gallowhill caravan park	Adjust road alignment if possible. Alternative is compensation	Negative Moderate
Blue WS2+1R	East Enoch	Provide crossing for walking cattle	Cultezeoun Mid Brochloch	Create alternative access	Yes	Replace, repair or divert	Gallowhill caravan park	Adjust road alignment if possible. Alternative is compensation	Negative Moderate
Yellow S2	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	None	None	Negative Moderate
Yellow S2R	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	Whitefaulds residential building land	Adjust road alignment	Negative Moderate

Option	Dairy farm severed	Mitigation	Farm accesses severed	Mitigation	Disruption to drainage and water supplies	Mitigation	Impact on development and amenity land	Mitigation	Overall impact after mitigation
Yellow WS2+1	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	None	None	Negative Moderate
Yellow WS2+1R	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	Whitefaulds residential building land	Adjust road alignment	Negative Moderate
Red S2	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	None	None	Negative Moderate
Red S2R	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	None	None	Negative Moderate
Red WS2+1	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	None	None	Negative Moderate
Red WS2+1R	East Enoch	Provide crossing for walking cattle	Cultezeoun	Create alternative access	Yes	Replace, repair or divert	None	None	Negative Moderate

Impacts (Design Year 15)

5.7.40 The proposed mitigation measures will significantly ease the impacts of the scheme on the day to day management of the affected farms. The number of affected farms is the same for each option but impacts on individual enterprises cannot be assessed in detail until farm visits are made in Stage 3.

5.7.41 However, the loss of between 18.2 and 23.2 ha of agricultural land will have a permanent negative impact on individual farms and the farming economy of the district as a whole. Overall, the negative impact on farming in the route corridor is assessed as conforming with the definition of moderate in **Table 5.7.58** (even with mitigation some rural landowners will experience significant disruption, and/or significant permanent decreases in land area and/or potential profitability).

5.7.42 As loss of land is the main long term impact, the Blue route options are the least preferred and the Yellow the most preferred. Within each of the route options, the S2+1 with a roundabout has the highest landtake figures. The difference in landtake between the preferred option (Yellow 3.1 at 18.2 ha) and the least preferred option (Blue 1.4 at 23.2 ha) is 5.0 ha, an increase of 27% over the lower figure. All Yellow options are preferred over the Red options which are in turn preferred over the Blue options from a land use perspective.

Conclusions

5.7.43 The Stage 2 assessment was informed by a site visit, but farmers were not interviewed. Reference was made to aerial photographs and published soil and land classification maps.

5.7.44 The majority of the route corridor is farmed for beef and sheep and is under grass with cereals and a range of other crops grown for fodder. There are small parcels of prime land within the Blue route corridor only and the majority of the land is of moderate quality in Class 3_2. It is estimated that around 14 agricultural holdings, forming 11 farm enterprises, are affected by each option, but no buildings would need to be demolished. A dairy enterprise at East Enoch could be potentially seriously affected as all the route options sever its pastures from the current location of the milking parlour.

5.7.45 Residential building land is affected by the Yellow options 3.2 and 3.4 at Whitefaulds and all the Blue Options impinge on the Gallowhill caravan park. Minor adjustments to the route alignments would remove these impacts. However it is likely that any alignment adjustments will only be possible for the Yellow route and therefore compensation will be required for impacts on the caravan park should the Blue option proceed.

5.7.46 Mitigation proposals relate to farm accesses, provision of a crossing for dairy cattle at East Enoch and restoration of field drains and water supply. These will significantly reduce the adverse impact of the scheme on day to day farm management operations. The negative effects of landtake by the scheme cannot be mitigated and this is therefore regarded as a permanent impact. Compensation for land take will be required (compensation for residential or commercial/business property is greater than that for agricultural property).

5.7.47 The plan area of the scheme ranges from 18.2ha to 23.2 ha of agricultural land and an additional, as yet unspecified, amount will be required for landscaping and attenuation ponds. This will have a permanent negative impact both on individual farms and on the farming economy of the district as a whole. The design year (15) negative impact of each option on farming in the route corridor is assessed as moderate, defined as ‘some rural landowners experiencing significant disruption, and/or significant permanent decreases in land area and/or potential profitability’.

5.7.48 As loss of land is the main long term impact, the Blue route options are the least preferred and the Yellow the most preferred. Within each of the route options, the S2+1 with the B7023 roundabout has the highest landtake figures. All Yellow options are preferred over the Red options which are in turn preferred over the Blue options from a land use perspective.

5.7.49 The preferred option from a land use perspective is Yellow 3.1 with Blue 1.4 being the least preferred.

5.8 Traffic Noise and Vibration

Introduction

5.8.1 This assessment examines the effects of traffic noise and vibration on the area surrounding the proposed scheme options at Maybole so that they can be taken into account in the choice and refinement of the final route option.

5.8.2 A Stage 2 assessment has been carried out in line with the Design Manual for Roads and Bridges Volume 11, Section 3, Part 7 (DMRB 11:3:7) "Traffic Noise and Vibration"[53].

5.8.3 The noise level predictions have been made based upon traffic counts and forecasts for 2004, the planned opening year of 2012, and the fifteenth year after this, 2027, designated the "design year". These noise level predictions have been made for the do-minimum and the twelve do-something scenarios, which comprise three base scenarios, each with three alternative sub-scenarios.

5.8.4 The approach to this assessment takes account of a baseline noise survey, traffic counts and extensive computer noise modelling.

Key Issues

5.8.5 Noise annoyance is defined by the World Health Organisation as 'a feeling of displeasure evoked by noise' and mainly affects people when they are in their homes or when they are in the streets. Individuals vary considerably in their sensitivity to traffic noise and therefore the relationship between noise exposure and nuisance adopts the concept of an average community annoyance response for each noise level.

5.8.6 The noise index adopted by the government for assessing road traffic noise is the dB $L_{A10,18h}$ level. This is defined as the arithmetic mean of the dB(A) noise levels exceeded for 10% of the time in each of the 18, one-hour periods between 6 a.m. and midnight and is normally based on annually averaged weekday traffic flows. A reasonably good correlation has been shown to exist between this index and residents' dissatisfaction with traffic noise over the range from about 30 $dBL_{A10,18h}$ to in excess of 80 $dBL_{A10,18h}$, which is within the range of noise found in this area.

5.8.7 The average community response to a change in noise varies between a sudden and gradual (steady state) increase in noise. The sudden increase giving rise to a greater percentage of people annoyed compared with the same noise increase for steady state conditions. In the period following a change in traffic flow, people may find benefits or disbenefits when the noise changes are as small as 1dB $L_{A10,18h}$, which is equivalent to an increase in traffic flow of 25% or a decrease in traffic flow of 20%.

5.8.8 Noise changes may result from differences in:

- Road alignment (vertical and horizontal);
- Sound generation (traffic flow, speed, gradient and road surface type); and
- Sound propagation (ground absorption and reflections).

[53] The Department of Transport. August 1994

Criteria for Significance of Impact

5.8.9 The response of the human hearing system is logarithmic rather than linear in behaviour, and is able to detect a noise level difference of about 1 dB(A) between two steady sounds, when presented in rapid succession under controlled laboratory conditions. The smallest change in environmental noise that is generally noticed by an individual over a period of time is about 3 dB(A). A 10 dB(A) change approximates to a subjective doubling or halving of loudness. Although there are no "British Standard" definitions to describe the magnitude and significance of noise levels changes, the following terms will be used here to describe traffic noise impact:

- <1dB(A) change - NEUTRAL impact
- 1<3 dB(A) change - PERCEPTIBLE impact
- 3<5 dB(A) change - SLIGHT impact
- 5<10 dB(A) change - MODERATE impact
- ≥10 dB(A) change - SUBSTANTIAL impact

Vibration

5.8.10 The DMRB 11:3:7 considers both noise and vibration. Traffic vibration is low frequency disturbance producing physical movement in buildings and their occupants. Vibration can be transmitted through the air (airborne) or through the ground (ground-borne).

Ground-borne Vibration

5.8.11 Ground-borne vibration can become a problem where heavy vehicles pass close to buildings. TRRL Research Report 102[54] concludes that vibration levels increased according to the height or depth of surface irregularities. It was found that where the irregularity in the road was within 5m of a building and its maximum height or depth was greater than approximately 20mm, there was the possibility of perceptible ground-borne vibrations being generated during the passage of heavy vehicles. There exists no simple model for predicting ground-borne vibration from road traffic. However, it may reasonably be assumed that newly constructed carriageways are unlikely to generate significant levels of such vibration and this impact has not been considered further.

Airborne-induced Vibration

5.8.12 Airborne vibration may manifest itself as the rattling of windows or light objects when the exhaust note of (usually heavy) vehicles coincides with a resonant frequency of an element of the building. There is, however, insufficient energy in the sound wave to cause building damage. According to DMRB 11:3:7, the percentage of people likely to be annoyed by airborne vibration is directly related to the percentage of people likely to be annoyed by traffic noise, only 10% lower. On average, airborne induced vibration is expected to affect a very small percentage of people at exposure levels below 58 dB $L_{A10,18h}$.

Methodology

5.8.13 An assessment of the impact of noise and vibration requires a comparison of the predicted noise levels resulting from each of the proposed scheme options with the pre-existing (baseline) levels.

[54] Watts, G. R., 1987

5.8.14 A procedure for the assessment of the impacts and effects of traffic noise from highway schemes was developed in the 1970s and was incorporated into DMRB 11:3:7. For the purpose of this assessment, an impact is defined as a change in noise level resulting from the scheme and an effect is the resulting effect on people and the environment, e.g. subjective annoyance.

5.8.15 At Stage 2 this requires the following steps to be undertaken:

- Identification of noise-sensitive locations within 300m of the road centre-line;
- Estimation of the number of properties within 300m of each route option, using the bands 0-100m, 100-200m and 200-300m; and
- Prediction of noise level changes as a result of the operation of the scheme at noise sensitive locations and other typical locations along the route.

5.8.16 The methodology also requires that where there are unscreened buildings within 40m of an existing or proposed route option, an estimate of the degree of traffic induced airborne vibration should be made.

5.8.17 The predicted noise levels reported here are based on 18 hour two way annual average weekday traffic (AAWT) flows on the existing A77 and other roads through Maybole. This is taken from the traffic data provided by Atkins Transport Planners and is based on high growth forecasts.

Study Area

5.8.18 The study area, in line with the requirements of DMRB 11:3:7 at Stage 2 has been defined as the area within 300m of the centre lines of each of the given route options. Similarly, the areas within 300m of the centre lines of the existing routes through Maybole, from which traffic will be diverted, have also been included in the assessment.

5.8.19 Where it is also considered that properties outside of the defined area are likely to experience changes in noise of greater than 1dB, these have also been included in the assessment.

5.8.20 For consistency, an identical set of receivers has been assessed under each scheme option.

5.8.21 DMRB at Stage 2 requires that the number of properties within 300m of each route option be estimated within 0 – 100m, 100 – 200m and 200 – 300m bands. This has been done and the estimated numbers are presented in **Table 5.8.62**.

Table 5.8.62 – Noise Sensitive Locations within 300m of the Scheme Centre Lines

Residential	**Number of Noise-Sensitive Residential Properties**		
Distance Band	**Blue**	**Red**	**Yellow**
0-100m	2	1	1
100-200m	10	35	75
200-300m	27	129	203
Other Noise Sensitive Locations	Ranch Caravan Park	Ranch Caravan Park	
		Gardenrose Primary School	Gardenrose Primary School
			Carrick Academy

5.8.22 There are three distinct route options under consideration which are here referred to as 'Blue', 'Red' and 'Yellow'. Each of the route options diverts the A77 to the north and west of Maybole.

5.8.23 For each of the coloured route options, a base and three alternative sub-options have been considered. These are as follows:-

- S2 carriageway without a roundabout at the junction with the B7023 Culzean Rd (base);
- S2 carriageway with a roundabout at the junction with the B7023 Culzean Rd;
- WS2+1 carriageway without a roundabout at the junction with the B7023 Culzean Rd;
- WS2+1 carriageway with a roundabout at the junction with the B7023 Culzean Rd.

5.8.24 The outputs of the traffic models, as input into the noise model, are different for each of the combinations under consideration.

Calculation of Road Traffic Noise

5.8.25 Road traffic noise levels have been predicted using the method detailed in the DoT/Welsh Office memorandum Calculation of Road Traffic Noise 1988 (CRTN)[55]. The predictive algorithms contained in CRTN were developed from extensive measurement data and validated out to distances of about 300 metres from the roads under consideration. Beyond this distance the prediction methodology is less accurate but is still suitable for purposes such as environmental appraisal of road schemes, where the key factor of interest is the change in noise levels rather than the absolute levels.

5.8.26 The CRTN method of predicting noise from a road consists of five main stages:

(i) Division of the road scheme into a number of segments;

(ii) Calculation of the basic noise level (BNL), at a reference distance of 10 m away from the nearside carriageway edge, for each road segment;

(iii) Assessment for each segment, of the noise level at the reception point, taking into account distance, ground attenuation and screening;

(iv) Correction of the noise level at the reception point to take into account site layout features including reflections from buildings and facades, and the size of the source segments; and finally;

(v) Combination of the contributions from all segments to give the predicted noise levels at the reception point for all roads.

Computer Modelling of Traffic Noise

5.8.27 Noise levels in the study area have been predicted using Atkins RoadNoise 2000 noise modelling software, which predicts in accordance with CRTN. This software builds a three dimensional model of features which may affect the generation and propagation of noise. These features have been captured from the following data sources:

- Ordnance Survey Land-line® data to define the alignments of existing roads and locations of houses and other structures;
- Ordnance Survey Landform Profile® data to define the existing ground topography and heights of existing roads.
- 3-dimensional road design details provided by Atkins Highways and Transportation for details of cuttings, embankments and proposed road heights.

5.8.28 Other inputs into the noise model include:

[55] Calculation of Road Traffic Noise. Department of Transport. HMSO. 1988

- Type of intervening ground between each road segment and each receiver;
- 18 Hour annual average weekday traffic flow (AAWT);
- Percentage of heavy duty vehicles (HDV);
- Annual average speed;
- Nature of the road surface.

5.8.29 RoadNoise does not consider additional noise sources such as human activities and commercial activities. All comparisons presented here are based on the 'worst case scenario'. This means that where an increase has been predicted on one facade but a decrease has been predicted on the other, the increase has been assigned to the property.

Baseline Conditions

5.8.30 In accordance with DMRB, the baseline for noise has been defined as the situation expected to exist just before the scheme opens. This is in the absence of any noise from construction operations and it is expected to be in 2012.

Baseline Survey Results

5.8.31 In July 2005, a noise survey was carried out to establish the baseline conditions prevailing in and around Maybole. A summary of the findings is presented here. Further details of the noise survey are presented in Appendix F.

5.8.32 Noise measurements were undertaken at four positions along the existing A77 highway through Maybole between 14:00hrs and 17:00hrs on a typical weekday. The measured $L_{A10,15min}$ levels were typically around 60 – 67 dB(A) at distances between 5m and 15m from the road.

5.8.33 Noise measurements were also undertaken at three positions around the southern outskirts of Maybole and four positions around the northern outskirts. A summary of these measurements is shown in **Table 5.8.63** below. The number shown in brackets after each position name is the corresponding noise model receiver i.d. which, in turn, enables the position to be identified on Figures 5028091_NOI_001 to 003.

Table 5.8.63 – Summary of Baseline Survey Results for Positions to the North and South of Maybole

Position (receiver i.d.)	Time Period	Summary Noise Levels (dB(A))				
		L_{Aeq}	L_{A10}	L_{A90}	L_{Amax}	Observed Noise Sources
South Maybole						
Kirkmichael Road T Junction (10)	11:00 - 14:00	63.6	56.6	43.9	90.5	Road traffic on A77 and occasional road traffic on Kirkmichael Road
Crosshill Road (7)	11:00 - 14:00	53.8	56.6	43.0	78.9	Road traffic on A77 and Crosshill Road
Allan's Hill (1)	15:00 - 17:00	57.2	51.7	34.8	86.9	Road traffic on A77 and Allan's Hill
North Maybole						
B7024 Overbridge (11)	14:00 - 16:45	52.5	55.7	42.0	75.9	Road traffic on B7024 Passenger Rail Traffic
Kirklandhill Path (13)	11:00 - 14:00	37.9	39.9	31.1	63.2	Occasional road traffic on Kirklandhill Path / cows
Gardenrose Path (12)	11:45 - 14:00	51.3	44.6	34.5	75.8	Occasional road traffic on Gardenrose Path / Culzean Road/cows
Culzean Road (4)	14:30 - 16:45	54.7	59.0	35.7	77.8	Road traffic on Culzean Rd / construction noise

5.8.34 The measured L_{A10} noise levels were typically around 55 – 59 dB(A), except at Kirklandhill Path and Gardenrose Path, where significantly lower noise levels were measured. Observation on site showed that there was very little contribution from road traffic using any of the major routes through Maybole (namely the A77, B7023 or the B7024) at Kirklandhill Path, and only a small contribution from the B7023 (Culzean Rd) at Gardenrose Path.

Consultation

5.8.35 No specific consultation was carried out with regard to road traffic noise and vibration.

Impacts (Opening Year 1) without Mitigation

5.8.36 Noise levels have been calculated at locations which are especially sensitive to noise and typical locations for the do-minimum and each of the base do-something scenarios in the opening year (2012). Examples of locations considered as being especially sensitive to noise and/or vibration are set out in DMRB 11:3:7 paragraph 8.4 and include schools, hospitals, care homes, heritage sites and outdoor recreation areas where existing ambient noise levels are below 50dB(A).

5.8.37 A sample of the calculated noise levels is shown in **Table 5.8.64** below. The positions of these locations are illustrated in Figures 5028091_NOI_001 to 003 in Appendix A.

Table 5.8.64 – Predicted Noise Levels at Selected Noise Sensitive and Typical Locations in the Opening Year

Receiver ID	Location	Predicted dB $L_{A10,18h}$ Noise Levels in the Opening Year			
		Do-Minimum	Blue Base Route Option	Red Base Route Option	Yellow Base Route Option
1	Allan's Hill	40	39	40	42
3	Point-Garry	69	61	61	61
4	Culzean Road	69	69	69	69
5	The Castle, A77	71	66	66	66
7	Crosshill Road	64	64	64	64
10	Kirkmichael Road T-Junction	59	59	59	59
11	B7024 Overbridge	66	66	67	66
12	Gardenrose Path	50	51	52	54
13	Kirklandhill Path	42	44	46	48
17	Elms Crescent	39	43	48	49
33	Gardenrose Primary School	37	44	46	49
130	St Murray (SE)	39	56	42	43
140	Nether Culzean (SE)	62	59	59	59
141	Nether Culzean (NW)	46	50	52	53
142	Kirklandhill	40	42	56	53
172	East Enoch	45	53	55	52
180	Fairknowe Care Home	58	58	58	58
270	St Cuthberts RC Primary School	66	62	62	62

5.8.38 A comparison between the predicted noise levels and the measured noise levels is shown **Table 5.8.65**.

Table 5.8.65 Comparison between measured and predicted noise

No.	Dur (hr)	Location	Meas $L_{A10,T}$	Est $L_{A10,18h}$	Pred $L_{A10,18h}$	Diff
South Maybole						
10	3	Kirkmichael Road T-Junction	57	56	59	+3
7	3	Crosshill Road	57	56	64	+8
1	2	Allan's Hill	52	51	40	-11
North Maybole						
11	2.75	B7024 Overbridge	56	55	66	+11
13	3	Kirklandhill Path	40	39	42	+3
12	2.25	Gardenrose Path	45	44	50	+6
4	2.25	Culzean Road	59	58	69	+11

5.8.39 The noise level predictions have been made at approximately the same positions as those at which the measured noise levels were taken. The differences between measured and predicted noise levels seen in the table above are mainly due to the following:-

- The difference between the AAWT flows used in the noise level prediction method and the specific traffic flow on the day of the survey (traffic counts were not undertaken during noise measurements).

- The noise level predictions do not take into account noise from other environmental sources. At positions where road traffic noise levels are lower, such as at Allan's Hill, there may therefore be an under prediction of noise levels compared to those measured.

5.8.40 In order to illustrate the overall impact of each of the base routes and the sub-options, the following tables present the numbers of residential properties which are predicted to experience increases and decreases in noise levels as a result of the scheme in the opening year. These assume a Hot Rolled Asphalt (HRA) road surface for the proposed new road. The effect of laying a low noise road surface is considered later in the chapter under 'Mitigation'.

5.8.41 Calculations have been undertaken at first floor level. Where noise increases are calculated on different facades of the same property, the highest noise increase is used in the assessment. Where there are noise decreases, the lowest noise decrease is used. In other situations the noise change which is the least beneficial to that particular receiver is used in the assessment.

5.8.42 As previously stated, the same set of receivers were modelled under each scenario. The number of receivers with noise level changes of less than +/- 1dB is different in each case, however and hence the total numbers of properties shown in the tables vary.

5.8.43 There is not expected to be a change in the net traffic flow passing through Maybole as a result of the implementation of any of the bypass options. Traffic flows are not expected to change, therefore, on the A77 to the north and south of the proposed bypass and there will not be a perceptible change in noise levels under any of the proposed bypass options.

Blue Route – S2 without Roundabout (base)

5.8.44 Most of the traffic is diverted from the current A77 route onto the proposed bypass. This results in a decrease in noise of between 3dB and 8dB along the existing A77.

5.8.45 Traffic changes on all other routes in and out of Maybole do not result in perceptible changes in noise.

5.8.46 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	130	92
3 to 5 dB	Slight	172	99
5 to 10 dB	Moderate	70	157
10 dB or more	Substantial	33	0
Total		**405**	**348**

5.8.47 These results show that more properties would experience an increase in noise as a result of this route option than would experience a decrease (refer to Table 5.8.3 and Figures 5028091_NOI_001 to 003 in Appendix A.

Blue Route – S2 with Roundabout

5.8.48 With the roundabout at the junction of the proposed bypass and the B7023 Culzean Rd, more traffic is predicted to divert onto the bypass rather than passing through the centre of the town. Greater increases in noise along the bypass are therefore predicted with this option.

5.8.49 The reduction in traffic levels on the A77 within Maybole results in decreases in noise of between 5 and 8dB.

5.8.50 Traffic changes on all other routes in and out of Maybole do not result in perceptible changes in noise except the B7023 between Maybole and the A77, where a drop in traffic results in reductions in noise of approximately 2 – 3 dB.

5.8.51 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	110	182
3 to 5 dB	Slight	144	105
5 to 10 dB	Moderate	98	212
10 dB or more	Substantial	38	0
Total		**390**	**499**

5.8.52 The results show that more properties would receive a decrease in noise as a result of this option than would experience an increase. There are, however, over 130 properties which would receive an increase in noise greater than 5dB.

Blue Route – WS2+1 without Roundabout

5.8.53 There are no significant differences in predicted traffic flows from the base route; for the bypass, the existing A77 or any other routes in and out of Maybole.

5.8.54 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	137	96
3 to 5 dB	Slight	172	99
5 to 10 dB	Moderate	70	157
10 dB or more	Substantial	33	0
Total		**412**	**352**

5.8.55 The overall numbers of properties with predicted increases and decreases in noise for the Blue WS2+1 route are very similar to those for the base route.

Blue Route – WS2+1 with Roundabout

5.8.56 There are no significant differences in traffic flows from the Blue S2 with roundabout option.

5.8.57 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	106	183
3 to 5 dB	Slight	132	94
5 to 10 dB	Moderate	114	212
10 dB or more	Substantial	41	0
Total		**393**	**489**

5.8.58 These results are similar to the Blue S2 with roundabout option; showing more predicted decreases in noise than predicted increases in noise.

Yellow Route – S2 without Roundabout (base)

5.8.59 Traffic is generally diverted from the current A77 route onto the proposed bypass. This results in a decrease in noise of between 3 and 8dB along the existing A77.

5.8.60 Traffic changes on all other routes in and out of Maybole do not result in perceptible change in noise.

5.8.61 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	141	82
3 to 5 dB	Slight	63	83
5 to 10 dB	Moderate	231	135
10 dB or more	Substantial	72	0
Total		**507**	**300**

5.8.62 These results show that more properties would experience an increase in noise as a result of this route option than would experience a decrease.

Yellow Route – S2 with Roundabout

5.8.63 As for the other 'with roundabout' options, more traffic is diverted onto the bypass rather than using the town centre route. There are, therefore, greater increases in noise associated with the bypass whilst there are a greater number of decreases in noise associated with the reduced traffic flow through the town.

5.8.64 Reduced traffic flows within Maybole result in decreases in noise of between 5 and 8dB. Reduced traffic flows on the B7023 between the A77 and Maybole result in reductions in noise between 1 and 3dB.

5.8.65 Traffic changes on all other routes in and out of Maybole do not result in perceptible changes in noise.

5.8.66 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	91	128
3 to 5 dB	Slight	77	88
5 to 10 dB	Moderate	195	174
10 dB or more	Substantial	109	0
Total		**472**	**390**

5.8.67 There are fewer overall increases in noise and an increased number of decreases in noise as a result of this sub-option as compared with the Yellow base route. There are still, however, more properties which would receive an increase in noise rather than a decrease.

Yellow Route – WS2+1 without Roundabout

5.8.68 There are no significant differences in predicted traffic flows from the Yellow base route; for the bypass, the existing A77 or any other routes in and out of Maybole.

5.8.69 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	122	72
3 to 5 dB	Slight	83	91
5 to 10 dB	Moderate	217	127
10 dB or more	Substantial	87	0
Total		**509**	**290**

5.8.70 These are similar to the Yellow base route. There are slightly more properties which would receive an increase in noise than in the base route and slightly fewer would receive a decrease in noise.

Yellow Route – WS2+1 with Roundabout

5.8.71 There is additional traffic on the bypass, generating noise levels around 1 dB higher than the base route, and resulting in less traffic on the A77 within Maybole, where noise levels are reduced between 5dB and 8dB.

5.8.72 There are no significant differences in traffic flow for this option when compared with the Yellow S2 route with roundabout option.

5.8.73 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	88	138
3 to 5 dB	Slight	75	87
5 to 10 dB	Moderate	191	174
10 dB or more	Substantial	121	0
Total		**475**	**399**

5.8.74 These are similar to the Yellow S2 route with roundabout. There are slightly fewer properties which would receive an increase in noise than in the base route and more properties would experience a decrease in noise.

Red Base Route – S2 without Roundabout

5.8.75 Traffic is generally diverted from the current A77 route onto the proposed bypass. This results in a decrease in noise of between 3 and 8dB along the existing A77.

5.8.76 Traffic changes on all other routes in and out of Maybole do not result in perceptible changes in noise.

5.8.77 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	145	97
3 to 5 dB	Slight	70	90
5 to 10 dB	Moderate	206	142
10 dB or more	Substantial	19	0
Total		**440**	**329**

5.8.78 These results show that more properties would experience an increase in noise as a result of this route option than would experience a decrease.

Red Route – S2 with Roundabout

5.8.79 Again, as for the 'with roundabout' options for the Yellow and Blue routes, more traffic is diverted onto the bypass rather than using the town centre route. There are, therefore, greater increases in noise associated with the bypass whilst there are a greater number of decreases in noise associated with the reduced traffic flow through the town.

5.8.80 Reduced traffic levels within Maybole result in decreases in noise of between 5 and 7dB. Reduced traffic flows on the B7023 between the A77 and Maybole result in reductions in noise between 2 and 3 dB.

5.8.81 Traffic changes on all other routes in and out of Maybole do not result in perceptible changes in noise.

5.8.82 The resulting changes in noise on scheme opening are as follows::

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	109	194
3 to 5 dB	Slight	64	86
5 to 10 dB	Moderate	207	195
10 dB or more	Substantial	34	0
Total		**414**	**475**

5.8.83 The results show that there are fewer increases in noise and more decreases in noise than for the Red base route.

Red Route – WS2+1 without Roundabout

5.8.84 There are no significant differences in predicted traffic flows from the Red base route; for the bypass, the existing A77 or any other routes in and out of Maybole.

5.8.85 The resulting changes in noise on scheme opening are as follows::

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	131	94
3 to 5 dB	Slight	84	96
5 to 10 dB	Moderate	205	142
10 dB or more	Substantial	31	0
Total		**451**	**332**

5.8.86 These results are similar to the Red Base route.

Red Route – WS2+1 with Roundabout

5.8.87 There is additional traffic on the bypass, generating noise levels 1 – 2 dB higher than the base route. There are no significant differences in traffic flows from the Red S2 route with roundabout option for the existing A77 or for any other routes in or out of Maybole.

5.8.88 The resulting changes in noise on scheme opening are as follows:

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	90	168
3 to 5 dB	Slight	72	84
5 to 10 dB	Moderate	202	189
10 dB or more	Substantial	62	0
Total		**426**	**441**

5.8.89 These results are similar to the Red base route with roundabout option. There are slightly fewer properties which would receive an increase in noise than in the base route whilst more would receive a decrease in noise.

Airborne Vibration

5.8.90 There are no unscreened properties within 40m of any of the alignment options, and therefore an assessment of airborne vibration impacts has not been undertaken in line with the requirements of DMRB at Stage 2.

5.8.91 It should be noted that although there are predicted to be substantial increases in noise at selected locations (such as at St Murray or Kirklandhill) depending on the route option under consideration, the predicted noise levels would still be less than 58 dB $L_{A10,18h}$ and therefore adverse airborne vibration impacts would not be expected.

5.8.92 Where noise levels are reduced along routes within Maybole there would be a corresponding decrease in annoyance from airborne vibration.

Summary of Opening Impacts

5.8.93 The following table summarises the opening impacts of the 12 options:

Table 5.8.66 – Summary of Opening Year Impacts on Noise

Route	Sub Option		Number of properties		
			Increases in Noise >=1dB	Increases in Noise >=10dB	Decreases in Noise >=1dB
Blue	1.1	Base S2	405	33	348
	1.2	S2 with Roundabout	390	38	499
	1.3	WS2+1	412	33	352
	1.4	WS2+1 with Roundabout	393	41	489
Yellow	3.1	Base S2	507	72	300
	3.2	S2 with Roundabout	472	109	390
	3.3	WS2+1	509	87	290
	3.4	WS2+1 with Roundabout	475	121	399
Red	2.1	Base S2	440	19	329
	2.2	S2 with Roundabout	414	34	475
	2.3	WS2+1	451	31	332
	2.4	WS2+1 with Roundabout	426	62	441

5.8.94 These results show that the sub-options with the roundabout are generally better than the equivalent sub-options without the roundabouts. With the roundabout there are fewer properties with predicted increases in noise and more properties with predicted decreases in noise when compared with the option without the roundabout.

5.8.95 The results show that sub-options having an additional lane perform similar to or slightly worse than the equivalent sub option without the lane. The numbers of properties with predicted increases and predicted decreases in noise are similar with or without the additional lane however.

5.8.96 The Blue routes are generally better than the Red and Yellow routes with a greater number of predicted decreases in noise and fewer predicted increases.

5.8.97 There are fewer predicted increases in noise greater than or equal to 10dB for the Blue and Red routes when compared with the Yellow route option. The Red base option 2.1 (S2 without roundabout) performs best overall in this regard.

5.8.98 The preferred route from a noise perspective, based on the overall number of predicted increases and decreases in noise, would be the Blue 1.2 (S2 with Roundabout) route option. The least preferred route option would be the Yellow 3.3 (WS2+1 without roundabout).

Mitigation Measures

General

5.8.99 Measures which reduce noise levels by interrupting the line of sight of a road (earth bunds and acoustic barriers) are most effective at close distances (less than 100m), and have negligible effects beyond a distance of a few hundred metres.

5.8.100 Measures which reduce noise levels at source (quieter road surfacing) are equally effective at all distances.

5.8.101 Given that most of the properties in Maybole are more than 200m from the proposed alignments (dependent on the route), a quieter road surface is the only form of mitigation which would effectively reduce the noise levels.

5.8.102 Two sets of results are given with different performances of quieter road surface. The first set of results is with a Level 2 road surface as defined in the Manual of Contract Documents for Highway Works (MCDHW)[56]. According to Table NG 9/30 of this document a Level 2 surface will provide a reduction in noise of 2.5dB when compared with a Hot Rolled Asphalt (HRA) surface.

5.8.103 The second set of results uses a Level 3 road surface, which will provide a reduction of 3.5dB when compared with HRA.

5.8.104 The entire length of the proposed bypass has been assumed to be surfaced in low noise road surfacing in each case. Where speeds are predicted to be under 75km/h, a lower, -1dB correction has been applied for all road surfaces. This is in line with the methodology in CRTN for impervious bituminous road surfaces (i.e. HRA) and has been used in the absence of more up-to-date information for modern low noise road surfaces at these speeds.

Level 2 Mitigation (Opening Year)

5.8.105 Results of the assessment for each of the base route options are shown below. It is expected that the same degree of improvement would be achieved by the use of low noise surfacing for each of the sub-options.

5.8.106 These results are summarised at the end of the mitigation section and compared back to the without mitigation noise levels.

[56] Manual of Contract Documents for Highway Works, Volume 2 “Notes for Guidance on the Specification for Highway Works” Series NG900, clause NG942

Blue Base Route – S2 without Roundabout

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	171	111
3 to 5 dB	Slight	145	96
5 to 10 dB	Moderate	53	160
10 dB or more	Substantial	33	0
Total		**402**	**367**

Yellow Base Route – S2 without Roundabout

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	164	90
3 to 5 dB	Slight	50	83
5 to 10 dB	Moderate	221	135
10 dB or more	Substantial	44	0
Total		**479**	**308**

Red Base Route – S2 without Roundabout

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	163	103
3 to 5 dB	Slight	150	94
5 to 10 dB	Moderate	105	145
10 dB or more	Substantial	9	0
Total		**427**	**342**

Level 3 Mitigation (Opening Year)

5.8.107 Results of the assessment for each of the base route options are shown below. It is expected that the same degree of improvement would be achieved by the use of low noise surfacing for each of the sub-options.

Blue Base Route – S2 without Roundabout

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	242	116
3 to 5 dB	Slight	80	97
5 to 10 dB	Moderate	36	160
10 dB or more	Substantial	33	0
Total		**391**	**373**

Yellow Base Route – S2 without Roundabout

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	163	92
3 to 5 dB	Slight	63	83
5 to 10 dB	Moderate	215	135
10 dB or more	Substantial	32	0
Total		**473**	**310**

Red Base Route – S2 without Roundabout

Change in Noise Level	Description	Number of properties	
		Increases in Noise	Decreases in Noise
1 to 3 dB	Perceptible	162	100
3 to 5 dB	Slight	170	91
5 to 10 dB	Moderate	68	155
10 dB or more	Substantial	6	0
Total		**406**	**346**

Summary of Mitigation Results

5.8.108 The use of low noise road surfacing would reduce the impacts from all scheme options at all locations but moderate to substantial noise impacts would still remain at a number of properties for each of the route options with both level 2 and level 3 surfacing.

5.8.109 The following table summarises the mitigation impacts of the three base route options.

Table 5.8.67 – Summary of Mitigation Results for Noise

Route	Sub Option		Number of properties		
			Increases in Noise >=1dB	Increases in Noise >=10dB	Decreases in Noise >=1dB
Blue	1.1	Base S2	405	33	348
	1.1	Base S2 with Level 2	402	33	367
	1.1	Base S2 with Level 3	391	33	373
Yellow	3.1	Base S2	507	72	300
	3.1	Base S2 with Level 2	479	44	308
	3.1	Base S2 with Level 3	473	32	310
Red	2.1	Base S2	440	19	329
	2.1	Base S2 with Level 2	427	9	342
	2.1	Base S2 with Level 3	406	6	346

5.8.110 These results show that for the Blue option there are some 3% fewer predicted increases in noise of 1 dB or more and some 7% more predicted decreases in noise 1 dB or more. For the Yellow option there are some 7% fewer predicted increases and some 3% more predicted decreases of 1dB or more. For the Red option there are some 8% fewer predicted increases and some 5% more predicted decreases of 1 dB or more.

5.8.111 It is expected that similar improvements would be seen as a result of low noise surfacing in each of the sub-route options.

Impacts (Design Year 15)

5.8.112 In the design year the noise levels in both the do minimum and all scheme options are predicted to be approximately 1dB higher than in the opening year. A comparison of the with-scheme predicted noise levels in the design year with the do-minimum predicted noise levels in the design year would therefore show no significant difference from the opening year assessment presented above.

5.8.113 When the predicted with-scheme noise levels in the design year are compared with the opening year do-minimum with-scheme noise levels, the impacts would be approximately 1dB worse than those given for the opening year. This would apply equally across all options and similarly for the do-minimum case.

Conclusions

5.8.114 The preferred route from a noise perspective, based on the overall number of predicted increases and decreases in noise, would be the Blue 1.2 (S2 with roundabout) route option. The least preferred route option would be the Yellow 3.3 (WS2+1 without roundabout).

5.8.115 The use of low noise road surfacing would reduce the impacts at all locations but moderate to substantial noise impacts would still remain at a number of properties for each of the route options.

References

1. Design Manual for Roads and Bridges. Volume 11 Section 3 Part 7. Traffic Noise and Vibration. The Department of Transport. August 1994.
2. Watts, G. R., Traffic induced ground-borne vibrations in dwellings. TRRL Research Report 102. 1987.
3. Calculation of Road Traffic Noise. Department of Transport. HMSO. 1988.
4. Manual of Contract Documents for Highway Works, Volume 2 “Notes for Guidance on the Specification for Highway Works” Series NG900, clause NG942. Highways Agency, May 2007.

5.9 Pedestrians, Cyclists, Equestrians and Community Effects

Introduction

5.9.1 This section provides an assessment of the impact of the proposed route options on journeys made in their locality by pedestrians, cyclists and equestrians. For ease of reference, the term 'pedestrians and others' is used to describe this group and community facilities.

Key Issues

5.9.2 The assessment of impacts on pedestrians and others generally focuses on three key aspects of peoples' journeys:

- Journey Length – changes in journey lengths and times resulting from any diversions or closures of footpaths, tracks, public rights of way or roads;
- Amenity – the effect on the amenity value of journeys, where amenity is defined as the relative pleasantness of a journey; and
- Community Severance - changes in community severance, where community severance is defined as the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows.

Methodology

5.9.3 The approach to be adopted for this Stage 2 Scheme assessment has been undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects.

5.9.4 For the purposes of this assessment, the study area was defined as a corridor 500m to each side of the centre of each of the proposed schemes, except where features or facilities of particular importance or potential impacts were identified outside this corridor.

5.9.5 The assessment of impacts on pedestrians and others was undertaken in accordance with the approach to environmental impact assessment outlined earlier in this report (Section 5).

5.9.6 Specifically the approach to be adopted for this assessment is through:

- Identification of the key community facilities used within the study area;
- Identification of routes used by pedestrians and others;
- Estimation of the numbers of pedestrians and others using particular routes; and
- Assessment of any likely changes in the key journey aspects resulting from the proposed scheme.

Baseline Conditions

5.9.7 Baseline conditions for pedestrians, cyclists, equestrians and community effects were established from information recorded during site visits, data from the STAG and DMRB Stage 1 Assessments produced by Atkins. Reference to the current South Ayrshire Local Plan (2006) has also been made.

5.9.8 The analysis undertaken in the STAG Part 1 Assessment[57] and DMRB Stage 1 Assessment[58] and subsequent site visits indicated that the only route or facility of significance in the area, other than footways associated with roads, is the National Cycle Route (NCN) 7 which runs north – south through Maybole.

5.9.9 However, the analysis also recorded that there were three roads with footways within the study area namely, the B7023 Culzean Road, B7024 Alloway Road and the 'C' Class road that links the B7023 and B7024. A further two roads without footways, Gardenrose Path and Kirklandhill Path as well as a bridle path (Lovers Lane) were also identified within the study corridor of the proposed route alignments.

5.9.10 In addition, there are various community facilities / amenities in and around Maybole, including the local library, town hall, churches, post office, swimming pool, golf course, children's playground, playing fields and the town's cemetery.

5.9.11 Outwith the boundaries of the built up area of the town there are a small number of private residential properties to the north of Maybole.

5.9.12 Figure 5028091_PLA_001 highlights the location of the Maybole town centre, areas designated in the Local Plan for community use (e.g. schools, plying fields and cemetery) and the NCN 7

Consultation

5.9.13 The STAG Part 1 consultation was undertaken with all parties identified on the agreed list of Statutory Bodies. In addition the Scottish Equestrian Association and British Horse Society have been contacted to confirm the status of equestrians in the area.

5.9.14 Further to the STAG Part 1 consultation and additional discussions the following responses were received from the following relevant bodies:

- Sustrans;
- Cyclists' Touring Club; and
- ScotWays.

5.9.15 Sustrans and the Cyclists' Touring Club noted the existence of National Cycle Route 7 but ScotWays stated that "the National Catalogue of Rights of Way did not show any rights of way in the town of Maybole"[59].

5.9.16 In addition, Maybole Community Council are involved in the consultation process as a Stakeholder[4] and therefore have been and will continue to be consulted at each key stage in the schemes' progression.

Impacts (Opening Year 1) without Mitigation

5.9.17 The impacts relating to all routes (and associated sub-options) for both the junctions and alignment are the same. Therefore the impacts have been outlined within one section below to avoid repetition.

[57] A77 Maybole Transport Study, STAG Part 1 Appraisal Final Report: Atkins, April 2006
[58] A77 Maybole Transport Study, DMRB Stage 1, Bypass Route Options Assessment Report: Atkins, August 2006
[59] A77 Maybole Transport Study, Consultation Report: Atkins, May 2006

5.9.18 There is limited potential for the community to experience severance impacts to pedestrian, cycle and equestrian journeys in Maybole in the 2012 year of opening as the location of the route options are all outwith the town boundary.

5.9.19 All three route options (Blue, Yellow & Red) include bridge crossings over all the roads and the bridle path north of Maybole and, therefore, although there would be short term disruption during the construction period there would be no permanent impacts. Due to there being no change in the situation for vehicle traffic, pedestrians and others on these roads there would be no impact.

5.9.20 However, the route options that include a roundabout with the B7023 Culzean Road will have an impact upon the pedestrian, cycle and equestrian journeys. The junction is proposed to be at-grade and so pedestrians, cyclist and equestrians would have to cross over the bypass to continue their journey along the B7023. Therefore, the options with a roundabout will result in a minor adverse impact on pedestrians, cyclist and equestrians.

5.9.21 As part of all three route options, the National Cycle Route 7, would also be bridged over the bypass and will therefore not be impacted upon by any of the scheme options. Cyclists travelling along the route will have fewer problems crossing the High Street as all the through traffic will have re-routed onto the bypass. This will therefore result in a minor beneficial impact on cyclists.

5.9.22 As shown in Figure 5028091_PLA_001, all of the route options follow alignments outwith the town's settlement boundary to the north and therefore do not pass through any community facilities or cause severance to them.

5.9.23 All route options are predicted to reduce the level of traffic in the town. In addition there will be a reduction of Heavy Goods Vehicles (HGVs) travelling through the town which could result in a perception of increased safety to pedestrians and cyclists using the current A77. Overall, the impact is considered to be minor beneficial for pedestrians and others.

5.9.24 Conversely, the reduction in the level of traffic on the local A77 road has the potential to result in an increase in vehicle speeds, reducing safety for pedestrians and others. Without mitigation, this would result in a minor adverse impact on pedestrians and others.

Mitigation Measures

General

5.9.25 Mitigation measures for all options are the same and no additional route specific mitigation measures proposed.

5.9.26 It is recommended that traffic speed levels through Maybole town, specifically along the High Street, is monitored post the bypass opening. Should it be confirmed that vehicle speeds have increased, we recommended for Ayshire Council to develop appropriate traffic calming measures within the town centre.

Impacts (Design Year 15)

5.9.27 The impact to travellers in the design year would be the same as in the opening year. However, accessibility to community facilities, specifically within the town centre, would be greater, because the expected growth of traffic on the A77 in the design year and beyond would not affect Maybole.

Conclusions

5.9.28 The analysis of the proposed routes indicates that because of all the proposed structures along the bypass alignments, all pedestrian, cycle and equestrian trips along the existing roads in the proposed bypass corridor would not be affected.

5.9.29 The proposed bypass will reduce vehicle trips in the town centre and therefore improve the general town centre environment for pedestrian and cycle trips, as well as improve general accessibility to community facilities that are located either side of the A77 in the Maybole town centre

5.9.30 The route options that include a roundabout with the B7023 Culzean Road would result in pedestrians, cyclists and equestrians having to cross the bypass which would be a minor adverse impact.

5.9.31 Overall, all the route options would result in moderate beneficial impacts to pedestrians, cyclists and equestrians and have a beneficial effect on access to community facilities. However, the options that include a roundabout with the B7023 Culzean Road would be less beneficial overall.

5.10 Vehicle Travellers

Introduction

5.10.1 This Stage 2 assessment is undertaken in accordance with DMRB 11:3:9[60]. The assessment considers two impacts, view from the road and driver stress.

5.10.2 The objective at Stage 2 is to undertake sufficient assessment to identify the factors and effects concerning vehicle travellers to be taken into account when developing and refining route options.

View from the Road

5.10.3 The 'view from the road' is defined as the extent to which travellers, including drivers, are exposed to the different types of scenery through which a route passes. Aspects which are considered are:

- The landscape character types of the areas through which the road passes.
- The extent to which travellers can view the scene.
- The quality of the landscape through which the route passes.
- Features of particular interest or prominence in the view.

Driver Stress

5.10.4 'Driver stress' can be defined for the purposes of this assessment as the adverse mental and physiological effects experienced by a driver travelling on a road network. Factors influencing the level of driver stress include road layout and geometry, surface riding characteristics, junction frequency and vehicle speed and flow per lane. The level of stress felt by individual drivers will also depend on the skill, experience, temperament, knowledge of the route and state of health of the driver at that particular time.

5.10.5 Driver stress has three main components, namely frustration, fear of potential accidents and uncertainty relating to the route being followed. Frustration is caused by a driver's inability to drive at a speed consistent with his or her wishes. The level of frustration increases as speed falls in relation to expectations, potentially caused by high traffic flow levels, intersections, road works, or difficulties in overtaking slower-moving traffic. Congestion can lead to frustration by creating a situation in which the driver does not feel in control, especially when he or she wishes to arrive at a destination by a particular time, but is held up by traffic congestion of an unpredictable duration.

5.10.6 Driver fear is caused by the imposing presence of other vehicles, inadequate sight distances, the likelihood of pedestrians, cyclists and animals entering onto the carriageway and poor road surfacing. Fear is highest when speeds, traffic flows and the proportion of Heavy Goods Vehicles (HGVs) are all high, and these factors become more important in adverse weather conditions. Improvements to existing roads may increase driver fear to some extent if the improvements result in increased traffic speeds and higher volumes of traffic (due, for example, to traffic diverting from alternative routes). However, this increased perception of danger may be offset in most cases by the superior design standards to which a new scheme is built (for example, longer sight distances, footbridges for pedestrians, good lighting, and a new road surface).

[60] Highways Agency, 1993

5.10.7 Route uncertainty is caused primarily by inadequate signing for the individual's purposes and poor lighting. Good design and layout together with adequate signage and lighting should help eliminate this cause of stress for drivers.

Key Issues

View from the Road

5.10.8 In areas of high quality scenic landscapes, route selection may allow travellers to appreciate the area and their location in relation to distinctive landscape features by allowing appropriate views. Views out from the road also provide interest which may help to alleviate driver stress.

Traffic Flows

5.10.9 The Stage 2 assessment of driver stress takes into account any differences in respective forecast traffic between the existing route and the proposed route options, and also their design characteristics (for example, junction layouts) as well as any other significant differences between scheme options.

5.10.10 The DMRB guidance notes that, when an assessment compares the 'do minimum' against 'do something' options, data on traffic volumes, traffic speeds and their inter-relationship should be the principal source. However the assessment should also develop a balanced general picture rather than long detailed descriptions of each option.

5.10.11 The other key factors adding to driver stress include; inadequate sight distances, the likelihood of pedestrians, particularly children, stepping into the road, inadequate lighting, and narrow roads.

Methodology

View from the Road

5.10.12 The four categories recommended in the DMRB that should be used in the assessment of the traveller's ability to see the surrounding landscape are as follows:

- No view – road in deep cutting or contained by earth bunds, environmental barriers or adjacent structures;
- Restricted view – frequent cuttings or structures blocking the view;
- Intermittent view – road generally at ground level but with shallow cuttings or barriers at intervals; and
- Open view – view extending over many miles, or only restricted by existing landscape features.

5.10.13 The significance of the predicted impact on the view from the road has been assessed by considering the relationship between the traveller's ability to see the surrounding landscape and the magnitude of change occurring to this view.

5.10.14 The impact is described as either adverse or beneficial and range from slight to substantial.

5.10.15 Impacts upon the quality and character of the landscape have been assessed as part of **Section 5.6** (Landscape Effects) of this report.

Driver Stress

5.10.16 No reliable correlations have been established between physical factors and driver stress levels therefore a detailed assessment of driver stress is not possible. However, driver stress has been evaluated in accordance with DMRB which suggests the use of a three point scale; low, moderate and high, to assess drivers stress based on traffic volume and traffic speed.

5.10.17 The assessment has been carried out for the proposed year of opening in 2012, based on the existing traffic conditions, and for the design year (2027). The DMRB offers guidance on assessing driver stress by using average peak hourly flows and average journey speeds for single carriageway roads as shown in **Table 5.10.68**. The categories apply only to those sections of road where traffic flows and speeds are known for over 1km of the route.

Table 5.10.68 – Relationship between Driver Stress and Traffic Flows (Single Carriageways)

Average peak hourly flow per lane, in flow units/ hour	Average Journey Speed Km/hr		
	Under 50	50-70	Over 70
Under 600	High	Moderate	Low
600 - 800	High	Moderate	Moderate
Over 800	High	High	High

Source: DMRB; Volume 11, Section 3, Chapter 4, Table 3

5.10.18 For reference in **Table 5.10.68**, a car or light van equals one flow unit, and a commercial vehicle over 1.5 tonnes or a public service vehicle equals three flow units.

Baseline Conditions

View from the Road

5.10.19 The A77 passes from rural countryside to the north east of the Maybole, through the built up town centre and back into countryside to the south west of the town.

5.10.20 The countryside to the north and south of Maybole has been assessed in Scottish Natural Heritage's Landscape Character Assessment of Ayrshire, and generally sits within the 'Foothills Landscape Type'. The character of the area has been further defined as part of this study, with the A77 passing through the following three 'Detailed Landscape Character Areas (LCA)' (refer to Figure 5028091_LAN_004 in Appendix A):

- Maybole Townscape LCA - Maybole sits astride the strong linear features of the A77 and railway line on a south facing slope, and therefore many of its properties will have long – if partially restricted – views out to the Southern Uplands. It is an historic town dating back some 900 years and contains a notable High Street including many fine historic buildings, with modern development on its periphery.

- Carrick Rolling Hills LCA – This area is dominated by the southern extent of the Carrick Hills - a series of rolling hills and slopes which include Knoweside Hill and Cairn Hill. Enclosed pastures prevail on the lower slopes, with rough grazing on more exposed, higher areas. Settlement is scarce, limited to a handful of white farmsteads on the hills' lower slopes. Extensive, panoramic views are available due to the topography and general openness of the landscape.

- Hillside Woodland & Pasture LCA – This area is defined by one of the dominant topographical features of the study area, Mochrum Hill, and is enhanced by the policies woodland of Culzean Castle, some 5km to the east. This woodland however rapidly gives way to pastoral farmland on the southern slopes of Mochrum Hill, at the foot of which a number of minor valleys cuts into the slopes, creating a dissected landform of incised valleys between rounded ridges and small summits. Settlement is scarce, limited to a caravan park, a handful of farmsteads on the hill's lower slopes and adjacent to the A77, with extensive views of the Southern Uplands being available from the southern slopes of Mochrum Hill.

5.10.21 The views along the A77 in Carrick Rolling Hills LCA northeast of Maybole are open to the southeast, and intermittent to the northwest due to the topography. Within Maybole itself views are restricted by the proximity and scale of the buildings alongside the road. To the southwest of the town, in the Hillside Woodland & Pasture LCA, views are generally intermittent as a result of the topography described above.

Driver Stress

5.10.22 A description of the existing A77 in relation to the key elements of driver stress is noted below:

- Traffic flow levels (2004 peak hours): 1,500 vehicles per hour (two way) passing through the town centre;
- Speed restrictions: rural section 60mph and town centre 30mph;
- HGV's: the existing percentage (2004) of HGVs is 13%;
- Carriageway: single carriageway (S2) with no overtaking opportunities along the rural section and narrow width in Maybole town centre;
- Junctions: rural section occasional junctions, whereas in the town centre many side road junctions;
- Signage and lighting: signage and street lighting only provided in Maybole town centre; and
- Segregation: route runs through main shopping area and residential areas and passes by the access to the secondary school which results in a large number of child pedestrians walking along the A77.

5.10.23 An assessment of the existing route of the A77 therefore indicates that drivers experience high levels of frustration, fear of potential accidents, and uncertainty when using the route due to the lack of safe overtaking sections and congestion. These factors are particularly acute in Maybole town centre.

Consultation

View from the Road

5.10.24 No specific consultation was carried out for this part of the assessment.

Driver Stress

5.10.25 No specific consultation was carried out for this part of the assessment.

Impacts (Opening Year 1) without Mitigation

Traffic Flows

5.10.26 A key element of the assessment is the level of traffic flow on the existing and proposed routes. Therefore, the traffic flows and percentage HGVs in the 'Do Minimum' and 'Do Something' have been taken from the Maybole Paramics model, as shown in **Table 5.10.69** below.

Table 5.10.69 – Traffic Flows

Existing and Proposed Route Options	Average 12 hour and peak hourly flow per lane, in flow units/ hour and HGV (%)			
	Opening Year 2012		Design Year 2027	
	12 hour	Peak hour	12 hour	Peak hour
A77 Maybole Town Centre ('Do Minimum' model)	10,385 (13%)	817 (12%)	14,098 (13%)	1,109 (12%)
A77 Maybole Bypass (Options 3.4 model*)	7,407 (19%)	583 (17%)	10,048 (19%)	790 (17%)

* Option 3.4 was used because it results in the highest level of traffic flow i.e. the worst case scenario

5.10.27 In addition to the traffic volume, traffic data gathered on the A77 shows that the predicted average vehicle speed in Maybole town centre (if the A77 was to remain in its current location) would be 49 km/hr in the opening year.

5.10.28 The Paramics model indicates that the average vehicle speed expected on the bypass in options 3.4 would be 70 km/hr in the opening year (2012).

View from the Road

5.10.29 All the Options would have similar impacts in terms of the change in view from the existing road due to the nature of a bypass development. The variant schemes within the Blue, Yellow and Red route corridors will provide negligible differences in terms of views provided, and as such the assessment has been carried out on the three route corridors only.

Blue Route Options

5.10.30 The first section of this route (Ch.0-800m) travels through the Hillside Woodland & Pasture LCA. As much of the road will be in a deep cutting in this section there will be no views available in a NW / SE direction although there will be elevated, open views available along the road alignment to the SW.

5.10.31 As the route passes into the Kirklandhill Ridge LCA (Ch.800-1900m) the view will briefly open up again to the NW / SE, providing views over Maybole before entering a deep cutting once more. Upon leaving the cutting the road will be on embankment with open views available in all directions.

5.10.32 The remainder of the route (Ch.1900-5250m) travels through the Carrick Rolling Hills LCA, and there will be open, extensive panoramic views of the Ayrshire Southern Uplands. However, landscape mitigation works in the form of screen planting and/or earthworks (introduced to reduce the effect of the road on the existing landscape and visual receptors) may restrict some of these views.

5.10.33 Of all of the three alignments, the Blue route travels northernmost into the Carrick Rolling Hills LCA, experiencing the extensive views that are characteristic of the northern part of this area. As a result, it will result in the greatest magnitude of change in the view compared to the Yellow and Red options.

Yellow Route Options

5.10.34 The first section of this route (ch.0-700m) travels through the Hillside Woodland & Pasture LCA. As much of the road will be in a deep cutting in this section there will be no views available in a NW / SE direction although there will be elevated, open views available along the road alignment to the SW.

5.10.35 As the route passes into the Kirklandhill Ridge LCA (ch.700-2600m) the view will briefly open up again to the NW / SE, providing intermittent views over Maybole through mitigation planting, before entering a deep cutting once more. Upon leaving the cutting the road will generally be at ground level or shallow embankment, with intermittent views through envisioned mitigation planting.

5.10.36 The remainder of the route (ch.2600-5000m) travels through the Carrick Rolling Hills LCA, and there will be open, extensive panoramic views to the south and southeast of the Ayrshire Southern Uplands, although it is likely that landscape mitigation works in the form of screen planting and/or earthworks (introduced to reduce the effect of the road on the existing landscape and visual receptors) may restrict some of these views.

Red Route Options

5.10.37 The first section of this route (Ch.0-800m) travels through the Hillside Woodland & Pasture LCA. As much of the road will be in a deep cutting in this section there will be no views available in a NW / SE direction although this will be offset by the elevated, open views available along the road alignment to the SW.

5.10.38 As the route passes into the Kirklandhill Ridge LCA (Ch.700-2600m) the view will briefly open up again to the NW / SE, providing intermittent views over Maybole with the road on embankment, before entering a deep cutting once more. Upon leaving the cutting the road will generally be at ground level or shallow embankment, with intermittent views. Mitigation planting is likely to be required in this area to reduce the visual impact of the road and traffic which will hinder views.

5.10.39 The remainder of the route (Ch.2600-5000m) travels through the Carrick Rolling Hills LCA, and there will be open, extensive panoramic views to the south and southeast of the Ayrshire Southern Uplands, although it is likely that landscape mitigation works in the form of screen planting and/or earthworks (introduced to reduce the effect of the road on the existing landscape and visual receptors) may restrict these views.

View from the Road - Assessment Summary

5.10.40 The ability for drivers to see the surrounding landscape is summarised in **Table 5.10.70** below. This will be broadly similar for all three alignments. However, the magnitude in the change of the view is slightly higher for the Blue route than the Yellow and Red options (which are broadly identical), and this is reflected in the final impact significance.

Table 5.10.70 – View from the Road Assessment Summary

Route Alignment	Ability to see the surrounding landscape			Summary Impact
	Hillside Woodland & Pasture LCA	Kirklandhill Ridge LCA	Carrick Rolling Hills LCA	
Blue	No View / Open	Intermittent	Intermittent	Moderate Beneficial
Yellow	No View / Open	Intermittent	Intermittent	Slight Beneficial
Red	No View / Open	Intermittent	Intermittent	Slight Beneficial

Driver Stress

5.10.41 In respect to driver stress, the different route alignments i.e. Blue, Yellow and Red, would not add to or detract from the levels of driver stress because the impact on driver stress would be caused by the differences in the carriageway provision i.e. overtaking facilities and speed. Therefore, only the following four different carriageway provision and junction options have been assessed:

- S2 (with climbing lanes);
- S2 (with climbing lanes) and new junction formed with the B7023;
- WS2+1 (including overtaking lanes); and
- WS2+1 (including overtaking lanes) and new junction formed with the B7023.

S2 without Roundabout

5.10.42 The description of the S2 road provision is noted below:

- 800 vehicles per hour on the bypass (max 500 vehicles per lane per hour);
- 60mph speed limit;
- Percentage of HGVs on the Maybole Bypass is 19%;
- Single carriageway with climbing lanes;
- There would be no new junctions along the bypass;
- New signing and lighting at proposed junctions with A77 (access to Maybole town centre); and
- The new bypass would channel all through traffic around Maybole minimising potential conflicts with pedestrians and in addition the bypass would prohibit pedestrian access.

Additional Impacts of Roundabout Added to S2

5.10.43 The only change from the S2 option and this option is the inclusion of a roundabout at the junction with the B7023. The only impacts on the level of driver stress are:

- Traffic flow levels (peak hours): 1,000 vehicles per hour on the bypass (max 800 vehicles per lane per hour); and
- Junction: one roundabout at the junction of the bypass and the B7023.

Additional Impacts of WS2+1

5.10.44 The description of the WS2+1 road provision is noted below:

- 800 vehicles per hour on the bypass (max 500 vehicles per lane per hour);
- 60mph on overtaking lanes and 60mph on single carriageway;
- Percentage of HGVs on the Maybole Bypass is 19%;
- Single carriageway with overtaking lanes in each direction.
- New signing and lighting at proposed junctions; and
- The new bypass would channel all through traffic around Maybole minimising potential conflicts with pedestrians and in addition the bypass would prohibit pedestrian access.

Additional Impacts of Roundabout Added to WS2+1

5.10.45 The only change from the WS2+1 option and this option is the inclusion of a roundabout at the junction with the B7023. The only impacts on the level of driver stress are:

- Traffic flow levels (peak hours): 1,000 vehicles per hour on the bypass; and
- Junction: one roundabout at the junction of the bypass and the B7023.

Analysis

5.10.46 From the traffic flow data and the descriptions, a broad assessment was undertaken using the three point descriptive scale as noted in DMRB. The assessment was based upon the proposed corridor and the three main components of driver stress, frustration, fear of potential accidents, and uncertainty relating to the route.

5.10.47 **Table 5.10.71** indicates that the different alignment options in themselves do not produce any variation in the level of driver stress. However, the variation in the carriageway provision and additional junction would vary the levels of driver stress and the levels are identified by ranking the options.

Table 5.10.71 – Level of Driver Stress

Route Alignment	Bypass Option		Level of Driver Stress	Rank
	No.	Description		
Blue	1.1	S2, no junction	Low	2
	1.2	S2, with junction	Low	4
	1.3	WS2+1, no junction	Low	1
	1.4	WS2+1, with junction	Low	3
Red	2.1	S2, no junction	Low	2
	2.2	S2, with junction	Low	4

Route Alignment	Bypass Option		Level of Driver Stress	Rank
	No.	Description		
	2.3	WS2+1, no junction	Low	1
	2.4	WS2+1, with junction	Low	3
Yellow	3.1	S2, no junction	Low	2
	3.2	S2, with junction	Low	4
	3.3	WS2+1, no junction	Low	1
	3.4	WS2+1, with junction	Low	3
Existing A77 Carriageway through Maybole town centre			High	

5.10.48 The addition of a junction to the route would add stress due to the necessity to manoeuvre around the junction. Therefore, the options that do not include a junction would be preferable to other options.

5.10.49 The design of the S2 and WS2+1 options indicates that the WS2+1 option would only have marginally more overtaking facilities than the S2 option. Therefore, in respect of driver stress the WS2+1 would be preferred.

5.10.50 Therefore, overall this indicates that all of the WS2+1 alignment options without the B7023 junction would be the most preferred and all the S2 alignment options with a the B7023 junction would be least preferred in respect of driver stress.

Mitigation Measures

View from the Road

5.10.51 All the route options will offer improved views from the road over the existing condition and as a result there are no proposed mitigation proposals.

5.10.52 Due to the screen planting and earthworks required to reduce the landscape and visual impacts of the route options, views from the road would not be as extensive as without this mitigation. It should be noted however that many people are visually tolerant of minor interruptions to views seen from their vehicle and the interruptions caused by mitigation planting do not detract from their perception of the scene.

Driver Stress

5.10.53 Due to the specification used in designing the bypass options the driver stress on each of the potential schemes would be minimal and would be much lower than the existing route of the A77 through Maybole. Therefore, there are no proposed mitigation measures. However, it is assumed that appropriate signage and lighting would be installed at the roundabout junction with the B7023 should this carriageway provision be developed further.

Impacts (Design Year 15)

5.10.54 There are no additional impacts identified for the Design Year (15) from those outlined for the Opening Year.

Conclusions

5.10.55 All the route options afford improved views for vehicle travellers over the existing condition. Even sections of road passing through wooded or newly landscaped areas are likely to be considered more attractive to vehicle travellers than the urban environment of the existing condition.

5.10.56 Although the Blue route options will provide the greatest variety of attractive views, with the Red and Yellow options being broadly similar, there is little difference between routes with regard to view from the road.

5.10.57 All the route options would result in lower levels of driver stress than the existing A77 through Maybole. No specific route alignment would provide a greater reduction in driver stress when compared against the existing situation because all the alignments would be constructed to the same standard. However, the carriageway provision and junction strategy would have an impact. The option with the lowest level of overtaking facilities and highest number of junctions would result in the highest level driver stress and the option with the highest overtaking facilities and least junctions would create the least driver stress.

5.10.58 Therefore, the preferred option that would cause the least driver stress would be the WS2+1 without a junction, followed by the S2 without a junction and then the WS2+1 with a junction and then the S2 with a junction.

5.10.59 When combining the View from the Road and Driver Stress assessments, the preferred option is Blue 1.3 followed by Yellow 3.3 and Red 2.3 (Red and Yellow route are equal in preference). The least preferred options are Red 2.2 and Yellow 3.2 followed by Blue 1.2.

5.11 Road Drainage and the Water Environment

Introduction

5.11.1 New roads can have an impact on the movement and quality of nearby surface and ground waters, both during the construction phase and once the road is operational. This section of the report describes the assessment undertaken to identify the potential impacts associated with the water environment that should be considered in the context of any of the proposed Maybole route options.

Key Issues

5.11.2 The key issues for consideration are:

- The location and quality of any watercourses;
- The conservation status of any watercourses or other water bodies;
- The sensitivity of groundwaters along the route and the location of any abstractions or private water supplies; and,
- Floodplain locations or any areas considered at risk of flooding.

5.11.3 Water quality is potentially affected by pollutants from runoff and spray including heavy metals (such as zinc and copper), suspended solids, chloride ions, organics and hydrocarbons. These are derived from road surface and vehicle wear, exhaust emissions, oil, de-icing salts and litter. Contamination can affect surface waters and also groundwater, potentially causing longer-term problems. This could impact on existing uses of the water for amenity, water abstraction and habitats.

5.11.4 The fluvial hydraulics of watercourses receiving road drainage can be affected by the presence of a new impermeable surface. New sections of carriageway may increase the volume of runoff that reaches the receiving watercourse and also reduce the time it takes to get there. This has implications for channel stability, aquatic habitats and flooding.

Methodology

5.11.5 The Road Drainage and Water Environment element of the DMRB 11:3:10 (HA216/06) at Stage 2 involves a more detailed assessment of the potential impacts on the water environment from any of the proposed route options taken forward from Stage 1. The objective is to identify a preferred route option to be taken forward for detailed assessment. The initial assessment consisted of a desk top study of the proposed route corridors followed by a walk over survey between key locations along the route options in June 2006.

5.11.6 Following the HA216/06 guidelines, example criteria for assessing the relative importance of water environment attributes are given in **Table 5.11.72** and the potential magnitude of impacts from route options on the water environment are given in **Table 5.11.73**. The significance of the impact is estimated by considering the sensitivity and the importance of the attribute and the predicted impact magnitude. Methods are given for assessing pollution impacts from routine runoff and accidental spillages

5.11.7 HA 216/06 then provides a framework through which the assessment considers the attributes of the existing water environment and their importance, along with the potential impacts of the proposed road scheme and their magnitude and significance.

Table 5.11.72 - Estimating the Importance of Water Environment Attributes (from HA 216/06, Table 5.3)

Importance	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	**Surface Water:** EC Designated Salmonid/Cyprinid fishery Ecosystem Class RE1*. Site protected under EU or UK wildlife legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Ramsar site). **Groundwater**: Major aquifer providing a regionally important resource or supporting site protected under wildlife legislation SPZ^ I. **Flood Risk**: Flood plain or defence protecting more than 100 residential properties from flooding.
High	Attribute has a high quality and rarity on a local scale	**Surface Water:** RQO" River Ecosystem Class RE2 Major Cyprinid Fishery. Species protected under EU or UK wildlife legislation. **Groundwater**: Major aquifer providing locally important resource or supporting river ecosystem SPZ II . **Flood Risk**: Flood plain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality and rarity on a local scale	**Surface Water**: RQO River Ecosystem Class RE3 or RE4. **Groundwater**: Aquifer providing water for agricultural or industrial use with limited connection to surface water SPZ III. **Flood Risk**: Flood plain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality and rarity on a local scale	**Surface Water**: RQO River Ecosystem Class RE5 and rarity on local scale. **Groundwater**: Non-aquifer. **Flood Risk**: Floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

*RE = River Ecosystem

^SPZ = Source Protection Zone;

"RQO = River Quality Objective;

Table 5.11.73 – Estimating the Magnitude of an Impact on an Attribute (from HA216/06 Table 5.4)

Magnitude	Criteria	Typical Example for Surface Water
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute	Potential high risk in Method A (Annex I) and potential failure of Total Zinc and Dissolved Copper in Method B. Calculated risk of pollution from an accidental spillage > 2% annually (Method D Annex I). Loss or extensive change to a fishery. Loss or extensive change to a Nature Conservation Site.
Moderate Adverse	Results in effect on integrity of attribute or loss of part of attribute.	Potential high risk in Method A (Annex I) and *either* potential failure of Total Zinc *or* Dissolved Copper (Method B Annex I). Calculated risk of pollution from accidental spillages > 1% annually and < 2% annually (Method D Annex I). Partial loss in productivity of a fishery.
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability	Potential high risk in Method A (Annex I) and no change in Total Zinc and Dissolved Copper in Method B (Annex I). Calculated risk of pollution from accidental spillages >0.5% annually and < 1% annually (Method D Annex I).
Negligible	Results in effect on attribute but of insufficient magnitude to affect the use or integrity.	The proposed scheme is unlikely to affect the integrity of the water environment. Low risk in Method A (Annex I) and risk of pollution from accidental spillages < 0.5%.
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually) (Method D Annex I).
Moderate Beneficial	Results in moderate improvement in attribute quality	Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk > 1% annually) (Method D Annex I).
Major Beneficial	Results in major improvement of attribute quality	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse.

5.11.8 The existing nature of the water environment within the study area was identified, where possible, through information obtained from the Scottish Environment Protection Agency (SEPA) and information available on the SEPA website. Consultation with the relevant bodies is discussed further in this Section.

5.11.9 Following elimination of the southern route options at Stage 1 a site visit was undertaken in January 2007 to inspect watercourses or any other locations that could receive discharges of road surface runoff from the proposed Blue, Red and Yellow A77 Bypass options north of Maybole. Watercourse crossing points were also inspected.

5.11.10 For this scheme, the water features of significance are the small tributaries crossed by the existing A77 and along the length of the proposed route options for the scheme. Groundwater is not considered to be a feature of significance as there are no known abstractions or protection zones in this area. The attributes include water quality, biodiversity, and conveying of flow and flood waters. No information has been received concerning discharges to water courses or surface water abstractions for water supply or other purposes within the study area.

5.11.11 The significance of the potential effects are estimated by considering both the importance of the attribute and the predicted impact magnitude as outlined in **Table 5.11.73** i.e. the predicted impact of the road on the baseline environment is considered. The matrix in **Table 5.11.74** shows the method for estimating the significance of effects.

Table 5.11.74 – Impact Appraisal Categories, Ordered by Significance

Importance of Attribute	Magnitude of Impact			
	Major	**Moderate**	**Minor**	**Negligible**
Very High	Very Large	Large / Very Large	Moderate / Large	Neutral
High	Large / Very Large	Moderate / Large	Slight / Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight / Moderate	Slight	Neutral	Neutral

5.11.12 Within this framework, the potential impacts on water quality have been assessed using the established methodologies for routine runoff and spillage risk outlined in HA 216/06.

5.11.13 The methodology for routine runoff involves tests to predict future concentrations of zinc and copper in receiving watercourses. This is based on traffic flow scenarios (Annual Average Daily Traffic, AADT) for 2012 and 2031. However, as none of the watercourses are gauged, no flow data is available for the small watercourses likely to receive road runoff discharges. The method was therefore adapted for this study to assess the minimum value of Q_{95}[61] that would be required to ensure dilution of discharge to at least the Environmental Quality Standard (EQS). This was then compared to approximate flow estimates for the water courses as determined during the route walkovers. Where a Q_{95} of this magnitude was deemed improbable, mitigation has been recommended.

5.11.14 The spillage risk assessment methodology provides the return period of a serious accident based on road length, presence of junctions, annual average daily traffic (AADT), percentage of heavy goods vehicles (%HGV), serious spillage rates, emergency services response time and the River Classification of the receiving watercourse. Given the number of combinations of road lengths and junction arrangements across all options a worst case assessment was undertaken to test whether the probability of accidental spillage causing a pollution incident represented an unacceptable risk.

[61] Q_{95} is the flow rate that is met or exceeded for 95% of the time.

Baseline Conditions

5.11.15 Two site walk over surveys have been conducted to examine the proposed route options in order to assess the potential impacts and constraints that each of the options would present on the local water environment. A general description is provided below of the route options in terms of the local terrain and any water features of note that could potentially be affected by the proposed route options. These are also shown in Appendix A.

5.11.16 Refer to Figure 5028091_WAT_001 for an outline of the baseline conditions and route options for the Maybole study area in terms of road drainage and the water environment.

5.11.17 From west to east, the proposed route options all start opposite Broomknowes Farm, approximately 500m to the west of Maybole. All take a north-easterly direction with an initial steep rise crossing a mixture of arable and pasture farmland before crossing the B7023 to the north-west of the town. The route options all continue across open farmland and cross Gardenrose Path halfway between the northern edge of the town and the Ladycross Road junction.

5.11.18 From this point the 'Blue' route option diverges from the Red and Yellow options and takes a more northerly line passing through open fields to the north of St Murray's Plantation before heading east. It passes south of a small hill approximately 100m AOD which separates the corridor from a small loch at Laigh Grange. From here the corridor follows a north-easterly direction continuing across open farmland north of the railway line before tying into the existing A77 just north of the existing Smithston Bridge.

5.11.19 The Red and Yellow route options take a closer line to the northern edge of Maybole passing through open farmland, after crossing the Gardenrose Path. They cross the B7024 just to the north of the town before following close to the railway on its northern side and tying into the A77 at the same location as the Blue route.

5.11.20 The watercourses within the area include:

- An unnamed burn issues from a spring close to Cultezeoun Farm approximately 500m to the west of Maybole and is culverted under the existing A77 near to Broomknowes Farm at the western tie-in.
- There is a minor watercourse to the east of Ladycross Wood, which was dry at the time of the site survey in June 2006 but was flowing in January 2007. This watercourse runs parallel to the Red and Yellow route options, occasionally below ground level, before turning south-west and crossing beneath the railway line and flowing into the Black Glen. It is then culverted beneath the existing A77 and flows into the Chapelton Burn.
- Another small watercourse, the Brockloch Burn, runs to the north of the 'Blue' route option and is then crossed by all route options close to the Smithston tie-in.
- A further, unnamed, burn issues adjacent to the railway track bed close to Nether Culzean farm and flows south to the Chapelton Burn, crossing the existing A77.

Water Resources

5.11.21 The study area lies in the upper catchment of both the Water of Girvan and the River Doon where land use is predominantly agricultural, both livestock and arable. No information has been received concerning surface water abstractions.

5.11.22 None of the minor watercourses potentially affected by the proposed route options are gauged by SEPA. Flows in all watercourses are small and in some cases can be dry during the summer months. The nearest river gauging stations are on the River Doon at Auchendrane (grid ref NS 338160) and on the Water of Girvan at Robstone (grid ref NX 217 997). Both of these stations are substantially downstream of the study area and do not provide information of value to this assessment.

Water Quality

5.11.23 The quality of all controlled waters in Scotland is classified by SEPA using data gathered from routine chemical and biological monitoring programmes and from an assessment of the aesthetic quality of the watercourse and the bankside environment. River water quality is scored on a five point scale as shown in **Table 5.11.75** below.

Table 5.11.75 – River Water Quality Classification Scheme

Class	Description
A1	Excellent
A2	Good
B	Fair
C	Poor
D	Seriously Polluted

5.11.24 No routine monitoring of the minor watercourses in the study area is undertaken by SEPA. The minor watercourse adjacent to the western tie-in flows into the Abbeymill Burn which is monitored downstream of this point and is graded Class B (Moderate) by SEPA (2004 data, from SEPA website[62]). The Abbeymill Burn joins the Water of Girvan approximately 4km downstream of Maybole, which is Class B at this point. The other minor water courses in the study area flow into the Chapelton Burn which is monitored and is Class A1 (Excellent).

5.11.25 No records of licensed discharges to the watercourses concerned have been received. Past pollution incidents investigated by SEPA have been as a result of agricultural pollution of the Abbeymill Burn and unrelated to any highways runoff causes.

Surface Water

5.11.26 The SEPA on-line indicative floodplain map[63] indicates that, except for the eastern tie-in at Smithston Bridge, the proposed route options lie outwith the flood envelope for a flood event with an 0.5% annual probability of occurrence (1:200 year event). A limited area around the Brockloch Burn upstream of Laigh Grange is shown as at risk of flooding. A further area where the burn runs parallel to the existing A77 is also shown as at risk. Further consideration of flooding will be required in any detailed assessment of preferred option.

[62] http://www.sepa.org.uk/data/index.htm, Jul 2006
[63] www.sepa.org.uk/flooding/mapping Jan 2007

Groundwater

5.11.27 No ground investigation has been undertaken for the proposed route options. The overall groundwater vulnerability classification for the Maybole district is "moderately permeable" but with superficial drift deposits of variable thickness that tend to impede groundwater recharge irrespective of soil classification (*BGS Groundwater Vulnerability Map of Scotland*).

5.11.28 No private water supplies are known of in the study area and there are no known groundwater abstractions. As a result of the groundwater vulnerability assessment above, groundwater in the area is considered to be at low risk of contamination from pollution due to road runoff. This assessment should be confirmed once further information becomes available and when a preferred route option has been selected.

Fisheries

5.11.29 The minor water courses potentially affected by the proposed options are not identified as fisheries of any type. However, downstream of the study area these water courses flow into designated Salmonid Waters under the Fisheries Directive (78/659/EEC)[64]. The small watercourse adjacent to the Broomknowes tie-in flows into the Abbeymill Burn which is designated as a Salmonid watercourse. The Brockloch Burn adjacent to the Smithston Bridge tie-in flows into the Chapelton Burn which is also designated as a Salmonid watercourse.

Consultation

5.11.30 SEPA was consulted on the preliminary route options (released in May 2006). There were no objections in principle to both the northern and southern options presented. General requirements were stated for the design of the scheme to ensure that the Water Environment (Controlled Activities – Scotland) Regulations 2005 for all watercourse crossings and final road drainage arrangements were adhered to. In addition SEPA specified that any SUDS/treatment ponds incorporated into the scheme should be well established prior to the road opening and that these should be protected during construction. Any culverts receiving road drainage should be surveyed to check they have sufficient capacity.

5.11.31 Further consultation with SEPA was undertaken when the preferred Blue, Red and Yellow options were identified for assessment at Stage 2. No formal response has yet been received, but during telephone conversations with SEPA officers no substantial concerns were raised about the route options in question. The requirement for SUDS/treatment ponds was reiterated. It was additionally stated that settlement lagoons be incorporated into mitigation for construction impacts. It was stated that SEPA had no knowledge of flooding in the study area but that the guidance in Scottish Planning Policy (SPP) 7, Planning and Flooding, should be followed where there was potential for the scheme to impact on flood risk.

5.11.32 South Ayrshire Council was contacted concerning the presence of any known private water supplies in the study area. None of the locations identified in the response were within the study area.

Impacts (Opening Year 1) without Mitigation

5.11.33 The proposed route options have the potential to impact on the water environment due to the increase in runoff from the greater impermeable surface area. Runoff from road surfaces transports a range of contaminants from the road surface into drainage channels and receiving watercourses or into groundwater. Structures within the floodplains and on or over watercourses may also alter the hydrological regime both upstream and downstream.

[64] http://www.sepa.org.uk/pdf/data/ salmonid/map of_salmonid_waters.pdf

There are a number of potential effects that could occur both during construction of the preferred scheme and thereafter during operation. These include:

- Pollution from surface water runoff;
- Pollution from accidental spills;
- Pollution of groundwater;
- Changes to hydrology/geomorphology;
- Increased risk of flooding, and
- Changes to fisheries and passage for fish/otters.

Tie-In Junctions

Broomknowes Roundabout

Blue and Red Route

5.11.34 The Red and Blue options place a roundabout slip across a tributary of the Abbeymill Burn and would require up to 20m of additional culvert length to convey the flow beneath this.

5.11.35 Additional road surface runoff from the new carriageway would result in an increased volume of surface drainage entering the burn at this point compared to present. There is the potential for increased peak discharge to exceed the conveyance capacity of the burn resulting in localised flooding and mitigation measures to attenuate flow will be required accordingly.

5.11.36 Assessment of pollution impacts from routine runoff using Method B (HA 216/06) indicates that the increased contaminant runoff from road surfaces poses a risk to the water quality downstream in Abbeymill Burn, a designated Salmonid Water. The predicted Q_{95} flow for EQS compliance in the receiving watercourse for both copper and zinc is considered to be well in excess of the actual value. Therefore mitigation using Sustainable Urban Drainage System (SUDS) measures such as roadside filter-drains and infiltration ponds would be required to minimise the impacts on water quality.

Yellow Route

5.11.37 The Yellow option ties-in to the existing A77 to the east of the burn crossing, thereby avoiding the requirement for additional culverting.

5.11.38 The impact and mitigation options with respect to peak discharge to the burn and water quality are the same as for the Blue and Red route options.

Smithston Bridge Roundabout

5.11.39 All options have the same footprint at the Smithston Bridge roundabout and tie-in and therefore have the same general impacts on the water environment. The new A77 bypass carriageway will be required to cross Brockloch Burn at the south-west exit from the roundabout. This will require a bridge or culvert along with an upgrade of the culvert where Brockloch Burn passes under the existing A77 route at Smithston Bridge.

5.11.40 Additional road surface runoff from the new carriageway would result in an increased volume of surface drainage entering the burn at this point compared to present. There is the potential for increased peak discharge to exceed the conveyance capacity of the burn resulting in localised flooding. Increased discharges could increase the frequency of flooding on the floodplain area downstream at the confluence of Brockloch Burn and Chapelton Burn. Mitigation in the form of flow attenuation would be required to ensure that the extent of the 200 year floodplain does not increase or downstream flood risk is not exacerbated.

5.11.41 Assessment of pollution impacts from routine runoff using Method B (HA 216/06) indicates that the increased contaminant runoff from road surfaces poses a risk to the water quality downstream in the Chapelton Burn, a designated Salmonid Water. The predicted Q_{95} flow for EQS compliance in the receiving watercourse for both dissolved copper and zinc is considered to be well in excess of the actual value. Therefore mitigation using SUDS measures such as roadside filter-drains and infiltration ponds would be required to minimise the impacts on water quality.

Blue Base Route – S2 without Roundabout[65]

5.11.42 In addition to the impacts outlined for the tie-in junctions, the Blue Base Route has the impacts described below.

5.11.43 The route crosses an unnamed, seasonally dry watercourse near to Ladycross Wood. The carriageway follows the same course as this burn for a distance of approximately 20m. This would result in the following:

a. The existing channel could either be culverted for this length under the new carriageway or the flow diverted into a new realigned channel with a shorter culvert under the road.

b. Road surface runoff is likely to be discharged to this burn. There is the potential for increased peak discharge to exceed the conveyance capacity of the burn resulting in localised flooding. Increased discharges could increase the frequency and magnitude of flooding on the low-lying fields immediately downstream.

c. Assessment of pollution impacts from routine runoff using Method B (HA 216/06) indicates that the increased contaminant runoff from road surfaces poses a risk to water quality downstream in the Chapelton Burn, a designated Salmonid Water. Furthermore, as this watercourse is susceptible to drying up in summer months, there is the potential for contaminant laden runoff to enter a dry channel during summer storms with no available channel flow to provide transport or dilution. Therefore mitigation would be required to maintain water quality.

5.11.44 After approximate chainage 1760m, surface drainage is likely to be discharged to Brockloch Burn along the reach between East Brockloch and Slateford Bridge. As a result, there are the same potential impacts as in a and b above, with the following qualifications:

[65] The main differences between the variations on the base route options relates to changes in road surface area discharging to particular watercourses. Differences in surface area arise from changes in total paved surface due to the presence/absence of roundabouts and climbing lanes and carriageway width. In addition, differences in the chainage to summit points and discharge points between options arising from variances in the long-profile can alter the volume of runoff entering watercourses.

a. The reach of Brockloch Burn between Slateford Bridge and Laigh Grange Bridge is at risk of flooding as indicated by the SEPA Flood Map. The areas at risk from the 1 in 200 year event are largely restricted to immediately overbank of the burn and the low-lying fields surrounding the recreational loch at Holmes. Nevertheless, there is potential for surface runoff discharge to exceed the conveyance capacity of the burn resulting in localised flooding.

b. Brockloch Burn is less likely to experience periods without flow, although there is only limited potential for contaminant dilution as determined using Method B (HA 216/06). Although ungauged, the Q_{95} is not thought to be sufficient to ensure that the EQS for dissolved copper or zinc will be achieved.

c. The recreational loch at Holmes is potentially a sensitive receptor to surface contaminants, although the nature of its stock is unknown at present. It is not known if there is a hydraulic connection between this water body and the Brockloch Burn.

5.11.45 For comparison with the other Blue Route options the paved areas contributing to road surface drainage to each of the receiving waters are as follows:

- 16,444 m^2 to the watercourse at Broomknowes;
- 4,092 m^2 to the watercourse near Ladycross Wood; and
- 38,992 m^2 Brockloch Burn.

Additional Impacts of Roundabout added to S2

5.11.46 The additional surface area resulting from the roundabout at the B7023 junction will result in an increase in the volume of runoff discharged to the burn at Broomknowes along with an increase in contaminant concentrations compared to the Blue Base Route.

5.11.47 There is a reduction in surface area of the section of road draining to the watercourse near Ladycross Wood due to a change in the chainages of the road summit east of the roundabout and the discharge point. This will reduce the volume of runoff and lower the contaminant load discharged at this point.

5.11.48 For comparison with the other Blue Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 18,590 m^2 to the watercourse at Broomknowes;
- 3,534 m^2 to the watercourse near Ladycross Wood; and
- 39,271 m^2 to Brockloch Burn.

Additional Impacts of WS2+1

5.11.49 Compared to the Blue Base Route, this option has greater surface area resulting from a wider carriageway. This will lead to increased contaminant and volume runoff to all discharge points. For comparison with the other Blue Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 17,416 m^2 to the watercourse at Broomknowes;
- 5,280 m^2 to the watercourse near Ladycross Wood; and
- 45,256 m^2 to Brockloch Burn.

Additional Impacts of Roundabout added to 2+1

5.11.50 The additional surface area resulting from the roundabout at the B7023 junction would result in an increase in the volume of runoff and contaminant concentrations discharged to the burn at Broomknowes and to Brockloch Burn. Less runoff and surface contaminants will be discharged to the burn near Ladycross Wood due to reduced surface area draining to this point. For comparison with the other Blue Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 22,175 m^2 to the watercourse at Broomknowes;
- 4,560 m^2 to the watercourse near Ladycross Wood; and
- 45,616 m^2 to Brockloch Burn.

Yellow Base Route – S2 without Roundabout

5.11.51 In addition to the impacts outlined for the tie-in junctions, the Yellow Base Route has the following impacts:

5.11.52 The route crosses a seasonally dry watercourse that drains into Black Glen. This crossing would require culverting. Road surface runoff is likely to be discharged to this burn with the following possible impacts:

a. There is the potential for increased peak discharge to exceed the conveyance capacity of the burn resulting in localised flooding and waterlogging.

b. Assessment of pollution impacts from routine runoff using Method B (HA 216/06) indicates that the increased contaminant runoff from road surfaces poses a risk to water quality downstream in the Chapelton Burn, a designated Salmonid Water. Furthermore, this watercourse is susceptible to drying up in summer months. As a result, there is the potential for contaminant laden runoff entering a dry channel during summer storms with no available channel flow to provide transport or dilution. Therefore mitigation would be required to maintain water quality.

5.11.53 The route crosses a small watercourse near Nether Culzean. This crossing will require culverting and if surface runoff is discharged there are the same impacts to the water environment as outlined in Paragraph 5.11.52.

5.11.54 For comparison with the other Yellow Route options the paved road surface areas contributing to drainage runoff to each of the receiving waters are as follows:

- 16,423 m^2 to the watercourse at Broomknowes;
- 20,166m^2 to watercourse draining to Black Glen;
- 8,546m^2 to watercourse by Nether Culzean; and
- 14,400m^2 to Brockloch Burn.

Additional Impacts of Roundabout added to S2

5.11.55 Compared to the Yellow Base Route, this option has greater surface area resulting from the roundabout at the B7023 junction and will result in an increase in the volume of runoff discharged to the burn at Broomknowes, along with an increase in contaminant concentrations. In addition, there is increased surface area draining towards Brockloch Burn. For comparison with the other Yellow Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 18,515 m^2 to the watercourse at Broomknowes;
- 19,980 m^2 to watercourse draining to Black Glen;
- 8,519 m^2 to watercourse near Nether Culzean; and
- 16,096 m^2 to Brockloch Burn.

Additional Impacts of WS2+1

5.11.56 Compared to the Yellow Base Route, this option has greater surface area resulting from a wider carriageway. This will lead to increased contaminant and volume runoff to all discharge points. For comparison with the other Yellow Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 16,936 m^2 to the watercourse at Broomknowes;
- 21,840 m^2 to watercourse draining to Black Glen;
- 10,800 m^2 to watercourse by Nether Culzean; and
- 15,976 m^2 to Brockloch Burn.

Additional Impacts of Roundabout added to WS2+1

5.11.57 The additional surface area resulting from the roundabout at the B7023 junction would result in an increase in the volume of runoff and contaminant concentrations discharged to the watercourse at Broomknowes and to Brockloch Burn. There will conversely be a slight reduction in the road surface area draining to the watercourse that flows into Black Glen. For comparison with the other Yellow Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 19,756 m^2 to the watercourse at Broomknowes;
- 21,600 m^2 to watercourse draining to Black Glen;
- 10,800 m^2 to watercourse by Nether Culzean; and
- 16,096 m^2 to Brockloch Burn.

Red Base Route – S2 without Roundabout

5.11.58 In addition to the impacts outlined for the tie-in junctions, the Red Base Route has the same impacts as the Yellow Route with respect to water course crossings and the water environment. The route crosses the same seasonally dry watercourse that drains to Black Glen, and the watercourse by Nether Culzean. The Red Route deviates from the Yellow Route by following the more westerly line from the Broomknowes tie-in in common with the Blue Route. As a result, the most significant variation between the Red and Yellow Routes arise from differences in paved surface area and the chainage of summits along the route. For comparison with the other options, the Red Base Route paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 16,258 m^2 to the watercourse at Broomknowes;
- 17,856 m^2 to watercourse draining to Black Glen;
- 11,718 m^2 to watercourse by Nether Culzean; and
- 12,496 m^2 to Brockloch Burn.

Additional Impacts of Roundabout added to S2

5.11.59 Compared to the Red Base Route, this option has greater surface area resulting from the roundabout at the B7023 junction and will result in an increase in the volume of runoff discharged to the burn at Broomknowes along with an increase in contaminant concentrations. There is also a slight reduction in the road surface area draining to the watercourse that flows into Black Glen. The drainage area discharging to the other watercourses is the same. For comparison with the other Red Route options, the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 18,197 m^2 to the watercourse at Broomknowes;
- 17,484 m^2 to watercourse draining to Black Glen;
- 11,718 m^2 to watercourse by Nether Culzean; and
- 12,496 m^2 to Brockloch Burn.

Additional Impacts of WS2+1

5.11.60 Compared to the Red Base Route, this option has greater surface area resulting from a wider carriageway. This will lead to increased contaminant and volume runoff to all discharge points. For comparison with the other Red Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 17,176 m^2 to the watercourse at Broomknowes;
- 23,040 m^2 to watercourse draining to Black Glen;
- 14,040 m^2 to watercourse by Nether Culzean; and
- 12,496 m^2 to Brockloch Burn.

Additional Impacts of Roundabout added to WS2+1

5.11.61 The additional surface area resulting from the roundabout at the B7023 junction would result in an increase in the volume of runoff and contaminant concentrations discharged to the watercourse at Broomknowes. There is also a slight reduction in the surface area draining to the watercourse that flows through Black Glen compared to Red option WS2+1 without the roundabout. For comparison with the other Red Route options the paved road surface areas contributing drainage runoff to each of the receiving waters are as follows:

- 20,554 m^2 to the watercourse at Broomknowes;
- 22,560 m^2 to watercourse at draining to Black Glen;
- 14,040 m^2 to watercourse by Nether Culzean; and
- 12,496 m^2 to Brockloch Burn.

Spillage Risk Assessment

5.11.62 The spillage risk assessment methodology given in HA216/06 was followed to examine the worst case for all the options in terms of road length and junction arrangement. For the upper limit opening year and 15 year AADT values for the route options with the B7023 roundabout junction the annual probability of accidental spillage was calculated to be less than 0.2%. Assuming a worst case response time to the site of greater than one hour, the risk of a serious pollution incident resulting from an accidental spillage was predicted to have an annual probability significantly less than the 1% threshold above which mitigation would be required.

Summary of Impacts

5.11.63 Following the guidance in HA216/06 described earlier in this Section the predicted impacts and their significance resulting from the route options under consideration are summarised below. The assessment summary table is provided in Appendix G.

5.11.64 For the A77 Maybole bypass northern route corridor, the water environment has high importance in terms of biodiversity, a medium importance in terms of dilution and removal of waste products, a medium or low importance in terms of conveyance of flow and a low importance in terms of groundwater. For all route options it is predicted that, without mitigation, the scheme will have a negligible impact of neutral significance on dilution and removal of waste products and a minor impact of neutral significance on groundwater.

5.11.65 There are, however, predicted moderate adverse impacts of moderate to large significance on the biodiversity on all watercourses affected by the three route options. Without mitigation there is also a moderate adverse impact of slight significance predicted on the conveyance of flow for the unnamed watercourse at Ladycross Wood (Blue option) and a minor adverse impact of slight significance predicted for the Brockloch Burn upstream of Slateford Bridge (Blue option) and the Brockloch Burn at the Smithston tie-in (All options).

Mitigation Measures

General

Construction Phase

5.11.66 Under the Water Environment and Water Services (Scotland) (WEWS) Act, which transposed the EU Water Framework Directive (2000/60/EC) into Scottish Law, a new Controlled Activities Regulations (CAR) regime is now in place for engineering works affecting a watercourse. Licensing and monitoring activities under the CAR regime are undertaken by SEPA. Under this a license will be required, the terms of which will seek to protect the ecological status of the watercourse in question.

5.11.67 Any construction work undertaken close to a watercourse has an inherent risk of surface water and groundwater contamination. Potential contaminants include fuel oils from mechanical plant, dirty water runoff from site, cement, site disturbance within the river channel and general debris from the construction site. Watercourses receiving runoff from the scheme are designated Salmonid Waters and are, therefore, sensitive and any contamination could have significant effects on water quality, wildlife and plant life. These effects could arise through, for example, the direct toxicity of contaminant spills, through blanketing by deposited sediment or through water quality impact such as dissolved oxygen depletion.

5.11.68 The risk of pollution of both surface and ground water during construction can be significantly reduced by the adoption of good working practices and strict adherence to the appropriate SEPA Guidelines. The key guidelines are listed below:

- PPG 1 General Guide to the Prevention of Water Pollution;
- PPG 5 Work in, Near or Liable to Affect Watercourses;
- PPG 6 Working at Demolition and Construction Sites;
- PPG 11 Preventing Pollution at Industrial Sites;
- PPG 21 Pollution Incident Response Planning;
- PPG 22 Dealing with Spillages on Highways; and
- PPG 23 Maintenance of Structures over Water

5.11.69 Guidance is also available in the CIRIA publications

- C532 - Control of Water Pollution from Construction Sites
- C648 - Control of Water Pollution from Linear Construction Projects.

5.11.70 Good working practice includes not storing materials next to the water features and early construction of SUDS features for sediment trapping, for example. SEPA have requested that settlement lagoons be considered during the construction phase to mitigate potential water quality impacts.

5.11.71 Further mitigation measures should include:

- On-site availability of oil spill clean up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak;
- Use of drip trays under mobile plant; and,
- Sediment trapping.

5.11.72 Any material imported for use in construction should be inert and free from contaminated material, so as to avoid any potential contamination of the watercourse.

5.11.73 Effective pollution prevention measures for siltation, hydrocarbons, other chemicals and concrete / cement / tar will be incorporated in the scheme design. Risk assessments for possible pollutants should be provided by the contractor's Construction Method Statement (CMS) prior to carrying out any work on site. Provided correct working procedures and practices are adopted, as outlined above, and care is taken to avoid pollution, no adverse impacts are anticipated during construction of the preferred option.

5.11.74 Any works close to watercourses, or that may lead to impacts within watercourses, should be timed to avoid any interference with spawning fish and breeding seasons for mammals.

Operation Phase

5.11.75 Surface water arising from road drainage runoff can be contaminated with silt, heavy metals, chemicals and oil which can be damaging to watercourses and groundwater. Potentially contaminated runoff requires treatment prior to discharge to a receiving watercourse. In areas where there is a high risk of oil pollution, it may be necessary to install an oil separator to protect the surface water and reduce the pollution risk. Due to the relatively low flows in the receiving watercourses there is little potential for dilution of contaminated runoff. It will, therefore, be necessary to incorporate measures to provide treatment of routine road surface runoff at all drainage outfall locations. These may take the form of filter drains, detention ponds and reed beds or a combination of these.

5.11.76 Increased surface runoff from paved areas will lead to increased flows and water levels in the receiving watercourses compared to the baseline. This presents the risk of localised flooding as well as changes in channel morphology arising from more frequent large flows. SUDS measures should also be designed to attenuate peak flows and minimise the effects of runoff on water levels within watercourses. SUDS devices such as detention ponds coupled with reed beds would be particularly appropriate as they act to both attenuate peak flows and to remove contaminants by providing a low velocity settlement environment.

5.11.77 All the route options would require water treatment and flow attenuation devices in the form of detention ponds at the Broomknowes and Smithston Bridge tie-ins. The capacity of these ponds will be dependent upon the preferred route option and the corresponding drainage surface area and traffic flows. Design guidance is available from DMRB vol 4 HA 103/06 *Vegetative Treatment Systems for Highway Runoff* and CIRIA publication *C521 Sustainable urban drainage systems – design manual for Scotland and Northern Ireland.*

5.11.78 Culverts and other artificial reaches of channel can be designed to minimise the impact of modifications to channel morphology and hydraulics and to allow the unhindered passage of fish and mammals (refer **Section 5.5** for further details).

Blue Route

5.11.79 In addition to the mitigation measures common to all route options the following further measures will be required:

- Re-routing of channel and culverting of the watercourse at crossing point east of Ladycross Wood. A hydraulic, hydrological and geomorphic assessment of the watercourse will be required in order to design a stable channel.

- Road drainage discharge to this watercourse would require collection via roadside filter-drains and/or outfall to an infiltration basin or balancing pond to regulate outflow. This will attenuate peak discharge and can be designed to remove excess pollutants prior to final discharge to the water environment. The volumetric and remediation design capacity of these measures should be informed with an analysis of road surface area drained, traffic flow forecasts and the appropriate statistical rainfall series. The peak discharge from the pond must not exceed the conveyance capacity of the receiving watercourse.

- Road drainage should be routed through SUDS measures before discharge to the Brockloch Burn between East Brockloch and Slateford Bridge. Measures could take the form of roadside filter-drains, infiltrations ponds and/or reedbeds. The capacity of the devices will be determined by the route option selected and the corresponding paved surface area and traffic flows.

Red and Yellow Route

5.11.80 Both the Yellow and Red Route Options have the same additional mitigation requirements, as follows:

- Road drainage to be discharged to the small watercourse draining to Black Glen after being routed through SUDS measures. These may take the form of roadside filter-drains, detention ponds and reedbeds. The capacity of the devices will be determined by the route option selected and the corresponding paved surface area and traffic flows.

- Road drainage may potentially be discharged to the small watercourse at Nether Culzean after being routed through SUDS devices. These may take the form of roadside filter-drains, infiltration ponds and/or reedbeds. The capacity of these devices will be determined by the route option selected and the corresponding paved surface area and traffic flows. A careful assessment should be made of the capacity of the receiving watercourse to assess the ability to accept peak runoff discharges due to the proximity of residential and commercial property at Nether Culzean.

Impacts (Design Year 15)

5.11.81 With good road drainage design incorporating the pollution control and flow attenuation measures described above it is considered that there is a low risk of any significant effects on the water environment as a result of any of the proposed route options. With mitigation, all potential impacts can be reduced to negligible with the exception of the unnamed watercourse at Ladycross Wood where a residual minor adverse impact remains as a result of the realignment required for the Blue option. The overall assessment is of negligible impact from any of the proposed route options, depending on mitigation measures.

Conclusions

5.11.82 Whilst all of the proposed route options present a number of constraints and potential impacts on the water environment it is considered that with good road drainage design all these impacts can be successfully mitigated against.

5.11.83 In comparing the proposed Base Route options the Red and Blue Routes will require culverting at the Broomknowes tie-in whilst the Yellow Route will avoid such engineering works at this location. In addition, the Blue Route alone will require realignment or culverting of the watercourse to the east of Ladycross Wood and increased drainage to the Brockloch Burn. The magnitude and significance of the other impacts are broadly the same between Base Route options. Therefore, the Yellow Base Route is the preferred option with respect to the water environment as this is the option with the lowest engineering impact.

5.11.84 When comparing the alternative Yellow Options it is not considered that there are significant advantages of one option over the others with respect to the water environment. All the Yellow Options require the same mitigation measures. However, the design capacity and therefore capital cost of mitigation for each option is dependent on the surface area drained. Options with a greater paved surface area will necessitate SUDS devices with a larger capacity in order to effectively attenuate and treat flows. The Yellow Options are ranked as follows, in order of increasing SUDS design capacity:

- Yellow S2
- Yellow S2R
- Yellow WS2+1
- Yellow WS2+1R

5.12 Geology and Soils

Introduction

5.12.1 The following assessment comprises a review of the potential impacts on the geology and soils of the study area in relation to each of the A77 Maybole bypass route options under consideration.

Key Issues

5.12.2 Potential issues relating to the route options under consideration include:

- Direct impact on underlying geology;
- Direct impact on geological or geomorphological features which are of specific interest or importance;
- Direct impact to soils through loss and destruction of agricultural soils;
- Impact on contaminated land.

Methodology

5.12.3 A desk study and site walk-over survey (February 2006) has been undertaken for an area extending approximately 250m either side of the route options under consideration. The desk study was undertaken to characterise the geology and soils of the study area and to obtain the following information:

- Locations of Site of Special Scientific Interest (SSSI);
- Other geological information such as Regionally Important Geological Sites (RIGS); and
- Details of contaminated sites.

5.12.4 Impact on the geology and soils of the study area have been assessed on a semi-quantitative basis by consideration of the area of land affected by each of the proposed route options.

Baseline Conditions

Geology

5.12.5 The geology within the study area is shown in Figure 5028091_GEO_001 in Appendix A.

5.12.6 The drift geology beneath the route options is dominated by Glacial Till (Boulder Clay), including occurrences as glacial moraine landforms. In addition limited occurrences of Glacial Meltwater Deposits (predominantly sand and gravels) are present beneath sections of the Blue route option and Alluvium (intermixed gravel, sand, clay and silt with minor occurrences of peat) present at the north-eastern extremity of the Blue, Red and Yellow Route options near to Smithston Junction.

5.12.7 The solid geology of the site area comprises predominantly Devonian aged Lower Old Red Sandstone Strata (brown and greenish grey sandstone with occasional bands of conglomerate, marl and tuffaceous sandstone). A dyke of basaltic/ doleritic composition is also present beneath a section of the route options to the north-east of Maybole.

5.12.8 There is no significant faulting or folding of the solid geology with the Lower Old Red Sandstone strata typically gently inclined at a maximum dip of 5 degrees towards the north-west however towards the north-eastern extent of the study area the Lower Old Red Sandstone strata dip more steeply at 15 degrees towards the north-east.

Soil Conditions

5.12.9 Soil conditions and land use classifications within the study are shown on the separate Soil Survey and Agricultural Land Use Classification Plans in Appendix A (Figure 5028091_GEO_002).

5.12.10 To the west and north of Maybole the route options are predominantly underlain by Maybole soils of the Maybole association whereas to the north-east of Maybole the route options are predominantly underlain by Glenalmond soils of the Glenalmond association. Localised occurrences of Meadownay and Altiwan soils of the Glenalmond association are present beneath all of the route options and a localised area of Darvel soils of the Darvel association is also present beneath the Blue route option.

5.12.11 The Glenalmond, Meadownay and Altiwan soils are recorded as tills derived from sedimentary rocks mainly of Old Red Sandstone age. The Maybole soils are recorded as moraine derived from sandstone of Lower Old Red Sandstone age and the Darvel soils as fluvioglacial sands and gravels.

5.12.12 The Maybole and Meadownay soils are recorded as iron podzols and the Darvel and Glenalmond soils brown forest soils. The Altiwan soils are non-calcareous gleys.

5.12.13 The Maybole and Meadownay and Darvel soils are all recorded to be freely draining whereas the Glenalmond and Darvel soils are recorded as imperfectly drained and the Altiwan soils as poorly drained.

5.12.14 The route options under consideration coincide predominantly with Grade 3_2 land which is defined as land capable of average production but high yields of barley, oats and grass. Small areas of higher quality Grade 3_1 land which is defined as land capable of producing consistently high yields of a narrow range of crops (principally cereals and grass) and/or moderate yields of a wider range of crops are present but these are fairly localised beneath the Blue route option. Minor areas of poorer quality Grade 4 land (defined as land capable of producing a narrow range of crops) are also present beneath all of the route options.

5.12.15 A proportion of the soils present are indicated by the agricultural land use plans to have either wetness, climatic, soil or gradient limitations on their potential usage. Consequently, potential agricultural land quality and sensitivity due to loss of soils is reduced.

Nationally Important Sites

5.12.16 No sites of special geological interest (SSSI's or RIGS) are present within the study area.

Contaminated Sites

5.12.17 No information was obtained during the course of the desk study or site walk-over to suggest the presence of significant contaminated land within the immediate vicinity of the route options under consideration. However it should be noted that encountering contaminated material during construction cannot be completely discounted.

Consultation

5.12.18 The geology of the study area was determined from British Geological Survey (BGS) 1:50,000 Scale Geological Maps Sheet 14W Ayr (Solid and Drift versions) together with available historical borehole records.

5.12.19 Information on soil types and agricultural land use within the study area was provided by the Macaulay Land Use Research Institute (MLURI).

5.12.20 The location of geological sites of Special Scientific Interest (SSSI's), Regionally Important Geological Sites (RIGS) have been determined by consultation with Scottish Natural Heritage (SNH).

5.12.21 The location of contaminated land has been assessed by reference to historical mapping and aerial photographs, consultation with South Ayrshire Council and information obtained from the Landmark Information Group in the form of an Envirocheck Report.

Impacts (Opening Year 1) without Mitigation

5.12.22 The impacts of each of the route options, including the junctions and sub-options, are the same, albeit they vary in magnitude. Therefore, to avoid repetition, impacts have been outlined only once.

5.12.23 The only significant impact identified as a result of any of the route options is the loss of soils due to land take. The impact is considered to be moderate adverse as the land which will be lost is not high quality agricultural land and widespread land of similar soil and agricultural classification will remain in the surrounding area.

5.12.24 The addition of a roundabout to any of the route options increases the loss of agricultural soils as a result of increased land take. Therefore, the adverse impact associated with the loss of agricultural soils is slightly increased. This is also the case for the widened carriageway provisions associated with the WS2+1 options.

Mitigation Measures

General

5.12.25 To minimise the loss of soils the design should consider the re-use of removed soil material elsewhere in the scheme. In addition should temporary land take be required during construction the design should maximise the proportion of such land which can be returned to agriculture following construction.

5.12.26 During construction the works should be undertaken in such a manner to minimise direct impacts to soils within the vicinity of any construction works including compaction of agricultural soils and soil erosion due to vegetation stripping.

5.12.27 No additional route specific mitigation measures were identified for any of the options.

Impacts (Design Year 15)

5.12.28 No impacts on the geology and soils of the study area are envisaged in addition to those identified for 'Opening Year 1' as detailed above.

Conclusions

5.12.29 There is a moderate adverse impact to the geology and soils of the study area associated with the loss of agricultural soils for all of the route options under consideration.

5.12.30 Comparing the Blue, Red and Yellow route options the Yellow route options are preferred due to the least land take and loss of agricultural soils. Considering the Blue, Red and Yellow route options individually the basic S2 route options are preferred, again as they result in the least land take and loss of agricultural soils.

5.12.31 On the above basis the most preferred route option from the perspective of impact to geology and soils of the study area is the Yellow 3.1 route option. The least preferred option is the Blue 1.4 route option.

5.13 Policies and Plans

Introduction

5.13.1 This section outlines the land use (including transport and environment) policy and planning framework for the Maybole Bypass study area.

5.13.2 The planning system provides direction for the future development and use of land in cities, towns and rural areas in the long-term public interest. The proposed route options could either contribute to or hinder planning policy at national, regional and/or local level. It is therefore important to assess the impacts of proposed road schemes on policies and plans at all levels of the planning process.

5.13.3 The purpose of this review is to assess how the achievement of policy objectives would be hindered or facilitated if any of the Maybole route options were to be constructed.

Key Issues

5.13.4 The key issues within a policies and plans context is the extent to which the different route options comply with the key land use policies and plans applicable to the study area.

Methodology

5.13.5 The planning policy impacts have been assessed in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 12 Plans and Policies for a Stage 2 Assessment.

5.13.6 This procedure encompasses reviewing the relevant policies and plans, identifying the key land use policies for the area, assessing the potential impacts of the route options on land use plans and policies and determining whether it contributes to or hinders these policy objectives.

5.13.7 Rather than provide an assessment of the likely impact of each route option against each policy, a broad assessment on the key policy issues has been undertaken.

5.13.8 In assessing the impacts the route options may have, it has been assumed that appropriate measures to avoid, minimise, or mitigate effects on the environment, as recommended in the other environmental chapters in this report, have been incorporated as part of the proposed development.

5.13.9 The policies have been identified through reference to the Local Plan Proposals Map (refer to Appendix A).

5.13.10 The planning constraints drawing only shows land use and environmental policy designations which appear on the Local Plan Proposals Maps. Where a relevant environmental designation is not shown on the Proposals Maps this assessment refers to other chapters in this report.

Baseline Conditions

5.13.11 The following plans and policies have been reviewed:

- National Planning Policy:
  - Scottish Planning Policy (SPP) 1: The Planning System[66];
  - SPP 2 : Economic Development[67];
  - National Planning Policy Guidance (NPPG) 5: Archaeology and Planning[68];
  - NPPG 14: Natural Heritage[69];
  - SPP 15: Planning for Rural Development[70;]
  - SPP 17: Planning for Transport[71]; and,
  - NPPG 18: Planning and the Historic Environment[72].
- Regional and Local Development Plans:
  - Ayrshire Joint Structure Plan 2025 (July 2000[73] and April 2006[74]); and
  - South Ayrshire Finalised Local Plan[75].
- Regional and Local Transport Strategies (LTS):
  - Regional Transport Strategy for the West of Scotland 2007 - 2021[76]; and
  - Local Transport Strategy for South Ayrshire[77].

5.13.12 A summary of each is provided in the following sub-sections.

National Policy

5.13.13 National planning and transport policies are outlined in the Government's series of Planning Policy Guidance Notes. These policies are in the form of National Planning Policy Guidance (NPPG) and Scottish Planning Policy (SPP). These set out the Government's policy on nationally important land-use issues and other planning matters. These provide national level policy advice on issues such as transport, noise, environmental protection and the trunk road network. Those considered to be relevant to this study are summarised in the following sub-sections.

SPP 1: The Planning System

5.13.14 This policy document outlines the role of the planning system in Scotland. It states that the three primary objectives for the planning system are to:

- Set the land-use framework for promoting sustainable economic development;
- Encourage and support regeneration; and
- Maintain and enhance the quality of the natural heritage and built environment.

[66] Scottish Executive, 2002
[67] Scottish Executive, 2002
[68] The Scottish Office Development Department, 1998
[69] The Scottish Office Development Department, 1999
[70] Scottish Executive, 2005
[71] Scottish Executive, 2005
[72] The Scottish Office Development Department, 1999
[73] The Ayrshire Joint Structure Plan Committee, 2000
[74] The Ayrshire Joint Structure Plan Committee, 2006
[75] South Ayrshire Council, 2006
[76] SPT, 2006
[77] South Ayrshire Council, 2001

5.13.15 In terms of transport, the policy seeks to ensure that the planning system is able to deliver the Government's commitment to a more sustainable, effective, integrated transport system. However, the promotion and extension of the transport network needs to be balanced against its impact on the environment, as protecting and enhancing the quality of the environment is a key objective of the planning system.

SPP 2: Economic Development

5.13.16 This policy document places an emphasis on the need to promote a successful economy through an effective and efficient transport infrastructure. It states that Transport Scotland has embarked on a continuing programme of improving the transport system to meet Scotland's economic and social needs without threatening the environment.

NPPG 5: Archaeology and Planning

5.13.17 This policy document seeks to encourage the preservation of the nation's heritage sites and landscapes of archaeological and historic interest. Essentially, the Government aims to accommodate development without eroding environmental assets, and this includes Scotland's archaeological heritage. The policy emphasises the need to have appropriate regard for archaeological remains as a finite and often highly fragile resource. The ultimate objective is to secure the best possible treatment of the archaeological heritage while at the same time accommodating the need for development.

NPPG 14: Natural Heritage

5.13.18 This policy document identifies how the Government's policies for the conservation and enhancement of Scotland's natural heritage should be reflected in land use planning. In this context, Scotland's natural heritage includes its plants, animals, landforms, geology, natural beauty and amenity. Natural heritage encompasses both physical attributes and aesthetic values and, given the long interaction between human communities and the land in Scotland, has important cultural and economic dimensions. The effect of a development proposal on the natural heritage can be a material consideration as to whether or not a designated area is likely to be affected.

NPPG 15: Planning for Rural Development

5.13.19 This policy document sets out how the planning system can assist rural areas of Scotland to achieve sustainable development. It acknowledges that people in rural areas are more heavily dependent on the private car and that rural car ownership is higher than the Scottish average, reflecting the fact that much of the rural population of Scotland has little alternative for many journeys. Nevertheless, through effective and planned development, proper consideration can be given to meet economic, housing and social needs for access to rural services. Overall, this policy sets out a guiding principle for councils considering proposals for rural development and that development in rural areas should benefit local communities economically, socially and environmentally.

SPP 17: Planning for Transport

5.13.20 The overriding objective contained in this policy document is to promote an integrated approach to land use, economic development, transport and the environment. The overall transport vision is "*of a Scotland where the economy can flourish and communities function without significant environmental and social problems arising from … traffic congestion and pollution* (paragraph 5)." It states that development plan policies are an important means of implementing transport strategies and a key influence on their development.

NPPG 18: Planning and the Historic Environment

5.13.21 This policy document recognises that the planning system provides a mechanism for the co-ordination and integration of conservation policies with other land-use, transport and environmental policies affecting the historic environment. Equally, it recognises that planning has a positive role to play in enabling development that is appropriate in terms of land-use, location and design. However, in doing so it seeks to safeguard the historic environment from inappropriate development, provides for change that respects the character of an area and for the needs of people within these areas.

Regional and Local Development Plans

5.13.22 The adopted Ayrshire Joint Structure Plan and the draft South Ayrshire Local Plan make up the statutory development framework for the South Ayrshire area. The Structure Plan represents the strategic element of the Development Plan for Ayrshire and sets the context for the Local Plan, which translates the strategic guidance into site-specific detail.

Ayrshire Joint Structure Plan 2025 (2000 and 2006)

5.13.23 The Ayrshire Joint Structure Plan was adopted by Scottish Ministers in January 2000. The Plan was recently updated and resubmitted to the Scottish Executive in June 2006, setting out the strategic planning context for the future of Ayrshire in the next 20 years. This review refers to both documents.

5.13.24 The 2000 Plan's vision is to achieve "*economic growth and environmental quality through a balanced and sustainable strategy for the benefit of Ayrshire and Scotland* (page 5)."

5.13.25 The 2000 Plan identifies Maybole as one of the many settlements in the region that experience unacceptable levels of traffic due to the settlement sitting astride a trunk road. It lists the A77 Maybole bypass as a scheme for which "*the three Ayrshire Councils shall encourage early construction* (page 36)." It therefore supports the upgrading of the A77 route, including the provision of a Maybole bypass.

5.13.26 The 2006 Structure Plan outlines the Development and Environment Framework for Ayrshire, which is shown in **Figure 5.13.7** and **Figure 5.13.8**.

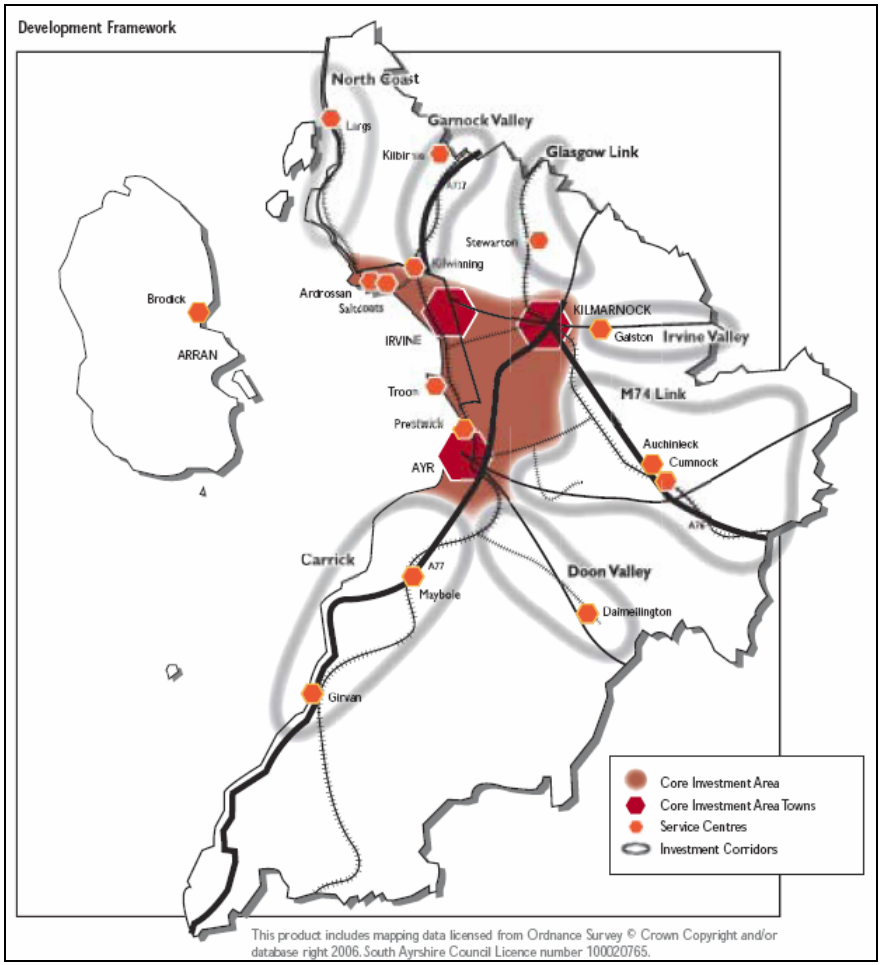
5.13.27 From **Figure 5.13.7**, it can be seen that the A77 route between Girvan and Ayr via Maybole is identified as an **Investment Corridor**, as it is considered to provide a key link between the region's main urban / economic centres, as well as to national and international markets.

5.13.28 The Structure Plans seek to balance the requirements for new development such as new roads, and protecting or enhancing the environment. As can be seen in **Figure 5.13.8**, the A77 at Maybole traverses through areas designated as **Green Network** (Policy ENV4) and is in close proximity to areas designated as **Sensitive Landscape Character / Landscape Protection area** (Policy ENV2).

5.13.29 These policies state that landscape will be given prime consideration in the determination of development proposals. Proposed developments located within an Investment Corridor and within Green Network areas will need to ensure that "*the landscape setting of communities, and the opportunities to link green spaces within and outside communities, shall be an integral consideration in the assessment of all local development proposals*".

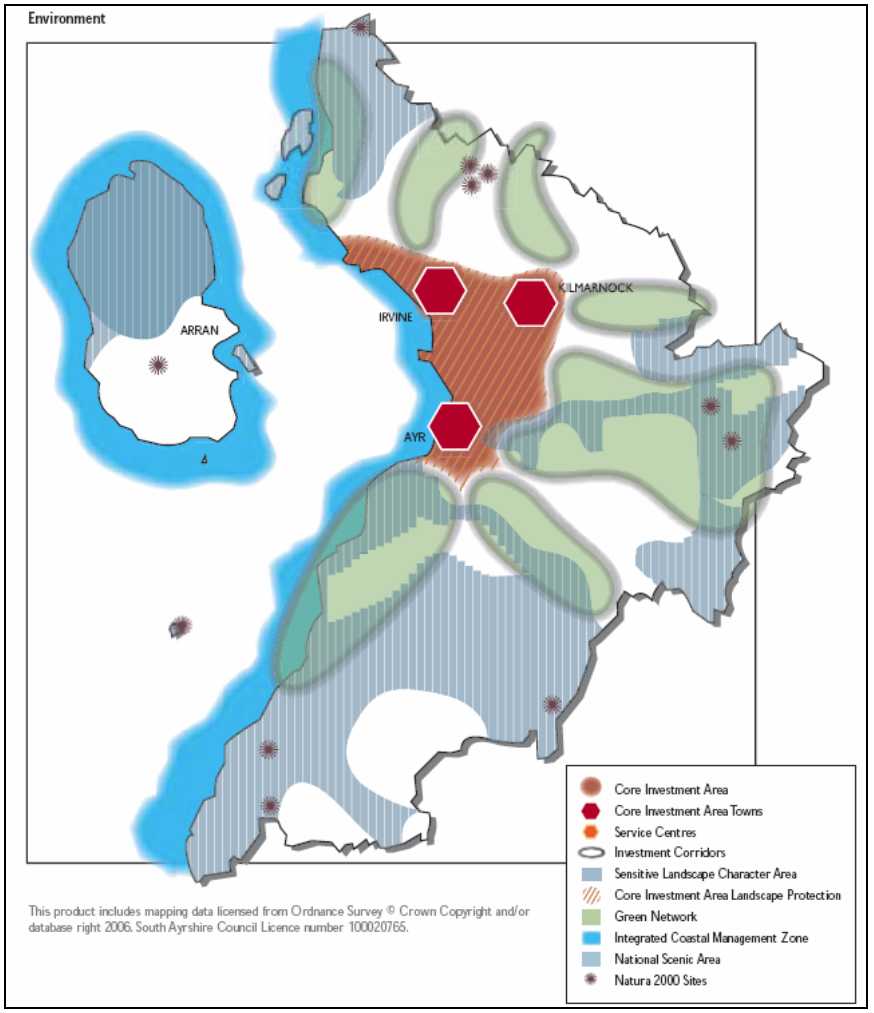
5.13.30 These and other environmental policies outlined in the Plans that are of most relevance to this study are summarised in **Table 5.13.76**.

Figure 5.13.7 – Ayrshire Development Framework



(Source: Draft Ayrshire Joint Structure Plan, 2006, page 9).

Figure 5.13.8– Ayrshire Environment Framework



(Source: Draft Ayrshire Joint Structure Plan, 2006, page 33)

Table 5.13.76 – Relevant Policies from the South Ayrshire Joint Structure Plan

Policy	Summary of Policy Statement (Text taken from the draft 2006 Plan)
Environment Policies	
E1 Landscape (2000 Plan) **ENV 1 Landscape Quality (2006)**	**The quality of Ayrshire's landscape and its distinctive local characteristics shall be maintained and enhanced. In providing for new development, care shall be taken to conserve those features that contribute to local distinctiveness including: settings of communities and buildings; patterns of woodland, fields, hedgerows and tree features; rivers, estuaries and coasts; historic landscapes; and skylines and hill features, including views.**
E2 – Sensitive Landscape Character Areas (2000 Plan) **ENV 2 Landscape Protection (2006 Plan)**	**In … Sensitive Landscape Character Areas, the protection and enhancement of the landscape shall be given prime consideration in the preparation of local plans and the determination of development proposals.**
ENV 3 Core Investment Area Landscape (2006 Plan)	**In addition to the greenbelt confirmed at Ayr, Prestwick and Troon, the three Councils shall explore the concept of a landscape protection area for the Core Investment Area including the possibility of defining a joint greenbelt.**
E5 – Countryside Access; and Recreation (2000 Plan) **ENV 4 Green Network (2006 Plan)**	**The three Ayrshire Councils shall develop and promote a Green Network for Ayrshire. Development within, adjacent to or affecting the areas identified in the Green Network should be designed to enhance the landscape quality and expand the habitat potential of the areas concerned. Within the Investment Corridors the three Councils shall ensure the landscape setting of communities, and the opportunities to link green spaces within and outside communities, shall be an integral consideration in the assessment of all local development proposals.**
E20 – Built Heritage, and **E21 – Archaeological Landscapes (2000 Plan)** **ENV 6 Protection of the Built Heritage (2006 Plan)**	**Development proposals considered to have an adverse effect on the heritage resources shall not conform to the structure plan. 'Heritage Resources' includes: listed buildings of architectural and historic interest; designated conservation areas; historic gardens and designed landscapes; and archaeological locations and landscapes.**
E6 – Biodiversity; and **E7, E8 and E9 – Nature Conservation (2000 Plan)** **ENV 7 Natural Heritage Designations (2006 Plan)**	**The three Ayrshire Councils shall recognise international and national natural heritage designations and the statutory protections afforded by them; and support the identification of additional Local Nature Reserves and continue to work with other stakeholders to implement the Ayrshire Local Biodiversity Action Plan.**
ENV 11 Air, Noise and Light Pollution (2006 Plan)	**The three Ayrshire councils shall not be supportive of new development that would expose large numbers of people to unacceptable levels of air, noise and light pollution.**
Transport Policy	
T9 (2000 Plan) **TRANS 3 Strategic Road Development (2006 Plan)**	**The three Ayrshire Councils shall work in partnership with relevant transport bodies to give priority to the study, promotion and development of: (iii) improvements to A77 between Kilmarnock and Stranraer; and develop and promote improvements to other parts of the strategic road network in the investment corridors, including traffic relief for communities and the safeguarding of land for strategic road network enhancement where appropriate.**

South Ayrshire Finalised Local Plan (2006)

5.13.31 The South Ayrshire Local Plan outlines the policy framework for the use of land over the next 10 years "*in a way which encourages economic development whilst conserving the local environment*".

Transport

5.13.32 The Plan states that the provision of a Maybole town bypass is a priority, as it is seen to address two main objectives of the Plan: the improvement of the environment; and the need to enable continued economic and business development. However, it recognises that a trunk road bypass is outside the Council's remit and therefore simply states that it "*strongly advocates the A77 trunk bypass route for Maybole road improvement scheme and recommends to the relevant implementing agency that they are treated as priority schemes*" (Recommendation 178).

5.13.33 Although the Local Plan does not contain a specific policy on safeguarding land for a bypass, the Local Plan Proposals Map shows a line to the north of the settlement boundary that is "*protected for a Maybole bypass*".

Settlement Strategy and the Environment

5.13.34 The Plan has defined a settlement boundary around Maybole. The area outside the settlement boundary is considered to be countryside and is designated as a Rural Protection Area. All of the route options would traverse across this area.

5.13.35 The **Rural Protection Area policy (STRAT3)** seeks to protect countryside that, although not necessarily of a sensitive environmental nature such as Greenbelt, still requires protection from development pressures and from inappropriate non-rural based uses or development.

5.13.36 The policy lists several points that a development in this area would need to comply with. Of most relevance to this study is point (a), in which a new development will need to demonstrate that it is "*of a significant economic benefit to the area*[79]." As far as possible, the development will also need to be sympathetic to the surrounding local natural and built environment and landscape; not be visually intrusive; and not adversely affect the landscape setting or amenity of communities.

5.13.37 There are also several other main environmental policies in the Local Plan relating to the Natural and Built Environment that are of relevance to this study, and these are summarised in **Table 5.13.77**.

5.13.38 The Local Plan's land-use designations for Maybole and the surrounding countryside are shown in Appendix A.

[78] http://www.south-ayrshire.gov.uk/LocalPlan/transport.htm
[79] http://www.south-ayrshire.gov.uk/LocalPlan/ruralprot.htm

Table 5.13.77 – Relevant environmental policies in the South Ayrshire Local Plan

Policy	Summary of Policy Statement
General policies that apply outwith the Settlement Boundary	
STRAT 3	Development within the **Rural Protection Area** (including a change of use or intensification of use) will require to be justified, to the satisfaction of the Council in terms of being: (a) A significant economic benefit.
STRAT 5	**Rural Protection Area:** In seeking to ensure a high quality environment, the Council will expect, that all development within this area to: be appropriate in its sitting, setting, layout, scale, massing, design and materials used in relation to its surroundings, so as to not be visually intrusive; respect and safeguard natural, built and archaeological heritage resources; safeguard the amenity of nearby dwellings, schools, institutions, workplaces or communities; be appropriate to its locality in terms of road safety; contribute to an efficient use of existing public services, facilities and infrastructure; employ the principles of sustainability in its design, location and use of materials; in the use of sustainable urban drainage systems; and is safe from reasonable risk of flooding without increasing a risk of flooding in other locations; take cognisance of the implications of the existence of, or proposals for notifiable installations (e.g. hazardous substances); and comply with the aims and objectives of the Plan.
ENV 8	The acceptability of proposals located within or having an impact on, scenic areas will be considered using the following criteria: the significance of impacts and cumulative impacts on the environment, particularly landscape and visual impacts; and where relevant, the extent of any economic benefits; or specific, justified requirement for a rural location.
ENV 13	There will be a presumption in favour of protecting prime quality agricultural land (defined as grade 1, 2 or 3.1 in the Macauley Land Classification system), where an alternative location for development may exist. The principles of this policy will also be applied where agricultural land or holdings are potentially fragmented by proposed development
General policies that apply throughout the Local Plan area	
ENV 2	The Council will favour safeguarding the integrity of sites of local natural heritage value, including: local nature reserves; sites containing species protected by the Habitats Directive, Wildlife and Countryside Act 1981 or the Badgers act 1992; wildlife sites and provisional wildlife sites; and ornithological sites.
ENV 3	The Council will require development proposals to have regard to safeguarding features of nature conservation value including woodlands, hedgerows, lochs, ponds, watercourses, wetlands and wildlife corridors in accordance with the Wildlife Strategy.
ENV 10	The Council will seek to safeguard historic gardens and designed landscapes. Proposals affecting these areas will be considered in terms of landscape impact and in relation to their history, architecture, horticulture and nature conservation qualities.
ENV 12	On development proposals involving loss of, or works to, trees - the Council will consider the extent of any adverse impact on the locality and will include as part of its assessment measures to safeguard trees, especially those covered by a provisional or confirmed tree preservation order.

Regional and Local Transport Policy

5.13.39 Regional and local transport policies for the area are outlined in the Regional Transport Strategy (RST) for the west of Scotland and South Ayrshire Local Transport Strategy (LTS).

Regional Transport Strategy for the West of Scotland 2007-2021

5.13.40 December 2006 saw the publication of the document 'A Catalyst for Change (The Draft Regional Transport Strategy for the West of Scotland 2007-2021)' by SPT. The document is currently subject to consultation and it is expected to be approved during 2007.

5.13.41 The Strategy identifies the A77 Maybole bypass as a Medium Term (up to 2014) project that would contribute towards reducing carbon emissions (Table 5.7, page 71).

Local Transport Strategy for South Ayrshire (2006)

5.13.42 The LTS for South Ayrshire details more specific polices related to transport in the local area. The LTS covers the period from 2006 to 2011. Route Hierarchy Policy 5 states that the Council will work with the Scottish Executive to implement an early start to upgrading the A77.

Summary of Policy Context

5.13.43 An illustration of planning constraints is shown in Figure 5028091_PLA_001 in Appendix A.

5.13.44 The Local Plan Proposals Map shows a line to the north of the settlement boundary that is "*protected for a Maybole bypass*".

5.13.45 All of the proposed route options would traverse through or be in close proximity to areas designated in the Structure Plan as Sensitive Landscape Character area (Policy ENV2) and Green Network area (Policy ENV4); and in the Local Plan as Rural Protection Area (Policy STRAT3). These policies aim to protect the countryside and state that impacts on landscape will be given prime consideration in the determination of development proposals.

5.13.46 In order to be policy complaint, the preferred route option would need to demonstrate that it:

1. Is of a significant economic benefit to the area;
2. Would be sympathetic to the surrounding local natural and built environment and landscape, and not be visually intrusive;
3. Would not adversely affect the landscape setting or amenity of communities; and
4. Would be designed to enhance the landscape quality and expand the habitat potential of Green Network areas concerned.

5.13.47 Appropriate measures would need to be incorporated into the preferred route option to mitigate any adverse impacts the development may have on the above.

Consultation

5.13.48 No consultation was carried out in undertaking this review.

Impacts (Opening Year 1) without Mitigation

All Route Options

5.13.49 The policy review confirms that there is a strong planning aspiration at national, regional and local level to provide a Maybole bypass as it is seen to offer significant economic benefits to the region, as well as within Maybole itself. All three route options would therefore satisfy the first criterion.

Tie-In Junctions

Broomknowes Roundabout

Blue and Red Route

5.13.50 It is considered that there is no discernable impact on policies and plans at this level of detail.

Yellow Route

5.13.51 It is considered that there is no discernable impact on policies and plans at this level of detail.

Smithston Bridge Roundabout

5.13.52 It is considered that there is no discernable impact on policies and plans at this level of detail.

Blue Base Route – S2 without Roundabout

5.13.53 The Blue Route presents a significantly different alignment to the outline route identified as "*protected for a Maybole bypass*" in the Local Plan Proposals Map. Of the three route options, it is considered likely to have a major adverse impact on landscape, which is the worst impact of the three options (refer to the Landscape Section of this report, Section 5.6). It is therefore considered to be the least preferred option in terms of consistency with polices and plans objectives.

Additional Impacts of Roundabout added to S2

5.13.54 It is considered that there is no discernable impact on policies and plans at this level of detail.

Additional Impacts of WS2+1

5.13.55 It is considered that there is no discernable impact on policies and plans at this level of detail.

Additional Impacts of Roundabout added to WS2+1

5.13.56 It is considered that there is no discernable impact on policies and plans at this level of detail.

Yellow Base Route – S2 without Roundabout

5.13.57 The Yellow Route adheres most closely to the outline route identified as "*protected for a Maybole bypass*" in the Local Plan Proposals Map. Of the three route options, it is considered likely to have a moderate adverse impact on landscape, which is the least impact of the three options (refer to the Landscape Section of this report, Section 5.6). It is therefore considered to be the preferred option in terms of consistency with polices and plans objectives.

Additional Impacts of Roundabout added to S2

5.13.58 It is considered that there is no discernable impact on policies and plans at this level of detail.

Additional Impacts of WS2+1

5.13.59 It is considered that there is no discernable impact on policies and plans at this level of detail.

Additional Impacts of Roundabout added to WS2+1

5.13.60 It is considered that there is no discernable impact on policies and plans at this level of detail.

Red Base Route – S2 without Roundabout

5.13.61 The Red Route also adheres closely to the outline route identified as "*protected for a Maybole bypass*" in the Local Plan Proposals Map, although not as close as the Yellow Route. Of the three route options, it is considered likely to have a moderate-major adverse impact on landscape, (refer to the Landscape Section of this report, Section 5.6). It is therefore considered to be the second preferred option in terms of consistency with polices and plans objectives.

Additional Impacts of Roundabout added to S2

5.13.62 It is considered that there is no discernable impact on policies and plans at this level of detail.

Additional Impacts of WS2+1

5.13.63 It is considered that there is no discernable impact on policies and plans at this level of detail.

Additional Impacts of Roundabout added to WS2+1

5.13.64 It is considered that there is no discernable impact on policies and plans at this level of detail.

Mitigation Measures

General

5.13.65 To satisfy the policies in the Structure Plan and Local Plan, summarised in **Table 5.13.76** and **Table 5.13.77**, the preferred route option should incorporate the mitigation measures recommended in the other environmental chapters of the report, specifically the landscape mitigation measures outlined in Section 5.6 of this report.

5.13.66 Conducting an open, transparent and effective consultation process throughout the project will also be the key to providing a route option that is accepted by the community, the Council and other key stakeholders.

Blue Route

5.13.67 No additional mitigation measures for the Blue route have been identified.

Yellow Route

5.13.68 No additional mitigation measures for the Yellow route have been identified.

Red Route

5.13.69 No additional mitigation measures for the Red route have been identified.

Impacts (Design Year 15)

5.13.70 Impacts against polices and plans in Year 15 (the Design Year) is predicted to be the same as that for the opening year.

Conclusions

5.13.71 In policy terms, the main thrust for the study area is twofold. Firstly, the proposed route must be considered to offer significant economic benefits to the region. Secondly, the policies seek to protect the countryside and where possible promote enhancements to the landscape and/or expand the habitat potential. Impacts on landscape will therefore be given "prime consideration" in the determination of development proposals.

5.13.72 The Local Plan Proposals Map also contains an outline route that is "*protected for a Maybole bypass*".

5.13.73 The policy review confirms that there is a strong planning aspiration at national, regional and local level to provide a Maybole bypass as it is seen to offer significant economic benefits to the region, as well as within Maybole itself. All three route options would therefore satisfy the first criterion.

5.13.74 Of the three route options, the Red and Yellow Routes adhere most closely to the outline route identified as "*protected for a Maybole bypass*" in the Local Plan Proposals Map. The Red and Yellow Routes are therefore considered to be more consistent with the aspirations of the Local Plan than the Blue Route.

5.13.75 All three options would have a negative effect on landscape (refer to the Landscape Section of this report, Section 5.6). The Blue Route is likely to have a major adverse impact, the Red Route a moderate-major adverse impact and the Yellow Route a moderate adverse impact on landscape.

5.13.76 The Yellow Route (any layout options) is therefore considered to be the preferred route within a policies and plans context.

5.14 Environmental Impacts Table

Introduction

5.14.1 This section presents a table of predicted environmental impacts for the A77 Maybole bypass route options. This outlines the main predicted impacts of the proposed route options, identified in this Stage 2 DMRB report, in summarised form and provides a comparison with the impacts of the existing situation in the form of a do-minimum scenario.

5.14.2 The environmental impacts have been tabulated under the following headings for the proposed route options and do-minimum scenario:

- Topic;
- Impact; and,
- Units/Interest.

5.14.3 All impacts have been identified as a result of the DMRB Volume 11 Stage 2 assessment process for each environmental discipline considered in this assessment. These impacts are tabulated in order to clearly define the environmental impacts of the proposed route options.

5.14.4 This table provides a summary of the impacts, which are detailed more fully in the relevant sections of this assessment. Reference should be made to individual sections of the environmental assessment for further explanation and full context.

Table 5.14.78 – Environmental Impacts Table

Topic	Impacts	Units/Interest	Blue 1.1	Blue 1.2	Blue 1.3	Blue 1.4	Red 2.1	Red 2.2	Red 2.3	Red 2.4	Yellow 3.1	Yellow 3.2	Yellow 3.3	Yellow 3.4	Do-Minimum
Air Quality	Change in emissions from traffic	Nitrogen Dioxide, Particulate Matter	Majority of properties experience an improvement in air quality due to a reduction in NO_2 and PM_{10}.	As for Blue 1.1 although the number of properties benefiting from an improvement is less.	As for Blue 1.1	As for Blue 1.2	Majority of properties experience an improvement in air quality due to a reduction in NO_2 and PM_{10}.	As for Red 2.1 although the number of properties benefiting from an improvement is less.	As for Red 2.1	As for Red 2.2	Majority of properties experience an improvement in air quality due to a reduction in NO_2 and PM_{10}.	As for Yellow 3.1 although the number of properties benefiting from an improvement is less.	As for Yellow 3.1	As for Yellow 3.2	All do something options result in a greater improvement to air quality than the Do-Minimum.
Cultural Heritage	Potential changes to setting of built heritage; potential disturbance of buried archaeological remains.	Scheduled Monuments, Listed Buildings, Conservation Area, Historic Garden and Designed Landscape, undesignated cultural heritage sites	No adverse impacts on SM. Minor Adverse on two LB. Major/moderate benefit on Maybole Conservation Area.	As for Blue 1.1 but impact on one LB increases to Moderate adverse.	As for Blue 1.2	As for Blue 1.2	No adverse impacts on SM. Minor adverse on two LB and one non-LB. Major/moderate benefit on Maybole Conservation Area.	As for Red 2.1 but impact on one LB increases to moderate adverse.	As for Red 2.2	As for Red 2.2	No adverse impacts on SM. Minor adverse on two LB and one non-LB. Major/moderate benefit on Maybole Conservation Area.	As for Yellow 3.1 but impact on one LB increases to moderated adverse	As for Yellow 3.2	As for Yellow 3.2	Adverse on Maybole Conservation Area (inc. A-Grade LB) Neutral on SM and LB outside of town centre.
Disruption due to construction	Resident/Road user disruption	Property, Land Use, Noise/Vibration, Landscape, Ecology, Cultural Heritage, Water Quality and Earthworks	Potential impacts on access track for East Enoch and St Murrays. Land take required at caravan park. Fifth best cut to fill balance.	As for Blue 1.1 but 7th best cut to fill balance	As for Blue 1.1 but 6th best cut to fill balance	As for Blue 1.1 but 8th best cut to fill balance	Potential impacts on access track for East Enoch, the caravan park and St Murrays. 11th best cut to fill balance.	As for Red 2.1 but 9th best cut to fill balance	As for Red 2.1 but worst cut to fill balance	As for Red 2.1 but 10th best cut to fill balance	Potential impacts on Whitefaulds residential development. 3rd best cut to fill balance.	As for Yellow 3.1 but best cut to fill balance	As for Yellow 3.1 but 4th best cut to fill balance	As for Yellow 3.1 but second cut to fill balance.	None.
Ecology and Nature Conservation	Habitat Loss, Disturbance, Fragmentation, Severance, Impacts on legally protected species	Ancient woodland, Semi-natural Woodland, Watercourses/ Culverts, Protected Species (e.g. otters, badgers, bats and breeding birds), Notable and UKBAP species of birds (e.g. yellowhammer) and mammal (e.g. brown hare).	Moderate negative including; habitat severance, ancient woodland sites disturbance, loss of semi-natural woodland site, loss of watercourses likely to support protected species and hedgerow habitat supporting notable species. Minor negative on woodland of local nature conservation value.	As for Blue 1.1 but slight increase in impact due to additional landtake	As for Blue 1.2 but slight increase in impact due to additional landtake	As for Blue 1.3 but slight increase in impact due to additional landtake	Minor negative including habitat, severance, loss of semi-natural woodland site, loss of watercourses likely to support protected species and hedgerow habitat supporting notable species. Minor negative on identified tree and hedgerow of local nature conservation value.	As for Red 2.1 but slight increase in impact due to additional landtake	As for Red 2.2 but slight increase in impact due to additional landtake	As for Red 2.3 but slight increase in impact due to additional landtake	Minor negative including; habitat, severance, loss of semi-natural woodland site, loss of watercourses likely to support protected species and hedgerow habitat supporting notable species. Minor negative impact on identified trees of nature conservation value.	As for Yellow 3.1 but slight increase in impact due to additional landtake	As for Yellow 3.2 but slight increase in impact due to additional landtake	As for Yellow 3.3 but slight increase in impact due to additional landtake	None.
Landscape Effects	Landscape character impacts	Landscape Character Areas, Designations, Landform, Vegetation, Land Use / Pattern	Minor to major adverse on landscape features with an overall major adverse on the landscape.	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	Minor to moderate - major adverse on landscape features with an overall moderate - major adverse on the landscape.	As for Red 2.1	As for Red 2.1	As for Red 2.1	Minor to moderate adverse on landscape features with an overall moderate adverse on the landscape.	As for Yellow 3.1	As for Yellow 3.1	As for Yellow 3.1	Neutral on landscape outwith the town centre. Neutral on town centre.

Topic	Impacts	Units/Interest	Blue 1.1	Blue 1.2	Blue 1.3	Blue 1.4	Red 2.1	Red 2.2	Red 2.3	Red 2.4	Yellow 3.1	Yellow 3.2	Yellow 3.3	Yellow 3.4	Do-Minimum
	Visual amenity impacts	Visual amenity receptors (number of receptors)	A total of 426 receptors are impacted on by this option, 344 have a significant adverse impact.	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	A total of 481 receptors are impacted on by this option, 333 have a significant adverse impact.	As for Red 2.1	As for Red 2.1	As for Red 2.1	A total of 482 receptors are impacted on by this option, 339 have a significant adverse impact.	As for Yellow 3.1	As for Yellow 3.2	As for Yellow 3.3	Neutral on receptors
Land Use	Farm accesses severed	Productive farms	Cultezeoun and Mid-Brockloch	Cultezeoun and Mid-Brockloch	Cultezeoun and Mid-Brockloch	Cultezeoun and Mid-Brockloch	Cultezeoun	Cultezeoun	Cultezeoun	Cultezeoun	Cultezeoun	Cultezeoun	Cultezeoun	Cultezeoun	None
	Loss of Prime Land		Very small parcels	Very small parcels	Very small parcels	Very small parcels	None	None	None	None	None	None	None	None	None
	Dairy farms severed		East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	East Enoch	None
	Land take		22.2Ha	22.3Ha	22.9Ha	23.2Ha	20.6Ha	20.8Ha	21.5Ha	21.8Ha	18.2Ha	19.3Ha	18.8Ha	19.8Ha	None
	Loss of housing land	Development land	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	Whitefaulds Estate	None
	Loss of caravan park land	Amenity land	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	Gallowhill	None
Traffic Noise and Vibration	Residential properties experiencing changes in noise levels with the scheme (in the opening year)	Individuals impacted as a result of Do-something scenario													
		Increase >1dB	405	390	412	393	440	414	451	426	507	472	509	475	None
		Increase >10dB	33	38	33	41	19	34	31	62	72	109	87	121	
		Decrease >1dB	348	499	352	489	329	475	332	441	300	390	290	399	
Pedestrians, Cyclists, Equestrians and Community Effects	Impacts on all relevant interests	Community facilities	Improved accessibility resulting in minor beneficial impact	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	Improved accessibility resulting in minor beneficial impact	As for Red 2.1	As for Red 2.1	As for Red 2.1	Improved accessibility resulting in minor beneficial impact	As for Yellow 3.1	As for Yellow 3.1	As for Yellow 3.1	Likely that access will continue to become more difficult due to increased traffic volumes in the town centre.
		Routes used by pedestrians and others	Routes would be improved to trips into the town centre due to reduction of traffic volume	As for Blue 1.1 but proposed roundabout at B7023 would introduce a new feature for pedestrians and others to navigate.	As for Blue 1.1	As for Blue 1.2	Routes would be improved to trips into the town centre due to reduction of traffic volume	As for Red 2.1 but proposed roundabout at B7023 would introduce a new feature for pedestrians and others to navigate.	As for Red 2.1	As for Red 2.2	Routes would be improved to trips into the town centre due to reduction of traffic volume	As for Yellow 3.1 but proposed roundabout at B7023 would introduce a new feature for pedestrians and others to navigate.	As for Yellow 3.1	As for Yellow 3.2	Likely that routes used by pedestrians and others will become less desirable due to the increased traffic volumes in the town centre
		Changes to key journey aspects	Journey times are unlikely to be affected	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	Journey times are unlikely to be affected	As for Red 2.1	As for Red 2.1	As for Red 2.1	Journey times are unlikely to be affected	As for Yellow 3.1	As for Yellow 3.1	As for Yellow 3.1	Journey times could potentially increase due to increased traffic volumes in the town centre

Topic	Impacts	Units/Interest	Blue 1.1	Blue 1.2	Blue 1.3	Blue 1.4	Red 2.1	Red 2.2	Red 2.3	Red 2.4	Yellow 3.1	Yellow 3.2	Yellow 3.3	Yellow 3.4	Do-Minimum
Vehicle Travellers	View from the Road	Visual amenity impacts	Improved view resulting in moderate beneficial impact	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	Improved view resulting in minor beneficial impact	As for Red 2.1	As for Red 2.1	As for Red 2.1	Improved view resulting in minor beneficial impact	As for Yellow 3.1			Neutral impact on views
	Driver stress	Average peak hourly flows, Over-taking facilities, Junctions, %HGVs	Peak hourly flows in town centre decrease, increase in %HGVs	As for Blue 1.1 but additional roundabout to navigate at B7023 Junction	As for Blue 1.1 but increased overtaking opportunity with additional lane	As for Blue 1.1, 1.2 and 1.3	Peak hourly flows in town centre decrease, increase in %HGVs	As for Red 2.1 but additional roundabout to navigate at B7023 Junction	As for Red 2.1 but increased overtaking opportunity with additional lane	As for Red 2.1, 2.2 and 2.3	Peak hourly flows in town centre decrease, increase in %HGVs	As for Yellow 3.1 but additional roundabout to navigate at B7023 Junction	As for Yellow 3.1 but increased overtaking opportunity with additional lane	As for Yellow 3.1, 3.2 and 3.3	Peak hourly flows in the town centre increase with no overtaking facilities. Side junctions neutral.
Water Quality and Drainage	Pollution of watercourses during construction Increased run off Pollution of watercourses during operation	Paved area contributing to Surface Runoff	59528m^2 to three watercourses	61395m^2 to three watercourses	67952m^2 to three watercourses	72351m^2 to three watercourses	58328m^2 to four watercourses	59895m^2 to four watercourses	66752m^2 to four watercourses	69650m^2 to four watercourses	59535m^2 to four watercourses	63110m^2 to four watercourses	65552m^2 to three watercourses	68252m^2 to four watercourses	No change
		Reduction of water quality, Culverting required, Flooding potential	Culverting required of one burn or possible realignment. Potential for localised flooding at three burns, runoff to sensitive waters further downstream. One watercourse dries up in summer reducing ability to transport or dilute contaminated runoff.	As for Blue 1.1, however additional surface runoff will be discharged to existing watercourses.	As for Blue 1.2.	As for Blue 1.2.	Culverting required of one burn, potential for localised flooding at three burns, runoff to sensitive waters further downstream. One watercourse dries up in summer reducing ability to transport or dilute contaminated runoff.	As for Red 2.1, however additional surface runoff will be discharged to existing watercourses.	As for Red 2.2	As for Red 2.2	Culverting required of one burn, potential for localised flooding at three burns, runoff to sensitive waters further downstream. One watercourse dries up in summer reducing ability to transport or dilute contaminated runoff.	As for Yellow 3.1, however additional surface runoff will be discharged to existing watercourses.	As for Yellow 3.2	As for Yellow 3.2	No change to existing
Geology and soils	Loss of soils due to increased land take.	Loss of soils	Agricultural soils resulting in moderate adverse impact.	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	Agricultural soils resulting in moderate adverse impact.	As for Red 2.1	As for Red 2.1	As for Red 2.1	Agricultural soils resulting in moderate adverse impact.	As for Yellow 3.1	As for Yellow 3.1	As for Yellow 3.1	Neutral impact
	Shortfall of site materials	Net import of materials (m^3)	43,849m^3	102,861m^3	46,921m^3	105,326m^3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Surplus site materials	Net export of materials (m^3)	N/A	N/A	N/A		402,768m^3	323,859m^3	425,526m^3	345,396m	18,583m^3	6,288m^3	27,254m^2	13,673m^3	Neutral
Policies and Plans	Compliance with National, Regional and Local Policy	Location of Protected Bypass Route	Significantly different from the protected route	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	Adheres closely to the protected route	As for Red 2.1	As for Red 2.1	As for Red 2.1	Adheres most closely to the protected route	As for Yellow 3.1	As for Yellow 3.1	As for Yellow 3.1	Neutral
	Impacts on Landscape		Major adverse impact	As for Blue 1.1	As for Blue 1.1	As for Blue 1.1	Moderate-major adverse impact	As for Red 2.1	As for Red 2.1	As for Red 2.1	Moderate adverse impact	As for Yellow 3.1	As for Yellow 3.1	As for Yellow 3.1	Neutral

5.15 Route Option Preferences

Introduction

5.15.1 This section presents a table of route preferences for each environmental discipline considered in this assessment.

5.15.2 The predicted impacts of each route option have been compared; each route option has been assigned a value on a scale of 1-12, 1 being most preferred and 12 being least preferred. This allows comparison of route preferences across environmental disciplines at this stage of assessment.

Table 5.15.79 – Route Options Preferences

Topic	Option											
	Blue 1.1	**Blue 1.2**	**Blue 1.3**	**Blue 1.4**	**Red 2.1**	**Red 2.2**	**Red 2.3**	**Red 2.4**	**Yellow 3.1**	**Yellow 3.2**	**Yellow 3.3**	**Yellow 3.4**
Air Quality	10	6	8	3	11	5	12	4	7	2	9	**1**
Cultural Heritage	9	10	11	12	5	6	7	8	**1**	3	2	4
Disruption Due to Construction	9	11	10	12	7	5	8	6	3	**1**	4	2
Ecology & Nature Conservation	9	10	11	12	5	6	7	8	**1**	3	2	4
Landscape Effects	9	10	11	12	5	6	7	8	**1**	2	3	4
Land Use	9	10	11	12	5	6	7	8	**1**	3	2	4
Noise &Vibration	3	**1**	3	2	7	5	7	5	11	9	12	9
Pedestrians, Cyclists, Equestrians & Community Effects	**1**	7	**1**	7	**1**	7	**1**	7	**1**	7	**1**	7
Vehicle Travellers	2	4	**1**	3	7	11	5	9	7	11	5	9
Road Drainage & the Water Environment	9	10	11	12	5	6	7	8	**1**	2	3	4
Geology & Soils	9	10	11	12	5	6	7	8	**1**	3	2	4
Policies & Plans	*9*	*9*	*9*	*9*	5	5	5	5	**1**	**1**	**1**	**1**

Most preferred option is **highlighted in bold**