A12 Four Villages Executive Summary

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Executive Summary

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1. General

This report is written in response to a brief entitled ‘Four Villages Bypass Study’ issued by Suffolk County Council in December 2013 dealing with improvements to the A12, which connects Lowestoft and East Suffolk to the strategic road network. AECOM understands that there have been previous proposals to improve the section of A12 between the Wickham Market bypass and the Saxmundham bypass. In addition to improving the route as a strategic link, these improvements would bring traffic relief to the villages of Marlesford, Little Glemham, Stratford St Andrew and Farnham. AECOM are aware that Suffolk County Council’s view is that the traffic impacts from the proposed Sizewell C development will be of such severity that there is an associated case for the provision of a bypass to these villages as part of the development. However, the scale of investment required is such that the provision of a continuous bypass may not be achievable as mitigation for the development impacts and therefore a partnership approach to funding and staged delivery may be necessary.

Suffolk County Council wishes to explore options for delivery of a bypass by staged improvements either as a single or dual carriageway. The aim of this report is to provide a summary of environmental assessments of the possible routes, for single and dual carriageway options, and to produce estimates of cost for construction of the improvements. This will enable a preliminary comparison of the deliverability of all of the A12 improvement options.

2. Route Options

For the bypass options AECOM have considered, in accordance with the brief, the following routes, all of which are shown in principle on the accompanying (outline) drawing number 60315689-SHT-00-FVSW-C-0003.

- Route SB1 (Pink Route) approximately 1.95km in length single carriageway, bypassing the villages of Farnham and Stratford St Andrew. Refer to accompanying drawing for further details.
- Route SB2 with Link1 and 2 (Green Route) 2.26km in length dual carriageway, bypassing to the north the villages of Farnham and Stratford St Andrew. Refer to accompanying drawing for further details.
- Route SB4 (Red Route) 2.85km dual carriageway, bypassing the village of Little Glemham. Refer to accompanying drawing for further details.
- Route SB5 with Link 1 (Blue Route) 3.50km in length dual carriageway, bypassing to the south the villages of Farnham and Stratford St Andrew. Refer to accompanying drawing for further details.
- Route LB3 (Orange Route) 5.60km dual carriageway, bypassing to the south the village of Marlesford and the village of Little Glemham. Refer to accompanying drawing for further details.

SCC also requested analysis of a two stage construction of SB1 (Pink Route). These two proposed routes are detailed as the North and South stages of the route and can be seen in (outline) plan number 60315689-SKE-00-FVSW-C-0034.

- Route SB1 North (Pink Route), approximately 1.05 km in length.
- Route SB2 South (Pink Route); approximately 0.90km in length.

A roundabout will also need to be constructed, linking the two sections. This has been included in the analysis to follow.

All routes apart from SB1 (Pink Route) have been designed as single and dual carriageway option. For further details of the proposed routes refer to the accompanying drawings.

3. Scheme Development and Construction Programme

An estimated construction programme has been defined based on previous AECOM design and construction work. The programme shows the approximate years in which the design and construction will take place but the durations of these may alter depending on extent of the further work. Table 1 shows a summary of the construction programme for each scheme.

Table 1: Construction programme summary

Activity	SB1	SB1 A12 North	SB1 A12 South	SB2	SB4	SB5	LB3
Carry out Preliminary Design and consultation	2014	2014	2014	2014	2014	2014	2014
Announce Preferred Route	2015	2015	2015	2015	2015	2015	2015
Carry out Detailed Design	2016	2016	2021	2016	2016	2016	2015-2016
Public Inquiry	2016	2016	2021	2016	2016	2016	2016
Order Publication Period and CPO	2017	2017	2022	2017	2017	2017	2017
Award of Tender	2018	2018	2023	2018	2018	2018	2018
Construction Period	2018-2019	2018-2019	2023-2024	2018-2020	2018-2020	2018-2020	2018-2020
Open to Traffic	2020	2020	2024	2020	2020	2020	2020

4. Construction Cost Estimate

AECOM has calculated indicative construction costs for the routes in accordance with new road design guidance provided in the DMRB. A summary of these costs can be seen in Table 2 as follows;

Table 2: Summary of costs

Route (Road Area)	Net Total (inc Opt Bias, Contingency, Inflation etc.)
SB1 – Pink Route 21,262m2	£ 18,651,620
SB1- Pink Route (North) 12,387 m2	£12,402,134
SB1- Pink Route (South) 8,875 m2	£6,800,452
SB2 – Green Route (Single Carriageway) 27,156m2	£ 25,915,017
SB2 – Green Route (Dual Carriageway) Including Link 1 and Link 2 51,210m2	£ 44,057,647
SB4 – Red Route (Single Carriageway) 28,040m2	£ 16,245,913
SB4 – Red Route (Dual Carriageway) 52,706m2	£ 25,650,099
SB5 – Blue Route (Single Carriageway) 38,418m2	£ 28,855,383

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Route (Road Area)	Net Total (inc Opt Bias, Contingency, Inflation etc.)
SB5 – Blue Route (Dual Carriageway) Including Link 1 68,463m2	£ 46,318,936
LB3 – Orange Route (Single Carriageway) 69,006m2	£ 55,683,518
LB3 – Orange Route (Dual Carriageway) 116,538m2	£ 92,404,852

5. Traffic Assessment (Journey Times, Accident Benefits and CO2 Benefits)

A traffic and economic assessment has been undertaken for the A12 between Wickham Market and the A1094. Carbon emissions have also been estimated as part of this assessment.

Following a traffic assessment the predicted volumes of A12 traffic, for the design year of 2031, using the proposed design scheme will be 20,992 vehicles per day. This figure is an increase of 35% in comparison to today's usage, excluding construction traffic from Sizewell C.

Table 3, shown below, provides a breakdown of the travel time savings for each of the scheme options, including single and dual carriageway alternatives. These have been calculated for each of the three model years and are the average time savings allowing for differing travel times between different hours of the day and days of the year. For the shorter single carriageway bypasses the time savings are about 0.5 minutes in 2031 whereas for the longer dual carriageway sections the time savings are slightly under 2 minutes. For the single carriageway options time savings are about 25% of existing route travel times which increases to around 40% for the dual carriageway options. As it can be seen, route LB3 is the most beneficial in reducing travelling times throughout the forecasted years, in comparison to all other proposed routes.

Table 3: Average Travel Time Savings per Vehicle (Minutes)

	2020		2024		2031	
Option	**Single**	**Dual**	**Single**	**Dual**	**Single**	**Dual**
SB1(whole Scheme)	0.42	n/a	0.45	n/a	0.49	n/a
SB1 A12 North	0.27	n/a	0.29	n/a	0.31	n/a
SB1 A12 South	n/a	n/a	0.16	n/a	0.17	n/a
SB2	0.59	1.11	0.61	1.16	0.65	1.21
SB4	0.83	1.43	0.86	1.49	0.90	1.56
SB5	0.56	0.99	0.59	1.04	0.63	1.09
LB3	0.81	1.66	0.85	1.75	0.91	1.84

An accident data analysis was conducted by AECOM to give an indication of the effect of the proposed routes on predicted accidents. Looking at single carriageway options, the SB2 (Green Route) and the SB5 (Blue Route) have a slightly better accident rate than

SB1 (Pink Route). SB4 (Red Route) has a relatively good accident rate and journey time saving make it worthy of consideration should further testing be required.

The results from the accident cost and benefits assessment for the single carriageway options have been summarised in Table 4, shown below;

Table 4: A12 Accident costs and benefits (Single carriageway options)

	SB1	SB1 (A12 North)	SB1 (A12 South)	SB2	SB4	SB5	LB3
Benefit Summary (£000s)							
Total Without-Scheme Accident Costs	17,946	9,894	7,678	20,550	22,363	24,641	33,660
Total With-Scheme Accident Costs	11,407	6,041	5,164	13,149	12,928	16,811	22,633
Total Accident Benefits Saved by Scheme	**6,539**	**3,852**	**2,514**	**7,401**	**9,435**	**7,830**	**11,028**
Accident Summary							
Total Without-Scheme Accidents	208.9	115.1	93.5	239.2	260.3	286.8	391.8
Total With-Scheme Accidents	132.8	70.3	62.9	153.0	150.5	195.7	263.4
Total Accidents Saved by Scheme	**76.1**	**44.8**	**30.6**	**86.1**	**109.8**	**91.1**	**128.3**
Casualty Summary							
Total Without-Scheme Casualties (Fatal)	8.1	4.4	3.6	9.2	10.1	11.1	15.1
(Serious)	46.3	25.5	20.7	53.0	57.7	63.6	86.8

(Slight)	282.3	155.7	126.3	323.3	351.8	387.7	529.6
Total With-Scheme Casualties (Fatal)	5.1	2.7	2.4	5.9	5.8	7.6	10.2
(Serious)	29.4	15.6	13.9	33.9	33.4	43.4	58.4
(Slight)	179.5	95.1	85.0	206.9	203.4	264.5	356.1
Total Casualties Saved by Scheme (Fatal)	**2.9**	**1.7**	**1.2**	**3.3**	**4.2**	**3.5**	**5.0**
(Serious)	**16.9**	**9.9**	**6.8**	**19.1**	**24.3**	**20.2**	**28.4**
(Slight)	**102.9**	**60.6**	**41.4**	**116.4**	**148.4**	**123.2**	**173.5**

Carbon emission data has been determined using the TUBA economic assessment software. Traded and untraded emissions data are available on a yearly basis in terms of tonnes and monetary costs. The monetary costs and benefits generally indicate a cost in terms of additional greenhouse gases with two options, SB4 (Red Route) single carriageway and SB1 North (Pink Route) showing a reduction in greenhouse gas emissions due to their shorter lengths compared to the existing A12.

6. Environmental Assessment

6.1. Air Quality

All the proposed road scheme options are predicted to lead to an overall improvement in air quality as the assessment scores are negative (excluding and including traffic from Sizewell C). The largest change in air quality is predicted to be an improvement in both Nitrogen Dioxide NO_2 and Particulate Matter PM_{10} concentrations of large magnitude as a result of the proposed SB1 (Pink Route), SB2 (Green Route), and SB5 (Blue Route) schemes.

SB1 (Pink Route), SB2 (Green Route), and SB5 (Blue Route) schemes are likely to remove exceedences on the A12 between Stratford St Andrew and Farnham. All the proposed bypass scheme options, except SB4 single carriageway, are predicted to result in an increase in Nitrogen Dioxide and Nitric Oxides, collectively known as NO_x and carbon emissions in 2035 relative to no scheme implementation in the same year. The positive Total Net Present Value for all the bypass options indicates a net beneficial impact (i.e. air quality improvement) over the lifetime of the schemes. Table 5 below, summarises the overall air quality findings.

Table 5: Overall Evaluation of Local Air Quality Significance

Key Criteria Questions	Yes / No				
	SB1 – Pink Route	**SB2 – Green Route**	**SB4 – Red Route**	**SB5 – Blue Route**	**LB3 – Orange Route**
Is there a risk that environmental standards will be breached?	No	No	No	No	No
Will there be a large change in environmental conditions?	Yes	Yes	Yes	Yes	Yes
Will the effect continue for a long time?	N/A	N/A	N/A	N/A	N/A
Will many people be affected?	No	No	No	No	No
Is there a risk that designated sites, areas, or features will be affected?	No	No	No	No	No

Key Criteria Questions	Yes / No				
	SB1 – Pink Route	SB2 – Green Route	SB4 – Red Route	SB5 – Blue Route	LB3 – Orange Route
Will it be difficult to avoid, or reduce or repair or compensate for the effect?	N/A	N/A	N/A	N/A	N/A

6.2. Noise

A Stage 1 noise assessment by following the principles of the DMRB assessment methodology has been carried out in order to establish whether the assessment should proceed to either the Simple or Detailed Assessment by considering the increases in noise levels at NSRs associated with the proposed scheme options.

At this stage only noise impacts relating to the operational use of the proposed development is considered. Temporary impacts relating to the construction of the proposed scheme will be dealt with at the later stages of the assessment. Table 6, summarises the noise assessment findings as seen below.

Table 6: Noise Assessment Summary

Route	Qualitative Impacts	Assessment	Potential Mitigation	Residual Effects With Mitigation
SB1	This scheme will increase noise levels at NSRs in Farnham and Stratford St Andrew in both short and long term	Significant	Low Noise Surfacing; Acoustic barrier	Insignificant
SB2	The proposed scheme is located to the north of the A12 in Stratford St Andrew/Farnham	Significant	Low Noise Surfacing; Acoustic barrier	Insignificant

Route	Qualitative Impacts	Assessment	Potential Mitigation	Residual Effects With Mitigation
SB4	This scheme is proposed to be located in the north to the A12 between Marlesford and Little Glemham. This scheme will increase noise levels at NSRs in Marlesford and Little Glemham.	Significant	Low Noise Surfacing; Acoustic barrier	Insignificant
SB5	This scheme is proposed to be located to the south of Farnham village and will increase noise levels at NSRs in the south of Farnham.	Significant	Low Noise Surfacing; Acoustic barrier	Insignificant
LB3	This scheme is proposed between south of Marlesford and north of Little Glemham and will increase noise levels at nearby NSRs. This scheme with Single carriageway option is considered to be the most beneficial option among the proposed options.	Significant	Low Noise Surfacing; Acoustic barrier	Insignificant

6.3. Biodiversity

The area surrounding the route options is dominated by the River Ore floodplain to the west surrounding route options LB3 (Orange Route) and SB4 (Red Route) and the River Alde floodplain to the east through which SB1 (Pink Route), SB2 (Green Route) and SB5 (Blue Route) pass.

The Biodiversity study carried out by AECOM set out to assess and evaluate the potential effects of the proposed route options. By identifying a study area, notable habitats and species could be identified as being adversely effected by a particular route. This study area could then identify which route would be the least damaging to the natural environment capital within the area. There were several survey limitations when the ecological walkover scoping survey was conducted by AECOM with full detail represented in the report. These included that the survey was only carried out on publically accessible land. Another limitation that should be highlighted is that dedicated species surveys have not been carried out in this assessment, this would be carried out in subsequent protected species survey.

For all the proposed routes Slight Adverse effects would be caused due to hydrologically linked drainage systems to internationally designated sites. This is deemed to only have a Slight Adverse effect because of the various sites relatively large distance from the proposed routes. Due to the bisecting of the largely arable land to construct the different routes, habitat fragmentation will occur in close proximity to the road. In many of the cases the road bisects multiple tributaries which support a number of species and groups including water voles, otters and Great Crested Newts (GCN). Valued fauna is also likely to be effected. The proposed routes also cut through hedgerows and field margins which support species rich flora and nesting habitats for birds and foraging communities. Mitigation measures are especially crucial for SB2 (Green Route) where at least six hedgerows will be directly affected by the route. The other routes also bisect hedgerows to a lesser degree. The agricultural landscape of the proposed bypass is dotted with small pockets of plantation woodlands and two CWS woodlands that are also classed as Ancient; Great Wood and Foxburrow Wood. LB3 (Orange Route) and SB4 (Red Route) are adjacent to Great Wood with direct impact on the woodland classed as Moderately Adverse prior to mitigation. SB5 (Blue Route) runs adjacent to Foxburrow Wood, located approximately 10m from the working corridor of the route.

Many of the routes go through woodland that has non-native invasive species. The construction of the new road could lead to enhancement of these areas with specific woodland management. Similarly, the watercourses present along the proposed routes offer poor passage for fish and other species. By extending existing culverts, a sympathetic design to reduce fragmentation could be introduced.

A table summarising the environmental effects of the proposed routes and proposed mitigation measures can be seen in Table 7. It can be seen from the table, that SB4 (Red Route) has the least adverse effect on the environment with the environmental assessment deeming only Slight Adverse impact on the study area. All the routes will lead to fragmentation of habitats, with mitigation measures detailed to reduce the impact. The least favourable route option is SB5 (Blue Route) which may lead to the risk of directly impacting the Ancient Woodland of Foxburrow Wood. This can lead to irreparable damage if mitigation measures are not correctly adhered too.

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Table 7: Biodiversity Summary (continues overleaf)

Route	Summary Assessment Score	Comments	Mitigation	Residual Effects with Mitigation
SB4 (Red Route)	Slight Adverse	Presence of GCN to be considered. Possible loss of habitats and fragmentation of woodland. Proximity of ponds to construction works, Protected fungus in RNR.	Translocation of the turfs, ensuring that the mycorrhizal sections are translocated where affected. Design of alignment of road to avoid habitat loss. Screening from the road via habitat replacement. Construction mitigation to prevent run off into connected drainage ditches and rivers. Consideration for bridge crossings to minimise habitat loss and fragmentation. Culvert designs to be suitable for safe passage for otter, watervole and bats. Pre-construction surveys of the chosen route would be required, revealing the connections between GCN meta populations and enable the design of suitable underpasses and replacement breeding and terrestrial habitat.	Slight Adverse
LB3 (Orange Route)	Slight to Moderate Adverse	Effects on a number of species and groups including GCN and watervole, Fragmentation of habitats and bisecting of small tributaries along route.	Construction mitigation to prevent run off into connected drainage ditches and rivers. Habitat loss could be avoided if dualling was weighted towards the southern side of the existing road. Consideration for bridge crossings to minimise habitat loss and fragmentation. Culvert designs to be suitable for safe passage for otter, watervole and bats. Pre-construction surveys and a Natural England Conservation Licence would be required.	Slight Adverse

Route	Summary Assessment Score	Comments	Mitigation	Residual Effects with Mitigation
SB1 (Pink Route)	Moderate Adverse	Potential to affect many species at the River Alde and its associated flood plain. Loss of habitat at Butchers Hole and Benhall Lodge Park Woodland.	Construction mitigation to prevent run off into connected drainage ditches and rivers. Habitat loss could be avoided if dualling was weighted towards the southern side of the existing road. Consideration for bridge crossings to minimise habitat loss and fragmentation. Culvert designs to be suitable for safe passage for otter, watervole and bats. Pre-construction surveys and a Natural England Conservation Licence would be required.	Slight Adverse
SB2 (Green Route)	Moderate Adverse	Potential to effect many species at the River Alde and downstream. Possible fragmentation of ponds, hedgerows and woodland. Loss of habitat at Butchers Hole and Benhall Lodge Park Woodland.	Construction mitigation to prevent run off into connected drainage ditches and rivers. Habitat loss could be avoided if dualling was weighted towards the southern side of the existing road. Consideration for bridge crossings to minimise habitat loss and fragmentation. Culvert designs to be suitable for safe passage for otter, watervole and bats. Pre-construction surveys and a Natural England Conservation Licence would be required.	Slight Adverse

Route	Summary Assessment Score	Comments	Mitigation	Residual Effects with Mitigation
SB5 (Blue Route)	Moderate to Large Adverse	Potential to affect GCN terrestrial habitat. Water vole may be moderately adversely affected due to closure of tributaries. Possible direct loss of Ancient Woodland.	Construction mitigation to prevent run off into connected drainage ditches and rivers. Consideration for bridge crossings to minimise habitat loss and fragmentation. Culvert designs to be suitable for safe passage for otter, watervole and bats. Pre-construction surveys of the chosen route would be required, revealing the connections between GCN meta populations and enable the design of suitable underpasses and replacement breeding and terrestrial habitat. Ancient woodland is not replaceable. Impacts upon this habitat, including indirect impacts should be avoided. Screening from the road via habitat replacement.	Large Adverse

6.4. Landscape

All of the proposed options have the potential to affect nationally and locally important designations, landscape character and visual amenity. SB1 (Pink Route) is considered to result in the largest residual effect on landscape character and visual amenity, due to the severance of the landscape pattern and proximity to Stratford St Andrew and Farnham. Route options LB3 (Orange Route), SB2 (Green Route) and SB5 (Blue Route) will all result in Moderate Adverse residual effects on the landscape and visual amenity due to the fragmentation of the landscape and loss of features. SB4 (Red Route) is considered to have the least effect on the landscape and visual amenity, with Slight Adverse residual effects due to the limited fragmentation of the landscape and limited loss of features. Landscape effects would be similar on these routes, varying from Moderate Adverse to Slight to Large Adverse on each. The results from the landscape assessment have been summarised in Table 8 shown below.

Table 8: Landscape and Visual Appraisal Summary

Route	Qualitative Impacts	Assessment	Mitigation	Residual Effects With Mitigation
LB3 (Orange Route)	Landscape Character	Large Adverse	Reinstatement of boundary planting, structure screen planting	Moderate Adverse
	Visual Amenity	Slight-Very Large Adverse		Slight- Large Adverse
SB1 (Pink Route)	Landscape Character	Large Adverse	As above	Large Adverse
	Visual Amenity	Slight- Large Adverse		Slight- Large Adverse
SB2 (Green Route)	Landscape Character	Large Adverse	As above	Moderate Adverse
	Visual Amenity	Moderate to Large Adverse		Moderate to Large Adverse
SB4 (Red Route)	Landscape Character	Moderate Adverse	As above	Slight Adverse
	Visual Amenity	Slight-Very Large Adverse		Slight-Large Adverse
SB5 (Blue Route)	Landscape Character	Moderate Adverse	As above	Moderate Adverse
	Visual Amenity	Slight- Large Adverse		Slight- Large Adverse

6.5. Heritage

The archaeological and cultural heritage assessment has collated baseline data within a study area of approximately 300 m from the proposed bypass, as required by guidance in DMRB. Data was collected from Suffolk Historic Environment Record, The English Heritage Archives Services and historic maps. Ninety-three archaeological sites were identified within the study area. The different route options will have various effects to heritage assets. Overall the effects on heritage assets would be slightly better for the SB1 (Pink Route) as the reduction of traffic in the conservation zone would outweigh any slight adverse effects. LB3 (Orange Route) will have the biggest impact on heritage assets with Glemham Park being directly affected by the construction route. The results of the heritage assessment is summarised in Table 9, shown below.

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Table 9: Heritage Assessment Summary

Route	Qualitative Impacts	Assessment	Mitigation	Residual Effects With Mitigation
LB3	Flint scatter (70). Part or complete loss of asset	Slight Adverse	Simple Assessment followed by additional evaluation if required.	Slight Adverse
	Glemham Park (33). Partial loss of asset and effects on the setting of the asset	Moderate Adverse	Topographic and photographic recording, use of screening	Slight Adverse
	Little Glemham. Reduction of traffic in the Conservation Area	Slight Beneficial	N/A	Slight Beneficial
SB1	Old field system (87). Part or complete loss of asset	Slight Adverse	Simple Assessment followed by additional evaluation if required.	Slight Adverse
	Pillbox (88). Effects on the setting of the asset	Slight Adverse	Photographic recording, use of screening	Slight Adverse
	Stratford St Andrew. Reduction of traffic in the Conservation Area	Slight Beneficial	N/A	Slight Beneficial
	Farnham. Reduction of traffic in the Conservation Area	Slight Beneficial	N/A	Slight Beneficial

Route	Qualitative Impacts	Assessment	Mitigation	Residual Effects With Mitigation
SB2	Pottery sherds (61). Part or complete loss of asset	Slight Adverse	Simple Assessment followed by additional evaluation if required.	Slight Adverse
	Stratford St Andrew. Reduction of traffic in the Conservation Area	Slight Beneficial	N/A	Slight Beneficial
SB4	Glemham Park (33). Partial loss of asset and effects on the setting of the asset	Moderate Adverse	Topographic and photographic recording, use of screening	Slight Adverse
	Marlesford Conservation Area (91). Reduction of traffic in the Conservation Area	Slight Beneficial	N/A	Slight Beneficial
SB5	Old field system (87). Part or complete loss of asset	Slight Adverse	Simple Assessment followed by additional evaluation if required.	Slight Adverse
	Flint scatter (66). Part or complete loss of asset	Slight Adverse	Simple Assessment followed by additional evaluation if required.	Slight Adverse
	Lithic scatter (67). Part or complete loss of asset	Slight Adverse	Simple Assessment followed by additional evaluation if required.	Slight Adverse
	Farnham. Reduction of traffic in the Conservation Area	Slight Beneficial	N/A	Slight Beneficial

6.6. Water Environment

Impacts associated with all routes are considered to be of low significance. The magnitude of impact of all scheme examined with mitigation in place will be either minor or negligible. A summary table can be found in Table 10 below.

It is difficult using this assessment methodology to distinguish clearly between options, especially since the application of mitigation can often be effective. However, the assessment has determined that both the Link 1 and Link 2 works are considered to have an insignificant impact on the surface water environment. Impacts associated with SB2, SB4 and SB5 are considered to be of low significance. From a surface water environment perspective, there is little to contrast SB2 and SB5, which are alternate sub-options and a decision between the two may ultimately be based on other considerations. SB4 is more than twice as long as any other sub-options, crosses more watercourses and lies within three WFD waterbodies. As such it may prove to be the most challenging to undertake from a surface water environment, with the greatest number of structures required to cross watercourses and the treatment of highway runoff requiring more assessment and separate Flood Defence Consents from the EA.

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Table 10 Water environment summary

	Potential impact	Pre-Mitigation		Post-Mitigation	
		Magnitude of Impact	Significance (Pre-Mitigation)	Magnitude of Impact	Significance (Post-Mitigation)
	Construction				
SB2	Silt-laden runoff	Minor	Up to Low Significance	Negligible	Insignificant
SB4			Up to Low Significance		Insignificant
SB5			Up to Low Significance		Insignificant
Link 1			Insignificant		Insignificant
Link 2			Insignificant		Insignificant
SB2	Chemical / fuel contamination and spillages or leaks	Moderate	Up to Significant	Negligible	Insignificant
SB4			Up to Significant		Insignificant
SB5			Up to Significant		Insignificant
Link 1			Up to Low Significance		Insignificant
Link 2			Insignificant		Insignificant
SB2	Localised erosion	Moderate	Up to Significant	Minor	Up to Low Significance
SB4			Up to Significant		Up to Low Significance
SB5			Up to Significant		Up to Low Significance
Link 1			Up to Low Significance		Insignificant
Link 2			n/a		n/a

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	Potential impact	Pre-Mitigation		Post-Mitigation	
		Magnitude of Impact	Significance (Pre-Mitigation)	Magnitude of Impact	Significance (Post-Mitigation)
SB2	Inappropriate disposal of waste	Negligible	Insignificant	Negligible	Insignificant
SB4			Insignificant		Insignificant
SB5			Insignificant		Insignificant
Link 1			Insignificant		Insignificant
Link 2			Insignificant		Insignificant
	Operation				
SB2	Water pollution from highway runoff	Negligible	Insignificant	Negligible	Insignificant
SB4			Insignificant		Insignificant
SB5			Insignificant		Insignificant
Link 1			Insignificant		Insignificant
Link 2			Insignificant		Insignificant
SB2	Spillage risk from polluting substances	Negligible	Insignificant	Negligible	Insignificant
SB4			Insignificant		Insignificant
SB5			Insignificant		Insignificant
Link 1			Insignificant		Insignificant
Link 2			Insignificant		Insignificant

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	Potential impact	Pre-Mitigation		Post-Mitigation	
		Magnitude of Impact	Significance (Pre-Mitigation)	Magnitude of Impact	Significance (Post-Mitigation)
SB2	Morphological effects	Minor	Up to Low Significance	Minor	Up to Low Significance
SB4			Up to Low Significance		Up to Low Significance
SB5			Up to Low Significance		Up to Low Significance
Link 1			Insignificant		Insignificant
Link 2			n/a		n/a
SB2	Loss of Ponds	Major	Low Significance	Negligible	Insignificant
SB4			Low Significance		Insignificant
SB5			Low Significance		Insignificant
Link 1			Low Significance		Insignificant
Link 2			Low Significance		Insignificant

7. Mitigation measures

It has been put forward by SCC that mitigation measures regarding the noise due to the proposed scheme developments is a significant issue. Following this raised concern; noise barrier preliminary estimates were conducted.

The proposed routes of the Four Villages bypass will affect the noise levels experienced at properties in the vicinity of the routes. The large quantity of vehicles on the routes will generate a continuous stream of noise from the engine and tyres of the vehicles. Adverse or beneficial effects on present noise levels are dependent on the proximity of the property location to the proposed route. AECOM are proposing to mitigate these effects by the construction of three metre high timber fencing, commonly known as noise or acoustic barriers. A preliminary estimate on where noise barriers may need to be constructed and the extent of the noise barriers is detailed below. The estimates have followed guidance set out by guidance from the DMRB titled: *'Environmental Barriers: Technical Requirements'.*

It is important to note that after 300m, the noise attenuation experienced with respect to the noise barrier is negligible in the rural location that the proposed routes are in. This is because soft ground such as countryside absorbs sound waves, attenuating the noise over a distance.

Table 11 below, details the estimate lengths of the noise barriers for the proposed routes. A three metre high timber fence has been assumed and further topography data would be required to progress the design further.

Table 11: Summary table of length of noise barriers

Route Option	No. of noise barriers
SB1(Pink Route)	**1No. x 400m**
SB1 (North) (Pink Route)	**0**
SB1 (South) (Pink Route)	**1No. x 400m**
SB2 (Green Route)	**2No. x 400m**
SB4 (Red Route)	**0**
SB5 (Blue Route)	**4No. x 400m**
LB3 (Orange Route)	**3No. x 400m**

8. Conclusion

From the foregoing tabulated and reported information there will need to be further work towards the assessment and design of a suitable improvement scheme in appropriate stages for the A12 Four Villages route. In order to address the most problematic part of the route, between Stratford St Andrew and Farnham three possible options have been identified, two of them examined for both dual carriageway and single carriageway scenarios.

On a cost basis, looking first at single carriageway options, SB1 (Pink Route) has clear advantages over the SB2 (Green Route) and SB5 (Blue Route). Time savings for the three routes are similar although accident savings are slightly better for the latter two. Additional greenhouse gases would be similar for all three. Noise would be reduced to acceptable levels by suitable mitigation on all three schemes between Stratford St Andrew and Farnham. It can be seen that with the exception of the split SB1 North section and SB4 (Red Route) there is a need for the installation of noise barriers to protect properties affected by the proposed routes. This would need developing at the preferred route stage of the project. For Air Quality it is predicted that no environmental standards would be breached and that few people would be affected by the changes for any of the routes.

Landscape effects would be similar on these routes, varying from Moderate Adverse to Slight to Large Adverse on each. Regarding biodiversity, from the ecological walkover scoping survey, an assessment of the proposed routes has been carried out. SB4 (Red Route) has the least adverse effect on the environment with the environmental assessment deeming only Slight Adverse impact on the study area. All the routes will lead to fragmentation of habitats, with mitigation measures detailed to reduce the impact. The least favourable route option is SB5 (Blue Route) which may lead to the risk of directly impacting the Ancient Woodland of Foxburrow Wood. This could lead to irreparable damage if mitigation measures are not correctly adhered too. Heritage effects would be slightly better for SB1 (Pink Route) as the reduction of traffic in the conservation zone would outweigh any slight adverse effects.

Much work has been done in this report on the design of the individual schemes. This has helped to provide reliable and detailed scheme estimates. For the dual carriageway versions of the Green and Blue routes there is a marked difference in costs compared with the single carriageway schemes. Although journey times would be significantly reduced with the dual carriageway versions there would need to be further assessment to establish cost/benefit ratios over a specified period in order to make a firm decision.

Turning to the other two schemes, LB3 (Orange Route) and SB4 (Red Route) the latter has some clear advantages. The relatively low cost of the single carriageway version of SB4 together with its relatively good accident rate and journey time saving make it worthy of consideration should further testing be required. However SB4 would only provide a

bypass of Little Glemham. Whilst providing good bypass facilities of both Marlesford and Little Glemham and the best accident rate and journey time savings of all the routes, LB3 (Orange Route) would be significantly more costly to construct than SB4 (Red Route). Again there would need to be further assessment to establish cost/benefit ratios over a specified period in order to make a firm decision, should these two routes be developed further.

It is therefore suggested that for the selected schemes cost/benefit ratio analysis be undertaken alongside design refinement including mitigation measures, accurate costing analysis and traffic forecast and a detailed environmental assessment. Once a preferred route has been decided, it is proposed that the following further investigations need to take place. The results of these may change the design and construction period specified in section 3.

- Liaison with Environment Agency;
- Further Investigation with Statutory Undertakers to C3 stage;
- A cost benefit analysis of the chosen route and
- Scheme delivery through Detailed Design and Construction stages.