

A428 Constraints Report

South Cambridgeshire District Council

10 March 2016

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Executive summary

The A428 corridor is one of the key radial routes into Cambridge with high levels of current and planned housing growth. Parts of the route currently suffer from congestion, poor journey times and journey time reliability during peak hours. The Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) and the Cambridge and South Cambridgeshire Submitted Local Plans identify a series of transport proposals to provide for increased travel demand over the period to 2031 including that arising from future development. On the A428 corridor, the TSCSC includes proposals for a congestion free public transport corridor into the city. These measures are reflected in the Cambridgeshire Local Transport Plan and the Long Term Transport Strategy, adopted by the County Council in November 2014. These plans were supported by a Strategic Environmental Assessment which considered the impact of the schemes.

As part of the Local Plan Examination process, the Inspectors have written to advise the Councils that they have identified some issues they consider need to be addressed at an early stage. Therefore South Cambridgeshire District Council have engaged Atkins to produce a report that investigates these issues, assesses the deliverability of the major transport infrastructure options related to growth, and adds to existing evidence to further demonstrate that these issues can be appropriately addressed.

The major transport infrastructure options for the A428 are divided into two areas: the Eastern section, extending from the A428/A1303 junction at Madingley Mulch roundabout to Cambridge city centre and the Western section, which covers the area west of Madingley Mulch to Cambourne. The report includes an analysis of the possible constraints for options for each section, drawing on the options developed in the Madingley Road / A428 Cambourne to Cambridge Corridor Study Draft Interim Report (2015) for this corridor. These have been assessed for the extent of the constraint over each option and the impact it may have on the delivery of that option. The possible constraints that have been considered are as follows:

- Green Belt
- Agricultural Land
- Heritage/ Archaeological considerations
- Environmental and ecological designations and considerations
- Physical considerations (e.g. contamination, land stability)
- Townscape and landscape impact
- Amenity Considerations (e.g. noise, lighting)
- Impact on footpaths and bridleways
- Utility/services
- Flooding and drainage measures
- Other planning policies

Transport infrastructure options - Key findings

- Due to land take and habitat loss the combined effects of the proposed routes is likely to impact moderately adversely on ecology, archaeology and landscape in the opening year, reducing to minor adverse in later years. There are a variety of mitigation measures that can be employed to support the delivery of indicative transport routes. These include careful route alignment, sensitive engineering, and detailed landscaping.
- The impacts on the water environment and flood risk are likely to be minor adverse or negligible due to the sustainable drainage mitigation that could be incorporated into the design.
- The cumulative effects on noise and lighting are likely to be “minor adverse/negligible”.

The analysis contained in this report identifies a series of environmental and engineering constraints associated with each of the six options emerging from the Greater Cambridge City Deal study. The impact of these constraints ranges in severity and extent, and mitigation measures have been identified that will, in most cases, address these impacts. This report identifies the negative impacts of the transport options but these should not be considered in isolation and need to be considered alongside the very considerable positive impact of the proposed options.

Generally these constraints lie within expectations of those typically encountered in transport projects of this nature and at this stage of development. Further investigation during scheme development would assist with determining the precise extent of some of the constraints identified and impact of route options which would then inform the selection of preferred route, its detailed alignment, detailed design and any mitigation which may be required. At this point there appear to be no substantial issues or constraints which would prevent delivery of the proposed City Deal scheme.

1. Introduction

1.1. Purpose of this report

The Cambridge and South Cambridgeshire Transport Strategy (TSCSC), and the submitted South Cambridgeshire Local Plan identify the infrastructure necessary to support sustainable new settlements along the A428 corridor. The Local Plan allocates a new village at Bourn Airfield of 3,500 homes and an extension to the West of Cambourne for 1,200 homes. South Cambridgeshire District Council has also received a planning application for a larger development West of Cambourne for 2,350 homes. As part of the Local Plan Examination process, the Inspectors identified some questions in relation to the deliverability of the necessary transport infrastructure for the A428, which also extends into Cambridge City Council's area.

To provide confidence that an acceptable scheme will be capable of being delivered, this study has been commissioned to explore the current constraints and the associated mitigation measures which may need to be adopted.

This report aims to provide further information in relation to the route options being explored through the Greater Cambridge City Deal to deliver the transport infrastructure identified as necessary to support major development in the A428 corridor, to assist the Local Plan process. The report is informed by work previously produced to support the Madingley Road / A428 Cambourne to Cambridge Corridor improvements being considered by the Greater Cambridge City Deal, including:

- Madingley Road / A428 Cambourne to Cambridge Corridor Study Draft Interim Report (Atkins on behalf of the City Deal Partnership)
- Cambridgeshire Local Transport Plan 3 Refresh Strategic Environmental Assessment Final Environmental Report

1.2. Report structure

The report is structured as follows:

- Introduction: containing background on the report aims.
- Methodology
- Findings
- Conclusion
- Appendices
 - Constraints Analysis
 - Planning Matrix
 - Constraints Maps

1.3. A428 City Deal Study

This A428 Constraints Report has been commissioned independently from the City Deal A428 Cambourne to Cambridge Better Bus journeys project, but draws on information from that project used for the initial assessment of the proposed transport interventions. A brief overview of the A428 Cambourne to Cambridge project is provided in this section as background.

The A428 Cambourne to Cambridge Better Bus journeys project, commissioned by the City Deal Partners, is one of the schemes prioritised in Tranche 1 to be developed during the first five years of the City Deal. This programme was selected from the adopted Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) which identifies a series of transport proposals to provide for increased travel demand over the period to 2031, including that arising from future development identified in the Submitted Local Plans.

The A428 project aims to provide high quality public transport infrastructure along the A428 corridor in the west of Cambridge, addressing current congestion and supporting planned growth and economic development within the Greater Cambridge area. This contributes towards the Greater Cambridge City

Deal's priorities by supporting the operation of fast, frequent and reliable bus services from settlements and areas of development west of Cambridge to the major employment locations within Cambridge and its western approaches.

Initial work on the project identified a number of potential options that had the ability to achieve the objectives of the scheme. These options were assessed using a framework consistent with the DfT's 'five cases' model. The DfT's model has been developed to appraise transport business cases on the basis of HM Treasury's Green Book appraisal. The six best-performing options identified were subject to public consultation in late 2015.

The options can be divided into two areas: the Eastern section, extending from the A428/A1303 junction at Madingley Mulch roundabout to Cambridge city centre and the Western section, which covers the area west of Madingley Mulch to Cambourne. The options were presented in this format as the City Deal funding timescales indicated funding for the Eastern section was included in the first tranche of investment (up to 2020), while options in the Western section would be included in tranches 2/3 (up to 2030).

Options for the eastern section of the corridor (tranche 1) comprise:

- 1A – Online eastbound bus lanes from the A1303 / A428 junction along Madingley Rise and Madingley Road to Lady Margaret Road;
- 1B – A new offline dedicated bus route running north-east from the A1303 / A428 junction, connecting to Madingley Road just west of the M11. A further eastbound bus lane on Madingley Road would be provided to Lady Margaret Road; and
- 1C – A new offline dedicated bus route running north of Coton and parallel to Madingley Road and Madingley Rise to Grange Road, with a connection to the West Cambridge University site.

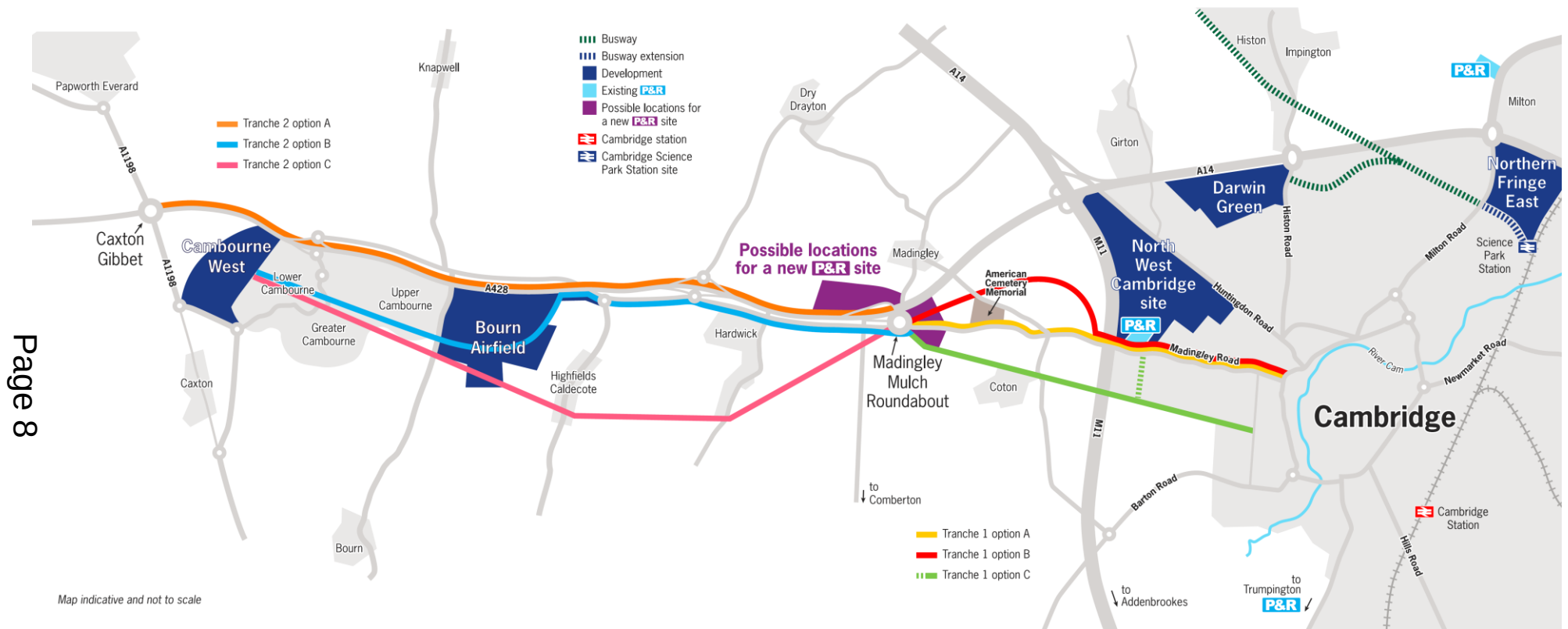
Options for the western section of the corridor (tranche 2) comprise:

- 2A – Improvement to bus services, which will run along the existing roads with no infrastructure improvements to the A1303 / A428 junction;
- 2B – A new route linking Cambourne and Bourn Airfield, before services running along St Neots Road with bus priority measures in place to the A1303 / A428 junction; and
- 2C – A new offline dedicated bus route connecting Cambourne and Bourn Airfield before running south of Hardwick to Madingley Mulch roundabout.

Figure 1-1 shows these options as they were presented during the consultation.

Consultation outcomes will be presented to the City Deal Executive Board's meeting on the 3rd of March 2016. The next steps of the process will be to continue to develop options and feasibility, identifying constraints and investment requirements. The results of this assessment appraisal will be presented in the form of an outline business case report to the City Deal Partnership in September to allow the Board to select a recommended option or options for further development. This process is consistent with Stage 2 of the Department of Transport's method for appraising transport projects and proposals.

Figure 1-1 Proposed A428 Options



2. Methodology

2.1. Study area

This report aims to examine and assess possible constraints present in the A428 corridor which may impact the delivery of one or more of the transport schemes being currently explored as part of the City Deal proposals. The constraints mapping was carried out over a wide area, depicted in Figure 2-1 although the assessment and analysis were limited to the corridors surrounding the indicative routes being considered as part of the City Deal scheme, as identified in the Madingley Road / A428 Cambourne to Cambridge Corridor Study Draft Interim Report.

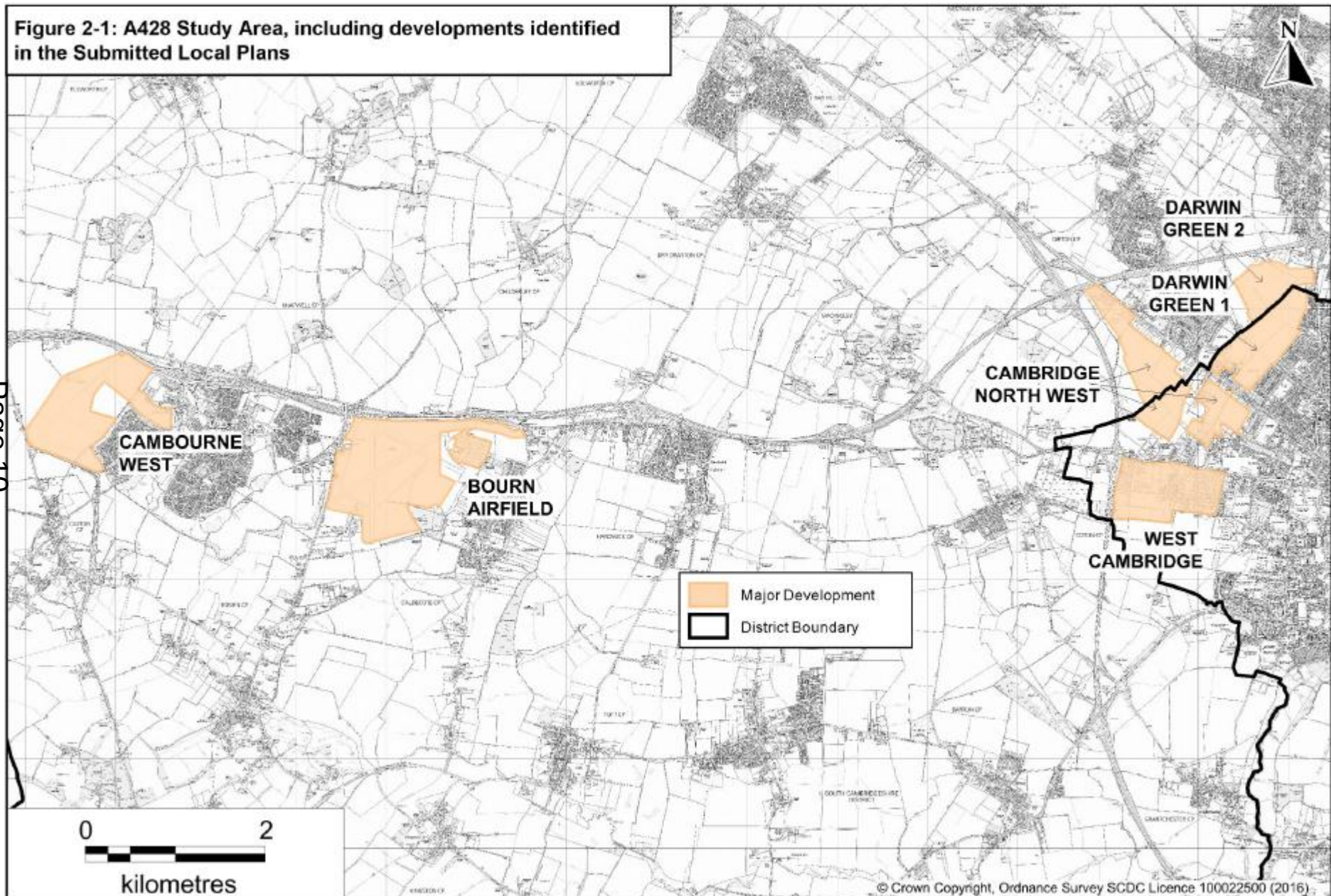
2.2. Constraints mapping

The first step in the study methodology involved preparing a series of constraint maps of the study area, which were then assessed against each of the indicative alignments identified in the Madingley Road / A428 Cambourne to Cambridge Corridor Study Draft Interim Report.

Constraint maps are included in Appendix C and are grouped according to the following:

- Land classification: containing details of urban, non-agricultural land and agricultural land by grade
- Environmental constraints: containing details of existing tree protection orders, County Parks, County Wildlife Sites, Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), Local Nature Reserves (LNR), Ancient Woodland and Green Belt.
- Water and flooding: containing details of rivers (water framework directive), and flood zones 2 & 3.
- Heritage constraints: containing details of listed buildings (grade I, II, II*), conservation areas, scheduled monuments and registered parks and gardens.
- Amenity: showing the extents of noise action planning areas and air quality management areas.
- Open space constraints: containing details of local green spaces, protected village amenity areas (PVAA), protected open spaces and the national cycle network.

Figure 2-1: A428 Study Area, including developments identified in the Submitted Local Plans



2.3. Impact assessment

To aid the in the assessment of how the constraints could impact on the proposed options, the indicative route alignments from the City Deal study have been examined in conjunction with the constraints maps. Since alignments are illustrative only, a wide corridor around the proposed routes has been considered for all offline options.

Appendix A contains full details of this assessment. Each of the proposed options has been assessed and categorised in terms of extent and impact on scheme delivery prior to application of any mitigation measures, which have also been identified. This categorisation has been undertaken based on the understanding of the route options and professional judgement.

Potential constraints have been identified and described, and where relevant, the mitigation measures that are available to address these have also been listed.

The analysis is intended to provide a proportionate evidence base for the local plan process to assess whether any substantial constraints may prevent an acceptable option of being identified and delivered. Specific route alignments beyond those presented at consultation have not been considered; this will be a separate task for the City Deal process as the scheme is developed in detail.

The findings of this assessment and study conclusions are summarised in the following sections.

3. Findings

This chapter of the report summarises the findings of the constraints assessment for each of the indicative alignments from the City Deal study.

Each route option has been appraised in detail against identified constraints, and the full results of this appraisal are provided in Constraints Analysis in Appendix A of this report. Each of the sections below provides a summary of these findings.

All distances have been reported to the nearest 0.5km, as the exact route alignments are not yet known.

Option 1A

Online eastbound bus lanes from the A1303 / A428 junction along Madingley Rise and Madingley Road to Lady Margaret Road.

This indicative alignment follows the existing A1303 corridor. The section of the A1303 stretching between the exit from the new Park and Ride to the eastern edge of the M11 lies within the Green Belt. Taking this option forward would require limited widening works within the Green Belt. It is unlikely to be considered inappropriate development because the road is already established within the Green Belt and widening works are unlikely to impact on the openness of the Green Belt or conflict with the purposes of including land in the Green Belt.

Although online, this indicative alignment could result in the limited loss of some grade 2 and 3 agricultural land which may require the restoration of farm facilities such as gateways, drains and fencing.

In terms of impact on heritage this indicative alignment could potentially have an effect on setting of nearby listed buildings, particularly the American Cemetery which includes Grade II* listed buildings and structures. It is also a Grade 1 Registered Park and Garden of Historic Interest. The existing road passes to the south of the American Cemetery and the impact of any road widening on these heritage assets would need to be considered and any impacts minimised through design and alignment. There are also buildings located on the south side of the road opposite the American Cemetery and potential to for road widening and associated mitigation on these buildings would also need to be addressed in the development of the alignment and the detailed design of the scheme.

The effect of the route on buried archaeology is not known at this stage, but given previous investigations in parts of the study area there is a high potential for archaeological remains to be encountered, as indeed is to be expected in respect of any scheme in this area. Additional detailed archaeological investigation would be required as part of further assessment. Mitigation measures for buried archaeology (if present) would depend on type of material present, but impacts are expected to be able to be mitigated.

As this option would require some widening of the A428 to accommodate an online bus lane, this in turn could impact upon Madingley Wood SSSI if widened to the north, although there is not expected to be any requirement to encroach into the SSSI. There are other possible impacts on road verge habitats. To address these concerns extended habitat surveys to identify protected or notable species and habitats will likely be required. Careful route alignment and scheme design will be necessary to minimise and mitigate any impacts, for example widening to the south onto largely agricultural land.

With regard to the ground conditions for this route it is likely that changeable ground conditions may require a variable and considered approach to any new construction. Additionally, it is possible that historical

industry may exist which could pose a constraint on the route option selection. Therefore a full ground investigation would be required along the length of the preferred option to identify any risks posed by the underlying formations.

There could be an impact on mature trees along the A1303 between Clerk Maxwell Road and Northampton Street. Whilst it is not possible to fully mitigate against the loss of vegetation, sensitive routing, engineering and landscape design such as hard & soft landscaping measures, such as replacement planting, will minimise the impact.

The road widening and increased traffic flow from this option will cause noise increases adjacent to the bus route. The affected areas include isolated dwellings between the Park and Ride facility and the M11 Bridge, and buildings adjacent to the Madingley Road. The magnitude of the noise impact is dependent on the frequency of the bus services using the proposed bus route and how close the widened sections will bring the realigned road to existing buildings. To minimise this impact various mitigation measures could be used as appropriate to the location to reduce additional vehicular noise from the buses, including the use of 'low noise' road materials and design measures at appropriate locations.

A route on this indicative alignment has the potential to cause impact on air quality at sensitive receptors if these are located within 200m of the proposed scheme. During construction, there is potential impact on sensitive receptors up to a distance of 350m as a result of dust soiling, depending on the specific alignment, although mitigation of dust emissions would be possible.

At this stage it is not possible to accurately determine the impact on utility services but it is expected that they will be present for all options and mitigation measures will be necessary once the extent is known.

There are no watercourses crossed by this option and the route is not within flood zone 2 or 3. Online widening of the existing highway and construction of the Park & Ride will result in additional impermeable area, with the potential for surface water pollutant runoff. Therefore mitigation measures such as Sustainable Drainage Systems (SuDS) should be incorporated into the design of the Park & Ride site and widening. To avoid potential significant effects, works should not encroach within 8m of a water feature. If this cannot be avoided then a permit will be required and the potential effects will need to be assessed and mitigation may be required.

Option 1B

A new offline dedicated bus route running north-east from the A1303 / A428 junction, connecting to Madingley Road just west of the M11. A further eastbound bus lane on Madingley Road would be provided to Lady Margaret Road;

The western part of this indicative route from Madingley Mulch roundabout to the M11 interchange is offline and within the Green Belt. The route re-joins the existing Madingley Road at the M11 junction and is online eastwards towards Cambridge. Whilst inappropriate development in Green Belt is generally restricted, development of local transport infrastructure can be considered as appropriate development. This would be the case where a requirement for Green Belt location can be demonstrated, it preserves the openness of the Green Belt and it does not conflict with the purpose of including land in Green Belt. The proposed option would have to undergo these tests to determine whether it constitutes appropriate development, and if not whether there are very special circumstances justifying the development. In either case, impact on the Green Belt would need to be minimised through detailed alignment and design. Landscaping should be used to minimise impact on openness.

West of the M11 the route is mainly Grade 3a agricultural land. Depending on alignment a route could also cause severance of arable fields. Therefore mitigation would involve providing alternative access to severed fields, restoring farm infrastructure and sensitive engineering design.

A direct physical impact on heritage assets is unlikely, although a route to the north may impact on the setting of listed buildings at the American Cemetery and Moor Barns Farm. Setting studies to determine the impact to listed properties and the Registered Historic Park and Garden are recommended as part of further assessment. With careful route alignment and mitigation measures potentially including screen planting to the south of the route and sensitive engineering design the impact on the Cemetery could be limited.

The effect of the route on buried archaeology is not known at this stage, but given previous investigations in parts of the study area there is a high potential for archaeological remains to be encountered, as indeed is to be expected in respect of any scheme in this general area. Additional detailed archaeological investigation would be required as part of further assessment. Mitigation measures for buried archaeology (if present) would depend on type of material present, but impacts are expected to be able to be mitigated.

Direct impact on Madingley Wood SSSI could be avoided by sensitive routing and design. A busway could cause adverse effects in terms of noise and light as it is adjacent to the western end of the offline section of this route. To address these concerns extended habitat surveys, to identify protected or notable species and habitats, will be required along with the appropriate mitigation measures to minimise impacts on this ancient woodland.

The indicative alignment passes thorough the 800 Wood, which comprises an area to the north of the SSSI, planted in 2008 by Cambridge University to commemorate its 800th anniversary. The indicative alignment also passes through countryside to the north of Madingley American Cemetery. Direct impact on the 800 Wood and visual impact on the wider landscape would need to be considered through mitigation including sensitive routing, engineering and landscape design such as hard & soft landscaping measures. Mitigation would also need to consider the impact on those properties along the existing A1303 into Cambridge.

The land required for this indicative alignment will include arable farmland, and the widening of the A428 east of the M11 may also affect road verge habitats. Mitigation would be in the form of extended habitat surveys to identify whether there is potential for protected or notable species and habitats to be present and if so mitigation would need to be incorporated as appropriate.

The widened section of the A1303 Madingley Road has the potential to increase noise levels at adjacent buildings. The magnitude of the noise impact will be dependent upon the frequency of the bus services using the proposed route and how close the widened sections will bring the realigned road to existing buildings. During the construction phase dust could also impact on air quality at sensitive receptors located within 200m of the proposed P&R site, offline busway and A1303 east of the M11 Bridge. Mitigation of dust arising from construction would be possible, and would depend on the exact nature of the construction activities. Noise increases can be mitigated through the use of design measures where appropriate, and the use of 'low noise' road materials could further reduce vehicular noise from the buses.

Only one footpath is crossed by the route but this is unlikely to cause severance effect due to low traffic volumes.

At this stage it is not possible to accurately determine the impact on utility services but it is expected that they will be present for all options and mitigation measures will be necessary once the extent is known.

The proposed alignment of this route would cross up to five watercourses, the status of these watercourses is unknown at the time of reporting, however this route is not within flood zone 2 or 3. The additional offline bus route, online widening of the existing highway, and construction of the Park & Ride will result in additional impermeable area, with the potential to cause surface water pollutant runoff. Therefore mitigation measures such as Sustainable Drainage Systems (SuDS) should be incorporated into the design of the Park & Ride site and highway works.

Option 1C

A new offline dedicated bus route running north of Coton and parallel to Madingley Road and Madingley Rise to Grange Road, with a connection to the West Cambridge University site.

This indicative alignment is located entirely within the Green Belt. This route would therefore require substantially more development within the Green Belt than options 1A and 1B. This area of Green Belt contains key views of a number of Cambridge's distinctive landmarks and is the closest area of countryside to the city's historic core. This area of land plays a key role in the setting of the west of Cambridge¹. If this indicative alignment is chosen, mitigation of impacts would need to be maximised through detailed alignment having regard to existing and committed development, and measures such as sensitive engineering design and landscaping.

Whilst inappropriate development in Green Belt is generally restricted, development of local transport infrastructure can be considered as appropriate development. This would be the case where a requirement for Green Belt location can be demonstrated, it preserves the openness of the Green Belt and it does not conflict with the purpose of including land in Green Belt. The proposed option would have to undergo these tests to determine whether it constitutes appropriate development, and if not whether there are very special circumstances justifying the development. In either case, impact on the Green Belt would need to be minimised through detailed alignment and design.

The indicative alignment passes through mainly Grade 3a agricultural land, from the proposed park and ride to Grange Road, with potential severance of arable fields, including a possible impact on Coton Orchard. Mitigation would involve providing alternative access to severed fields, compensating landowners and restoring farm infrastructure such as gateways, drains and fencing.

A direct impact on heritage assets is unlikely, although the route may impact on the setting of listed buildings and conservation areas in Coton and Cambridge. Setting studies to determine the impact to listed properties are recommended as part of further assessment, but screen planting and detailed alignment could mitigate these impacts.

The effect of the route on buried archaeology is not known at this stage, but given previous investigations in parts of the study area there is a high potential for archaeological remains to be encountered, as indeed is to be expected in respect of any scheme in this general area. Additional detailed archaeological investigation would be required as part of further assessment. Mitigation measures for buried archaeology (if present) would depend on type of material present, but impacts are expected to be able to be mitigated.

The western end of the indicative alignment is within 100m of Madingley Wood SSSI which could be adversely affected during construction and by noise and light during operation of the route. There is potential for protected species to be present particularly within woodland and hedgerows, therefore to address these concerns extended habitat surveys to identify protected or notable species and habitats will be required and mitigation incorporated as appropriate.

This indicative alignment could have a visual impact on the landscape for the properties on the northern outskirts of Coton, however any visual impact could be mitigated to address significant effects by sensitive routing, engineering and landscape design such as hard & soft landscaping measures.

The indicative alignment has the potential to increase road traffic noise levels at Coton, the West Cambridge university site, Adams Road, Herschel Road and Grange Road. The magnitude of the noise impact is

¹ LDA Inner Green Belt study (Nov 2015)

dependent on the frequency of the bus services using the proposed bus route. Noise increases can be mitigated through route alignment, use of design measures, ensuring that the roads are well maintained and use 'low noise' materials to avoid additional vehicular noise from the buses.

The route also has the potential to cause impact on air quality at sensitive receptors up to a distance of 350m from construction activities as a result of dust soiling. Mitigation of dust emissions from construction is also possible.

One footpath and Wimpole Way long distance path is crossed by the indicative alignment, but this is unlikely to cause severance effect due to low bus traffic volumes and can be mitigated with traffic controls where required.

At this stage it is not possible to accurately determine the impact on utility services but it is expected that they will be present for all options and mitigation measures will be necessary once the extent is known.

This option would cross up to one watercourse (Bin Brook) although this crossing may make use of existing infrastructure. The route is not within flood zone 2 or 3. The increase in impermeable area from the construction of this route would need to be mitigated so as not to increase the risk of surface water flooding. The implementation of attenuation and pollution prevention measures in the form of Sustainable Drainage System (SuDs) may be required to mitigate the impacts. To avoid potential significant effects, works should not encroach within 8m of a water feature. If this cannot be avoided then a permit will be required and the potential effects will need to be assessed and mitigation may be required.

Option 2A

Improvement to bus services, which will run along the existing roads with no infrastructure improvements to the A1303 / A428 junction therefore of little impact.

This option involves improvements to bus services, which will travel along the existing A428 to Madingley Mulch roundabout, requiring no changes to existing infrastructure. As a result, the impacts on Green Belt, agricultural land, heritage assets, environmental and ecological assets, landscape and waterways are likely to be minimal. Minor impacts to noise and air quality could occur due to increased services and traffic flow through Cambourne.

Option 2B

A new route linking Cambourne and Bourn Airfield, before services re-join the St Neots Road with bus priority measures in place to the A1303 / A428 junction

This route is only offline in the section from Cambourne to Bourn Airfield, which lies outside the Green Belt, before it re-joins the existing St Neots Road. It therefore has minimal impact on the Green Belt. Only minor junction realignments to provide bus priority are proposed on the section of St Neots Road, which is already an established route within the Green Belt. It is likely that these will be accomplished within the existing highway boundary, hence requiring minimal or no additional land-take.

Loss of agricultural land in this section of the route will likely be minimal for similar reasons. The route would run through the new village at Bourn Airfield resulting in no additional loss of agricultural land. In the section between Cambourne and Bourn Airfield, where the route is offline, it crosses land classed as agricultural Grade 2.

A direct impact on heritage assets is unlikely, although the route may potentially impact on the setting of listed buildings (for details of location please see the analysis tables in Appendix A or the constraint maps in Appendix C). Setting studies to determine the impact to listed properties are recommended as part of further assessment, but screen planting and sensitive engineering design could mitigate these impacts.

The effect of the route on buried archaeology is not known at this stage, but given previous investigations in parts of the study area there is a high potential for archaeological remains to be encountered, as is to be expected in this area. Additional detailed archaeological investigation would be required as part of further assessment. Mitigation measures for buried archaeology (if present) would depend on type of material present, but impacts are expected to be able to be mitigated. Where the route would pass through major new development these matters would likely be addressed through the planning and development process for those developments, subject to scheme construction timescales.

Environmental and ecological considerations include proximity to the Eversden and Wimpole Woods Special Area of Conservation (SAC), which is located 5.5km to the south. Habitats Regulations Assessment (HRA) screening, potentially leading to full assessment, will be required to assess possible impacts to Barbastelle bats which are a qualifying feature of the site. The findings of the Local Transport Plan HRA should be noted, which based on the information available at that stage concluded some elements of the scheme would have no adverse effects, but that some elements of the route may require further assessment once detailed proposals were known.

Caldecote Meadows SSSI is approximately 1.5 km south of the indicative alignment of the offline busway, and Hardwick Wood SSSI is approximately 2 km north. The indicative alignment also passes through arable farmland, small blocks of woodland, and hedgerows. Habitat surveys to identify protected or notable species and habitats will likely be required. Mitigation would include appropriate routing and sensitive design, and as a last resort habitat compensation.

A section of the route passes through Bourn Airfield, which is an active recreational airfield and former RAF WWII airfield and proposed in the submitted Local Plan as the site for a new village. There is a high potential for land contamination beneath the airfield, therefore it is recommended that a full contamination desk study is undertaken as part of scheme development if this route is selected. As this area is proposed for development, such a process could form part of the wider development of the site, subject to scheme construction timescales. A full ground investigation along the length of the preferred option should also be undertaken to identify any risks posed by the underlying formations.

A route on this indicative alignment is likely to have visual impact on properties in Cambourne, Highfields Caldecote and Hardwick in addition to visual impact from public rights of way in the area. These impacts could be mitigated to address any significant effects by sensitive routing, engineering and landscape design, including hard & soft landscaping measures. Vegetation losses could be mitigated to some degree through re-planting, although amenity value and character of mature trees will be lost in the short term.

The offline section of the bus route is unlikely to cause a significant noise impact. The online sections will increase the traffic flow of buses through Cambourne and the A1303 St Neots Road, causing a potential noise increase at dwellings in Cambourne, the northern edge of Hardwick and approximately 40 isolated buildings adjacent to the A1303 St Neots Road. It is possible that a noise impact may occur at the new housing development at Bourn Airfield, but the submitted Local Plan requires a segregated bus link through the new settlement and there is potential to address noise issues through planning and design of that development and the bus route. The magnitude of the noise impact is dependent on the frequency of the bus services using the proposed bus route. Noise increases can be mitigated through route alignment, use of design measures, ensuring that the roads are well maintained and use 'low noise' materials to avoid additional vehicular noise from the buses.

A route on this indicative alignment also has the potential to cause some impact on air quality at sensitive receptors located within 200m of the old A428, the bus route through Cambourne and the proposed offline busway through the Bourn Airfield development, commensurate with the level of use and nature of the vehicles. During construction, there is potential impact on sensitive receptors up to a distance of 350m as a result of dust soiling, although mitigation of dust emissions would be possible and would depend on the exact nature of the construction activities. The Local Plan requires delivery of bus routes through the new developments, there is therefore an opportunity to design the route as part of the master planning, and consider construction impacts as part of the wider development process.

One footpath is crossed by the indicative alignment but this is unlikely to cause severance effect due to low traffic volumes. The offline section of the route has the potential to include a new footpath/cycleway adjacent to the route, providing increased connectivity between Bourn and Cambourne.

The indicative alignment is not subject to any overriding constraints regarding the water environment. There are no water crossings along the route. It does not lie within a Groundwater Protection Zone, although there is such an area approximately within 1 km to the south. The route is underlain by a superficial aquifer designated as Secondary (undifferentiated) and Bedrock aquifer underlain by Principal aquifer. The route is not affected by any flood zones (2 or 3). Any impact on flood risk could be mitigated through appropriate design, including use of SUDs.

Option 2C

A new offline dedicated bus route connecting Cambourne and Bourn Airfield before running south of Hardwick to Madingley Mulch roundabout.

A proportion of Option 2C, stretching from the proposed Park and Ride site to Main Street (Hardwick), is within the Green Belt. West of Main Street the route is no longer within Green Belt.

Whilst inappropriate development in Green Belt is generally restricted, development of local transport infrastructure can be considered as appropriate development. This would be the case where a requirement for Green Belt location can be demonstrated, it preserves the openness of the Green Belt and it does not conflict with the purpose of including land in Green Belt. The proposed option would have to undergo these tests to determine whether it constitutes appropriate development, and if not whether there are very special circumstances justifying the development. In either case, impact on the Green Belt would need to be minimised through detailed alignment and design.

This option is offline and a busway following this indicative alignment has the potential to sever small grass fields around Hardwick, used mainly for horses, and large arable fields elsewhere. It would not be possible for a route following this alignment to avoid agricultural land, mitigation would involve providing alternative access to severed fields, compensating landowners and restoring farm infrastructure such as gateways, drains and fencing.

A direct impact on heritage assets is unlikely, although the indicative alignment may potentially impact on the setting of listed buildings, which are mainly located in settlements. Setting studies to determine the impact to listed properties are recommended as part of further assessment, but route alignment, screen planting and sensitive engineering design could mitigate these impacts.

The effect of the route on buried archaeology is not known at this stage, but given previous investigations in parts of the study area there is a high potential for archaeological remains to be encountered, as is to be expected in this area. Additional detailed archaeological investigation would be required as part of further assessment. Mitigation measures for buried archaeology (if present) would depend on type of material present, but impacts are expected to be able to be mitigated. Where the route would pass through major new development these matters would likely be addressed through the planning and development process for those developments, subject to scheme construction timescales.

Environmental and ecological considerations include proximity to the Eversden and Wimpole Woods Special Area of Conservation (SAC), which is located 5.5km to the south. Habitats Regulations Assessment screening, potentially leading to full assessment will be required to assess possible impacts to Barbastelle bats which are a qualifying feature of the site. The findings of the Local Transport Plan HRA are noted,

which based on the information available at that stage concluded that some elements of the scheme would have no adverse effects, but that some elements of the route may require further assessment once detailed proposals were known.

Caldecote Meadows SSSI and Hardwick Wood SSSI are both approximately 1 km south of the indicative route. The indicative alignment also passes through arable farmland, small blocks of woodland, and hedgerows. Habitat surveys to identify protected or notable species and habitats will likely be required. Mitigation would include appropriate routing and sensitive design, and as a last resort habitat compensation. A section of the route passes through Bourn Airfield, which is an active recreational airfield and former RAF WWII airfield and proposed in the submitted Local Plan as the site for a new village. There is a high potential for land contamination beneath the airfield, therefore it is recommended that a full contamination desk study is undertaken as part of scheme development if this route is selected. As this area is proposed for development, such a process could form part of the wider development of the site. A full ground investigation along the length of the preferred option should also be undertaken to identify any risks posed by the underlying formations.

A route on this indicative alignment is likely to have visual impact on properties in Cambourne, Highfields Caldecote, Hardwick and Northfield Farm in addition to visual impact from rights of way in the area. These could be mitigated to address significant effects by sensitive routing, engineering and landscape design such as hard & soft landscaping measures. Vegetation losses could be mitigated to some degree through re-planting, although amenity value and character of mature trees will be lost in the short term.

A route on this indicative alignment would increase the traffic flow of buses through Camborne and Caldecote, causing a potential increase in road traffic noise level at approximately 35 dwellings, but this would depend on the specific alignment and would be commensurate with the level of use and nature of the vehicles. Further noise increases may occur at Main Street (Hardwick) and isolated buildings adjacent to the A1303 St Neots Road depending on specific alignment. It is possible that a noise impact may occur at the new housing development at Bourn Airfield, but the submitted Local Plan requires a segregated bus link through the new settlement and there is potential to address noise issues through planning and design of that development to accommodate the bus route. Noise increases can be mitigated through route alignment, use of design measures, ensuring that the roads are well maintained and use 'low noise' materials to avoid additional vehicular noise from the buses.

A route on this indicative alignment also has the potential to cause some impact on air quality at sensitive receptors located within 200m of the bus route through Cambourne and proposed offline busway through the Bourn Airfield development, Highfields Caldecote and Hardwick. During construction, there is potential impact on sensitive receptors up to a distance of 350m as a result of dust soiling, depending on the specific alignment, although mitigation of dust emissions would be possible. The Local Plan requires delivery of bus routes through the new developments, there is therefore an opportunity to design the route as part of the master planning, and consider construction impacts as part of the wider development process.

Several footpaths/bridleways are crossed by the indicative alignment but this is unlikely to cause severance effect due to low traffic volumes. The offline section of the route has the potential to include a new footpath/cycleway adjacent to the route, providing increased connectivity between Cambourne and the A1303.

The indicative alignment is not subject to any overriding constraints regarding the water environment. The route will require crossing numerous watercourses, including a WFD assessed watercourse (Bin Brook). The option is within 1 km of a Groundwater Source Protection Zone. The route is underlain by a superficial aquifer designated as Secondary (undifferentiated) and bedrock aquifer underlain by Principal aquifer. New junctions created from the integration of new routes could increase spillage risk. An appropriate SUDs

scheme would be required to mitigate any pollution risk. The indicative alignment is not affected by any flood zones (2 or 3), except at the watercourse crossing, hence appropriate design to mitigate the risk of flooding would be required at this location. Elsewhere, any impact on flood risk could be mitigated through appropriate design, including use of SUDs.

Corridor summary

The indicative alignment of Option **1A** follows the existing A1303 corridor which is an established transport route in this location. This is a broad corridor and most constraints are medium in extent and capable of being mitigated through measures previously mentioned. However as this passes close to heritage assets and could have a detrimental impact in terms of increased traffic and noise on the surrounding area. Therefore if this option is to be taken forward then sensitive design and route alignments must be carefully considered. This option offers minimal land take in terms of greenbelt and landscape, but where additional widening is required existing highway infrastructure may pose a constraint which will need to be addressed. With the mitigation measures in place and further detailed investigation, it is considered that this transport option can be delivered.

The indicative alignment of Option **1B** provides an offline dedicated bus route which connects to Madingley Road just west of the M11. The offline route is within greenbelt and would require agricultural land take. The constraints for this route, as identified and detailed above, relate predominantly to the impact on the rural landscape and heritage assets. These impacts will need to be addressed through detailed consideration of alignment, design and mitigation. The section east of the M11 will have the same constraints and mitigations as Option 1A. Whilst there are certain constraints in the 1B option, this is a broad corridor and most constraints are medium in extent and capable of being mitigated therefore, with the mitigation measures in place and further detailed investigation, it is considered that this transport option can be delivered.

The indicative alignment of Option **1C** provides a new offline dedicated bus route. This offline route is entirely within greenbelt, in an area which contains key views of a number of Cambridge's distinctive landmarks and is the closest area of countryside to the city's historic core. The constraints for this route, as identified and detailed above, relate to the impact on the rural landscape, and historic buildings. To successfully deliver this option would require the significant effects to be addressed by sensitive routing, engineering and landscape design such as hard & soft landscaping measures. Whilst there are certain constraints in the 1C option, this is a broad corridor and most constraints are medium in extent and capable of being mitigated, therefore with the mitigation measures in place and further detailed investigation, it is considered that this transport option can be delivered.

The indicative alignment of Option **2A** follows the existing A428 corridor which is an established transport route in this location. This option requires no changes to existing infrastructure and therefore only minor impacts to noise and air quality are possible due to increased services and traffic flow. This is an established corridor and most constraints are minor in extent and capable of being mitigated through appropriate measures. Therefore if this option is to be taken forward then with the mitigation measures in place and further detailed investigation, it is considered that this transport option can be delivered.

The indicative alignment of Option **2B** provides an offline dedicated bus route from Cambourne to Bourn Airfield before it re-joins the existing St Neots Road. The offline route is not within greenbelt but would require agricultural land take. The St Neots Road section of this option is already an established route within the Green Belt and only requires minor junction realignments to provide bus priority which can be accomplished within the existing highway boundary. There are slight concerns regard the proximity of the route to Caldecote Meadows SSSI and Hardwick Wood SSSI but these concerns can be mitigated. Whilst there are certain constraints in the 2B option, this is a broad corridor and most constraints are medium in extent and capable of being mitigated, therefore with the mitigation measures in place and further detailed

investigation, it is considered that this transport option, which is connected to the Bourn Airfield new village, can be delivered.

The indicative alignment of Option **2C** provides a new offline dedicated bus route. A proportion of this option, stretching from the proposed Park and Ride site to Main Street (Hardwick), is within the Green Belt. West of Main Street the route is not within Green Belt. The constraints for this route, as identified and detailed in previous sections of this report relate to the impact on the rural environment as the route will cause severance of several small grass fields around Hardwick and large arable fields elsewhere the rural landscape. To successfully deliver this option would require the impacts to be addressed by sensitive routing, engineering and landscape design such as hard & soft landscaping measures. Whilst there are certain constraints in the 2C option, this is a broad corridor and most constraints are medium in extent and capable of being mitigated, therefore with the mitigation measures in place and further detailed investigation, it is considered that this transport option, which is connected to the Bourn Airfield new village, can be delivered.

Scheme Costs

The infrastructure cost for the options above as reported in the City Deal Interim report are summarised in the table below.

Scheme	Infrastructure Cost
1A	£18 million
1B	£20 million
1C	£67 million
2A	nominal
2B	£11 million
2C	£27.5 million

Overall outturn capital cost for transport projects of this nature include infrastructure (construction) costs, land costs, scheme development costs and site supervision. The overall cost of similar schemes in the UK is varied, ranging from £3.9M/km (Luton Guided Busway) to £17M/km (for the Leeds New Generation Transport).

Infrastructure costs for each of the six options have been reported in the City Deal Interim report and are included in Appendix A. The infrastructure costs for the present high level outline options currently range from £2.3M/km to £4.9M/km and are dependent on elements such as costs of new structures. When added to land and other costs, this would place them within the range of these example schemes.

At this time and prior to the production of the outline business case appraisal there is no indication that the present range of estimated land costs would adversely affect the viability of any of the options being considered.

4. Conclusion

The brief for this study was to provide additional evidence to demonstrate that the transport infrastructure necessary to support sustainable new settlements as identified in the Submitted Local Plan can be delivered. South Cambridgeshire District Council required a robust understanding of potential environmental, physical and planning constraints affecting this corridor and whether these could impact the delivery of a range of

transport interventions that will support the sustainable delivery of the key developments proposed in this corridor.

Atkins have carried out a study of all six route options emerging through the City Deal process, utilising work previously produced to support the Madingley Road / A428 Cambourne to Cambridge Corridor improvements, including desktop and site investigations. The study aimed to establish the environmental and engineering constraints which could affect the delivery of the proposed transport infrastructure. The study also provides evidence, in the way of mitigation measures, which demonstrates that any identified constraints can be appropriately addressed.

The key findings of this study are:

- Due to land take and habitat loss the combined effects of the proposed routes is likely to impact moderately adversely on ecology, archaeology and landscape in the opening year, reducing to minor adverse in later years. There are a variety of mitigation measures that can be employed to support the delivery of indicative transport routes. These include careful route alignment, sensitive engineering, and detailed landscaping.
- The impacts on the water environment and flood risk are likely to be minor adverse or negligible due to the sustainable drainage mitigation that could be incorporated into the design.
- The cumulative effects on noise and lighting are likely to be “minor adverse/negligible”.

The analysis contained in this report identifies a series of environmental and engineering constraints associated with each of the six options emerging from the City Deal study. The impact of these constraints ranges in severity and extent, and mitigation measures have been identified in most cases.

Generally these constraints lie within expectations of those typically encountered in transport projects of this nature and at this stage of development. Further investigation during scheme development would assist with determining the precise extent of some of the constraints identified which would then inform the selection of preferred route. At this point there appear to be no substantial issues which would prevent delivery of the proposed City Deal options.

Appendices

Appendix A. Constraints Analysis

This section of the report provides an analysis of the proposed options against a series of constraints which could impact on the delivery of the different routes within this corridor. The significance of an effect is assessed by looking at the change against existing and/or predicted baseline conditions as a result of the construction and operation of the routes.

Each of the proposed options has been assessed and categorised in terms of extent and impact, with issues identified, described, and with the mitigation measures that are available to address these issues. Categorisation was undertaken based on the understanding of the route options and professional judgement.

Extent of Constraint

Extent	Description
Maximum	The constraint impacts upon the majority of the indicative alignment.
Medium	The constraint impacts upon a section of the indicative alignment.
Negligible	The constraint has minor impact upon the indicative alignment or at a specific location on the indicative alignment.

Impact on Scheme Delivery (before mitigation)

Type	Description
Major Impact	The identified constraint is unavoidable and could have a major effect on cost and delivery of the programme.
Medium Impact	The identified constraint is unavoidable and could have a medium effect on cost and delivery of the programme.
Low Impact	The identified constraint is unavoidable and could have a low effect on cost and delivery of the programme.
Negligible / Neutral Impact	The constraint has a potential negligible or neutral cost involved and / or impact on deliverability and programme.

The tables below provide the outputs from the study and are structured around the suitability and deliverability of the options.

Table 4-1 Suitability considerations

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
Green Belt		Whilst inappropriate development in Green Belt is generally restricted, development of local transport infrastructure can be considered as appropriate development, where it can demonstrate a requirement for Green Belt location, preserves the openness of the Green Belt, and does not conflict with the purpose of including land in Green Belt. The proposed option would have to undergo these tests to determine whether it constitutes appropriate development. When considering any planning application, local planning authorities should ensure that substantial weight is given to any harm to the Green Belt. The schemes are identified in the Local Transport Plan, and are necessary to provide local transport infrastructure. A significant portion of the schemes is located within Green Belt. The proposed development is not likely to be considered as inappropriate within Green Belt. Green Belt designation, and the potential need for mitigation to reduce impact on the Green Belt, presents a risk to the cost, deliverability and programme that needs to be addressed. The impact of the Green Belt designation varies by option. Park and Ride: The proposed Park and Ride location is entirely		Sensitive engineering design can be used to minimise as far as practicable the degree to which the scheme impacts on the Green Belt's openness and the purposes of including land in the Green Belt, which may for example include: ensuring that any associated buildings and structures are of a suitable size relatable to the operational requirements; visual screening and landscaping measures; limiting of lighting etc.

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Maximum	within Green Belt. The impact of the Park and Ride site itself on the Green Belt, and the risk associated with justifying its location within the Green Belt, is considered to be equal in each option presented below. Therefore, a generalised score is provided for the Park and Ride site itself here, and scoring of the various route options is also provided below to enable comparison of risks associated with those routes specifically.	High	Option 1A: Although a section of this Option is within the Green Belt, because the proposal requires only limited widening along the route of the existing highway it is unlikely mitigation would be required.
	Negligible	Option 1A: A portion of Option 1A is within the Green Belt – the section of the A1303 stretching between the exit from the new Park and Ride to the eastern edge of the M11. East of this point the A1303 is no longer within Green Belt, but Green Belt continues to the north of the road until dwellings on Lansdown Road and therefore has potential to be encroached upon by widening works. The route continuing east of this point is not within Green Belt designation and as such is not considered further within this section. Limited widening works proposed along the section of A1303 within the Green Belt is unlikely to be considered inappropriate development because the road is already established within the Green Belt and widening works would not impact on the openness of the Green Belt or conflict with the purposes of including land in the Green Belt. Proposed widening works within the Green Belt designation is considered to give rise to a low risk to cost, deliverability and programme.	Low	

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Medium	Option 1B: The section of Option 1B west of the M11, that would comprise a new two-way bus only road plus a track used for maintenance and as a cycleway and footpath, is within Greenbelt. This Option would require development of greenfield land within the Green Belt beginning at the north of the Park and Ride and ending at a tie-in with the existing A1303 located between Meadow View and the driveway of Rectory Farm. The route would then continue along the A1303 in the same way as Option 1A. This Option would require a greater area of development within in the Green Belt than would Option 1A, and has a greater risk of reducing the openness of the Green Belt or conflicting with the purposes of including land in the Green Belt, giving rise to risk to the cost, deliverability and programme for this Option.	Medium	Option 1B: Development of Greenbelt land would be required to deliver part of this Option. Sensitive engineering design (see examples above) and landscaping should be used to minimise impact on openness.
	Medium	Option 1C: This Option would comprise a new two-way bus only road plus a track used for maintenance and as a cycleway and footpath located entirely within the Green belt, stretching through agricultural land from the proposed park and ride to Grange Road. The alignment would run south of existing development, largely associated with the University of Cambridge that is immediately to the south of the A1303. This Option would require substantially more development within the Green Belt than Options 1A or 1B and carries a greater risk of reducing the openness of the Green Belt or conflicting with the purposes of including land in the Green Belt. This gives rise to risk to the cost, deliverability and programme for this Option. Option 2A: Would have no impact on Green Belt as it would use existing routes, with no works within the Green Belt.	Medium	Option 1C: Development of Green Belt land would be required to deliver this Option. Mitigation of impacts would need to be maximised through detailed alignment having regard to existing and committed development, and measures such as sensitive engineering design and landscaping

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Negligible	Option 2B: A portion of Option 2B, the St Neots Road stretching between the exit to the proposed Park and Ride to the Cambridge Road, would be within the Green Belt. However, works in this area are limited to minor junction realignment that would not extend beyond the highway boundary. West of this point the route would no longer be within Green Belt and is not considered in this section.	Negligible	Option 2A: No mitigation required.
	Medium	Limited works that may be necessary along the St Neots Road are unlikely to be considered inappropriate development. The road is already established within the Green Belt. Works would not impact on the openness of the Green Belt or conflict with the purposes of including land in the Green Belt. Therefore, Green Belt designation gives rise to a low risk to cost, deliverability, and programme for this Option.	Medium	
	Medium	Option 2C: A proportion of Option 2C, comprising a new two-way bus only road plus a track used for maintenance and as a cycleway and footpath, stretching from the proposed Park and Ride site to Main Street, is within Green Belt. West of Main Street the route no longer within Green Belt and is not considered in this section. This Option would require development of greenfield agricultural land within the Green Belt and may reduce the openness of the Green Belt or conflict with the purposes of including land in the Green Belt. This gives rise to risk to the cost, deliverability and programme for this Option.	Medium	Option 2C: Development of Green Belt land would be required to deliver part of this Option. Sensitive engineering design (see examples above) and landscaping should be used to minimise impact on openness.

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
Agricultural Land				
		Planning policy contained in the NPPF states that local planning authorities should take into account the economic and other benefits of the best and most versatile (BMV) land. Where significant development of agricultural land is deemed necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality. Detailed Agricultural Land Classification surveys available on www.magic.gov.uk and the A14 Ellington to Fen Ditton Environmental Statement ² improvement indicate that the great majority of the affected land is of BMV quality in Grade 3a, with small areas of Grade 2. Grade 3b land is of very limited extent. The majority of the land take for the proposed routes is under some type of agricultural activity, mainly large arable farms in rotations based on winter wheat. The significant exception is Coton Orchards which is one the last remaining working orchards in Cambridgeshire.		There is no alternative land of inferior quality or a brownfield site in the vicinity, where the options could go. Where fields are permanently severed, alternative routes to the fields would need to be established and the landowner compensated for the disruption to the farm layout. Field drainage systems will also have to be modified and gates and fencing/hedging replaced. In some cases small areas of severed fields would be purchased and taken for landscaping or habitat creation
	Negligible	Option 1A: Option would result in the loss of a small amount of mainly Grade 3a agricultural land at the Park and Ride and in the few places where the highway is widened. No fields will be severed	Low	Option 1A: There is no alternative land of inferior quality or a brownfield site in the vicinity. No mitigation is possible apart from compensating landowners and restoring farm infrastructure such as gateways, drains and fencing.
	Medium	Option 1B: Option would result in the loss of mainly Grade 3a agricultural land and severance of large arable fields.	Medium	Option 1B: There is no alternative land of inferior quality or a brownfield site in the vicinity. Mitigation will involve providing alternative access to

² A14 Ellington to Fen Ditton Environmental Statement, published October 2009.
http://iprojects.costain.com/a14_public_area/Public/VOL%201/v1%20-%2012%20land%20use.pdf

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Medium	Option 1C: Option would result in the loss mainly Grade 3a agricultural land and potentially severance of large arable fields. It could also sever parts of the Coton Orchard, depending on exact routing, and possibly cause additional damage during the construction phase due to dust affecting pollination and fruit quality	Medium	severed fields, compensating landowners and restoring farm infrastructure such as gateways, drains and fencing. Option 1C: There is no alternative land of inferior quality or a brownfield site in the vicinity. Mitigation will involve providing alternative access to severed fields, compensating landowners and restoring farm infrastructure such as gateways, drains and fencing.
	Negligible	Option 2A: No loss of agricultural land apart from some Grade 3a at the Park and Ride.	Low	Option 2A: There is no alternative land of inferior quality or a brownfield site in the vicinity of the Park and Ride so no mitigation possible
	Negligible	Option 2B: No loss of agricultural land apart from some Grade 3a at the Park and Ride.	Low	Option 2B: There is no alternative land of inferior quality or a brownfield site in the vicinity of the Park and Ride so no mitigation possible
	Medium	Option 2C: Option would result in the loss of mainly Grade 3a agricultural land. Around Hardwick small grass fields, used mainly for horses would be severed. Elsewhere there would be severance of large arable fields.	Medium	Option 2C: There is no alternative land of inferior quality or a brownfield site in the vicinity. Mitigation will involve providing alternative access to severed fields, compensating landowners and restoring farm infrastructure such as gateways, drains and fencing.
Heritage/ Archaeological considerations (please note townscape and		Archaeological and built heritage assets of local to National importance are known throughout the proposed options. Madingley is home to the Grade I listed Madingley Hall, as well as several Grade II* listed buildings, where impacts to setting		All of the options would require a full desk-based assessment of heritage assets. All of the options would also

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
landscape are covered under a separate section below)		may need to be carefully considered. The same considerations will need to be given to the setting of the Grade I listed American Military Cemetery and associated Grade II* listed features. There are conservation areas at Madingley and Coton. There is a high potential for archaeological remains extending throughout all options. Previous investigations in advance of proposed developments in the area, including the A428 Caxton to Hardwick Improvement Scheme, identified archaeological evidence of local to regional significance throughout the area. Prehistoric archaeology dating to the Mesolithic is suggested through finds at the Bourne Airport; a Bronze Age barrow was identified along the A428 route near the Bourn Airfield; Iron Age field systems and settlements are scattered throughout the area. The A428 follows the purported route of a Roman Road; Roman settlements are known at the eastern end of the options. Extensive Anglo-Saxon settlement activity has been identified in Madingley, and medieval archaeology is almost ubiquitous in the areas nearer to Cambridge. Post-medieval archaeology relating to industrial activity, from windmills to WWII battalion headquarters, is also well-represented.		require setting studies to assess impacts to Grade I and II* listed properties. All, except for Option 1A would require additional detailed archaeological evaluation (Option 1A may require less initial evaluations, but would likely still require archaeological mitigation).
	Medium	Option 1A: Potential effect on setting of Listed Buildings, particularly the American Cemetery, on route into Cambridge. Effect on buried archaeology not known at this stage.	Medium	Option 1A: This Option would require additional detailed archaeological evaluation. The existing road passes to the south of the American Cemetery and the impact of any road widening on these heritage assets would need to be considered and any impacts minimised through design and alignment.
	Medium	Option 1B: Potential effect on setting of Listed Buildings at American Cemetery and Moor Barns Farm. Effect on buried archaeology not known at this stage.	Medium	
	Medium	Option 1C: Potential effect on setting of Listed Buildings and Conservation Areas in Coton and Cambridge. Effect on buried archaeology not known at this stage	Medium	Option 1B: Mitigation for effects on setting of Listed Building in close proximity to the route would be difficult but possible, could include screen planting to reduce setting impacts to limit the impact on the Cemetery. With careful route alignment and mitigation
	Negligible	Option 2A: Route makes use of existing infrastructure, negligible impacts.	Low	

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Medium	Option 2B: Potential effect on setting of Listed Buildings. Effect on buried archaeology not known at this stage	Medium	measures potentially including screen planting to the south of the route and sensitive engineering design the impact on the Cemetery could be limited.
	Medium	Option 2C: Potential effect on setting of Listed Buildings and Hardwick Conservation Area. Effect on buried archaeology not known at this stage	Medium	Option 1C: Detailed alignment and screen planting could mitigate setting impacts. Mitigation for buried archaeology (if present) would depend on type of material present but could be mitigated. Option 2A: N/A Option 2B: Screen planting could mitigate setting impacts. Mitigation for buried archaeology (if present) would depend on type of material present but could be mitigated. Option 2C: Screen planting could mitigate setting impacts. Mitigation for buried archaeology (if present) would depend on type of material present but could be mitigated
Environmental and ecological designations and considerations		The proposed schemes have the potential to affect ecological features, both species and habitats, by loss of land to the schemes, severance and fragmentation of habitats, by direct mortality of animals and by a number of indirect ways including		General: Eversden and Wimpole Woods SAC (All Options including park and ride): Habitats Regulations Assessment⁵ screening, potentially

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Park and Ride: Medium	disturbance, pollution, spray from traffic etc. Eversden and Wimpole Woods Special Area of Conservation³ (SAC) (All Options including Park and Ride): This site which is designated for Barbastelle bats is located within 10 km to the south/south-west of all Options and the Park and Ride. Options 2b and 2c are closest passing approximately 5.5 km to the north of the SAC. Park and Ride (All Options): The Park and Ride location is immediately adjacent to Madingley Wood Site of Special Scientific Interest (SSSI⁴) which is designated for its broadleaved ancient woodland habitat. The woodland could be adversely affected during construction as widening of the A1303 may require land take within the SSSI, although widening to the south of the A428 at this location could potentially avoid this impact. The SSSI could also be adversely affected by noise, light and air pollution during operation of the Park and Ride. Construction of the Park and Ride would result in the loss of grassland fields and hedgerow. Notable habitats such as important hedgerows may also be present. . There is potential for protected or notable species such as great crested newts, bats, barn owls, badgers, and common reptile	Park and Ride: Medium/High	leading to full assessment will be required to assess possible impacts to Barbastelle bats which are a qualifying feature of the site. The findings of the Local Transport Plan HRA are noted, which concluded some elements of the scheme would have no adverse effects, but that some elements of the route may require further assessment once detailed proposals were known⁶. Park and Ride (All Options): Consultation with Natural England during the planning process relating to development within the Madingley Wood SSSI impact zone and impact upon priority habitat. Extended phase 1 habitat survey would be required to identify whether there is potential for protected or notable species and habitats to be present. Further detailed phase 2 surveys may be required.

⁵ Formal Appropriate Assessment is required to be undertaken by the competent authority before undertaking, or giving consent, permission or other authorisation for a plan or project which is likely to have a significant effect on . Habitat Regulations Assessment (HRA) is a recognised step by step process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European protected sites (e.g. SACs), examines alternative solutions, and provides justification for projects and plans.

³ Special Areas of Conservation (SAC) are strictly protected sites designated under the EC Habitats Directive to protect those habitat types and species which are considered to be most in need of conservation at a European level (excluding birds). European sites are protected under Conservation of Habitats and Species Regulations 2010 (as amended)

⁴ Sites of Special Scientific Interest (SSSI) are sites protected under the Wildlife and Countryside Act 1981(as amended).

⁶ Local Transport Plan Habitats Directive Assessment (See paragraphs 7.1.7 and 7.1.8, and table D.7)
http://www4.cambridgeshire.gov.uk/download/downloads/id/3237/local_transport_plan_habitats_regulations_assessment

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
		species to be present. Ponds and drains which may have potential to support great crested newts are present within 500 m of the park and ride location.		
	Option 1a: Medium	Offline Busway and road widening (Options 1a, 1b, 1c, 2b, and 2c): There is potential for protected and notable species such as great crested newts, bats, barn owls, badgers, water vole and common reptile species to be present particularly within the off-road busway options. Ponds and drains which may have potential to support great crested newts are present within 500 m of the option. Notable habitats such as important hedgerows may also be present. Option Specific: Option 1A: Widening of the A428 to accommodate the online bus lane could require land take within Madingley Wood SSSI. The SSSI could also be adversely affected by noise and light during operation of the bus lane. Widening of the A428 may also affect road verge habitats including hedgerows and individual mature trees. The option is mainly on the line of the existing A428 and there is less potential for protected or notable species and habitats to be present than for the other offline options.	Option 1a: Low/Medium	Offline Busway and road widening (Options 1a, 1b, 1c, 2b and 2c): Extended phase 1 habitat survey would be required to identify whether there is potential for protected or notable species and habitats to be present. Further detailed phase 2 surveys may be required. Whilst it is not possible to fully mitigate against the loss of vegetation, sensitive routing, engineering and landscape design such as hard & soft landscaping measures, such as replacement planting, will minimise the impact.
	Option 1b: Medium	Option 1B: The western end of the offline route option is immediately adjacent to Madingley Wood SSSI. This could be adversely affected during construction and by noise and light during operation of the busway. The land take will include arable farmland with small blocks of woodland and hedgerows. Field drains may also need to be culverted. Widening of the A428 east of the M11 may also affect road verge habitats including hedgerows and individual mature trees. East of the M11 the option is mainly on the line of the existing A428 and there is less potential for protected or notable species and habitats to be present.	Option 1b: Medium	

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Options 1c: Medium	Option 1C: The western end of the offline route option is within 100 m of Madingley Wood SSSI. This could be adversely affected during construction and by noise and light during operation of the busway. The route passes through arable farmland with small blocks of woodland, hedgerows and a nursery/orchard. Field drains may also need to be culverted.	Option 1c: Medium	
	Option 2a: Negligible	Option 2A: From the park and ride the bus route is online on the existing A428 and is unlikely to have impacts to any designated sites or protected or notable species and habitats.	Option 2a: Negligible/low	
	Option 2b: Medium	Option 2B: Caldecote Meadows SSSI is approximately 1.5 km south of the offline busway, Hardwick Wood SSSI is approximately 2 km of the offline busway. The route passes through new residential areas, arable farmland, small blocks of woodland, and hedgerows. Field drains may also need to be culverted.	Option 2b: Medium	
	Option 2c: Medium	Option 2C: Caldecote Meadows SSSI and Hardwick Wood SSSI are both approximately 1 km south of the offline busway. The route passes through residential areas, arable farmland, small blocks of woodland, and hedgerows. Field drains may also need to be culverted.	Option 2c: Medium	
Physical considerations (e.g. contamination,		All options BGS mapping⁷ does not show the presence of Superficial deposits within the route option corridor; west of Coton, Till		All options A full contamination desk study is required for all options, incorporating

⁷ British Geological Survey, n.d. Geology of Britain Viewer [online] Available at <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>. Accessed 25/02/2016

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
land stability)		overlies the bedrock. River Terrace Deposits (sands and gravels) and alluvium and present adjacent to the River Cam in the east of the corridor.		available historical mapping and MOD information to identify historical industry that may pose a constraint for the proposed route options.
		The bedrock underlying the corridor is shown to be varied. Moving east to west, each option crosses the Gault Formation (clay/mudstone), sporadic pockets of Chalk (West Melbury Marly Chalk Formation). West of Highfields the Woburn Sands Formation (sandstone) is present, mudstones of the Kimmeridge Clay Formation underlie the Bourne airfield area and the West Walton and Ampthill Clay Formations are present west of Cambourne.		A full ground investigation is required along the length of the preferred option to identify any risks posed by the underlying formations. It is also necessary to determine the location of any underground structures and potential contamination present at the site. Any contamination identified must be fully remediated prior to the commencement of any construction.
		It is likely that these changeable ground conditions may require a variable and considered approach to the formation of the proposed transport route. Additionally, it is possible that historical industry may exist in the corridor area which could pose a constraint on the route option selection.		
	Medium	Option 1A: Cambridge University Farm historical landfill is located c. 500 m north of Option 1A and 1B. The landfill accepted inert waste (unlicensed) from July 1984 to May 1986 ⁸ .	Medium	
	Medium	Option 1B: No currently known physical considerations.	Medium	
	Negligible	Option 1C: No currently known physical considerations.	Low	
	Medium	Option 2B and 2C: Bourn Airfield is an active recreational airfield and former RAF WWII airfield. There is a high potential for land contamination beneath the airfield.	Major	

⁸ Environment Agency, 2016. *What's in your backyard?* Available at <http://maps.environment-agency.gov.uk/wiyby> Accessed on 25 February 2016

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
Townscape and landscape impact	Medium	Option 1A: This option passes close to Madingley American Cemetery, a Registered Park and Garden of Historic Interest. There is likely to be significant impact on trees covered by Tree Preservation Order (TPO) along A1303 between Clerk Maxwell Road and Northampton Street. Considerations for this option will be: - Visual impact on properties along existing A1303 into Cambridge; - Visual impact on rights of way between M11 and A428. - Impact on vegetation along A1303 (removal of trees due to widening the existing highway); - Significant impact on trees covered by TPO along A1303 between Clerk Maxwell Road and Northampton Street, - Visual impact on Madingley Hill Mill (Grade II listed building); - Visual impact on Madingley Hill Mill Farm, Crome Lea Farm, Coton Court; - Landscape impact on Madingley Wood (registered ancient woodland), especially in the area along the Crome Lee Farm and Coton Court - Limited impact on wider landscape character, as this option follows existing route.	Medium	Option 1A: Visual impact could be mitigated to address significant effects by sensitive routing, engineering and landscape design such as hard & soft landscaping measures. Vegetation losses could be mitigated to some degree through re-planting, however some permanent loss would occur, due to the limited space available, especially along existing A1303 into Cambridge. The amenity value and character of mature trees will be lost in the short term, as the value and character of any re-planted trees need time to fully develop. Impact on landscape would be permanent.
	Medium	Option 1B: Possible alignment passes to the north of Madingley American Cemetery, a Registered Park and Garden of Historic Interest	Medium	Option 1B: Visual impact could be mitigated to address significant effects by sensitive routing, engineering and landscape

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
		and Grade I listed building. Considerations for this option will be: - Visual impact on properties along existing A1303 into Cambridge; - Visual impact on Moor Barns Farm, Grade II listed building; - Significant landscape impact on Madingley Wood (registered ancient woodland); - Significant impact on trees covered by TPO along A1303 between Clerk Maxwell Road and Northampton Street; - Visual impact on right of way between M11 and A428; and impact on wider landscape character, as this option cut across the open fields.		design such as hard & soft landscaping measures. Vegetation losses could be mitigated to some degree through re-planting, however some permanent loss would occur, due to the limited space available, especially along existing A1303 into Cambridge. The amenity value and character of mature trees will be lost in the short term, as the value and character of any re-planted trees need time to fully develop. Loss of ancient woodland could be avoided by appropriate routing. Impact on landscape would be permanent.
	Medium	Option 1C: This option is located further south than 1a and 1b. Considerations for this option will be: - Visual impact on properties on the northern outskirts of Coton; - Visual and physical impact on right of way between M11 and A428; - Impact on landscape, as this option cut across the open fields; - Minor loss of vegetation; - Visual impact on the properties within the Madingley Hall Conservation Area; - Visual impact on rights of way; and - Visual impact on Madingley Hill Mill Farm, Crome Lea Farm, Coton Court.	Medium	Option 1C: Visual impact could be mitigated to address significant effects by sensitive routing, engineering and landscape design such as hard & soft landscaping measures. Vegetation losses could be mitigated through re-planting. Impact on landscape would be permanent.
	Medium	Option 2B: Considerations for this option will be: - Visual impact on properties in Cambourne, Highfields Caldecote and Hardwick conservation area; - Visual and physical impact on rights of way;	Medium	Option 2B: Visual impact could be mitigated to address significant effects by sensitive routing, engineering and landscape design such as hard & soft

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Medium	- Minor loss of vegetation; and - Impact on wider landscape character as the option cuts across the open fields. Option 2C: Considerations for this option will be: - Visual impact on properties in Cambourne, Highfields Caldecote and Hardwick; - Visual impact on Northfield Farm; - Visual and physical impact on rights of way; - Minor loss of vegetation; and - Impact on wider landscape character, especially where the option cuts across the open fields.	Medium	landscaping measures. Vegetation losses could be mitigated to some degree through re-planting. The amenity value and character of mature trees will be lost in the short term, as the value and character of any re-planted trees need time to fully develop. Impact on landscape would be permanent. Option 2C: Visual impact could be mitigated to address significant effects by sensitive routing, engineering and landscape design such as hard & soft landscaping measures. Vegetation losses could be mitigated to some degree through re-planting. The amenity value and character of mature trees will be lost in the short term, as the value and character of any re-planted trees need time to fully develop. Impact on landscape would be permanent.
Amenity Considerations (e.g. noise, lighting)	Medium	Option 1A: New lighting if used could increase impact. Road widening and increased traffic flow from the proposed bus route have the potential to cause noise increases adjacent to the bus route. The affected areas include isolated dwellings between the Park and Ride facility and the M11 bridge, and buildings adjacent to the Madingley Road. The magnitude of the noise impact is dependent on the frequency of the bus services using the proposed bus route and how close the widened sections will bring the realigned road to existing buildings. Potential impact on air quality at sensitive receptors (such as schools, hospitals and residential properties) located within 200m of the proposed P&R site and the A1303, both east and	Medium	All options: Mitigation for effect of lighting possible in the long term, and through minimising lighting and positioning in the short term. Noise increases can be mitigated through the use of noise barriers where appropriate and ensuring that the roads are well maintained and use 'low noise' materials to avoid additional vehicular noise from the buses. Mitigation of dust emissions from construction possible.

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Medium	west of the M11 bridge. Potential impact on air quality at sensitive receptors within the Cambridge City AQMA declared for potential exceedances of the annual mean NO2 air quality strategy objective. Potential impact on sensitive receptors up to a distance of 350m from construction activities as a result of dust soiling Option 1B: New lighting if used would increase impact. Noise from the proposed bus route is unlikely to give rise to a significant effect between the Park and Ride facility and the M11 bridge as it is routed away from dwellings located on the A1303 St Neots Road. The widened section of the A1303 Madingley Road has the potential to increase noise levels at adjacent buildings. The magnitude of the noise impact is dependent on the frequency of the bus services using the proposed bus route and how close the widened sections will bring the realigned road to existing buildings. Potential impact on air quality at sensitive receptors located within 200m of the proposed P&R site, offline busway and A1303 east of the M11 bridge. Potential impact on air quality at sensitive receptors within the Cambridge City AQMA declared for potential exceedances of the annual mean NO2 air quality strategy objective. Potential impact on sensitive receptors up to a distance of 350m from construction activities as a result of dust soiling	Medium	
	Medium	Option 1C: New lighting if used would increase impact. The proposed offline routes have the potential to increase road traffic noise levels at Coton, where residential properties are located within 300m of at least one of the proposed routes. The routes into west Cambridge could increase road traffic noise levels at Adams Road, Herschel Road and Grange Road, where several university buildings are located. The magnitude of the noise impact is dependent on the frequency of the bus services using the proposed bus route.	Medium	

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Medium	Potential impact on air quality at sensitive receptors located within 200m of the proposed P&R site and offline busway. Potential impact on sensitive receptors up to a distance of 350m from construction activities as a result of dust soiling Option 2B: New lighting if used would increase impact. The offline section of the bus route is unlikely to cause a significant noise impact. The online sections will increase the traffic flow through Camborne and the A1303 St Neots Road, causing a potential noise increase at dwellings in Camborne, the northern edge of Hardwick and approximately 40 isolated buildings adjacent to the A1303 St Neots Road. It is possible that a noise impact may occur at the new housing development at Bourn Airfield, but there is potential to address noise issues through planning and design of that development as well as the bus route. The magnitude of the noise impact is dependent on the frequency of the bus services using the proposed bus route. Potential impact on air quality at sensitive receptors located within 200m of the old A428, the bus route through Cambourne and the proposed offline busway. Potential impact on sensitive receptors up to a distance of 350m from construction activities as a result of dust soiling	Medium	
	Medium	Option 2C: New lighting if used would increase impact in open landscape. The proposed bus route will increase bus travel through Camborne and Caldecote, causing a potential increase in road traffic noise level at approximately 35 dwellings. Further noise increases may occur at Main Street (Hardwick) and isolated buildings adjacent to the A1303 St Neots Road. It is possible that a noise impact may occur at the new housing development at Bourn Airfield, but there is potential to address noise issues through planning and design of that development as well as the bus route. The magnitude of the noise impact is dependent on the frequency of the bus services that will use the proposed bus route. Potential impact on air quality at sensitive receptors within 200m of the bus route through Cambourne and proposed offline busway through Highfields Caldecote and Hardwick.	Medium	

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
		Potential impact on sensitive receptors up to a distance of 350m from construction activities as a result of dust soiling.		
Impact on footpaths and bridleways		The potential for improved cycle and walking facilities integral to all options has been assessed qualitatively for all options. From Madingley Mulch to the junction with Cambridge Road, a bi-directional cycle and footpath runs along the southern side of the carriageway. This shared use footpath crosses several junctions which provide access to residences and businesses, but these are relatively distant from one another. The shared footpath transitions to the other side of the carriageway just east of the Cambridge Road junction. Segregated shared use footpaths run both on the north and the south side of the carriageway east of the M11. Accesses to residences and businesses are more common along this section, increasing the risk of accidents and forcing cyclists to slow down in certain sections. On-road cycleways are provided intermittently from the junction with Clark Maxwell road to the inner ring road. Facilities along the Cambourne to Madingley Mulch section are limited, with cyclists using the old A428 (St Neots Road) as an on-road route. A shared footway is provided from the junction leading to Highfields Caldecote to Madingley Mulch. There are a number of Public Rights of Way routes that will be affected by the proposed routes, consideration should be given to re-routing and access provision.		:
	Negligible	Option 1A: Option unlikely to add to existing severance effect due to low traffic volumes	Low	Option 1A: Effects can be mitigated
	Negligible	Option 1B: One footpath and one bridleway crossed by option but unlikely to cause severance effect due to low traffic volumes	Low	Option 1B: Effects can be mitigated with traffic controls.
	Negligible	Option 1C: One footpath and Wimpole Way long distance path crossed by option but unlikely to cause severance effect due to low traffic volumes	Low	Option 1C: Effects can be mitigated with traffic controls

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Negligible	Option 2B: One footpath crossed by option but unlikely to cause severance effect due to low traffic volumes. Offline section of the route has the potential to include a new footpath/cycleway adjacent to the route, providing increased connectivity between Bourn and Cambourne.	Low	Option 2B: Effects can be mitigated with traffic controls. Potential for increased connectivity between Bourn and Cambourne.
	Negligible	Option 2C: Several footpaths/bridleways crossed by option but unlikely to cause severance effects due to low traffic volume. This option has the potential to include a new footpath/cycleway adjacent to the route, providing increased connectivity between Cambourne and the A1303.	Low	Option 2C: Effects can be mitigated with traffic controls. Potential for increased connectivity between Cambourne and the A1303.
Utility/services	Medium	Utility services are present for all options and mitigation measures will be necessary. For urban sections of the proposed routes the concentration of services will be greater, but it is anticipated that any diversionary works required would be of a similar scale to other highway schemes where widening of the carriageway occurs. For rural sections the presence of services are fewer but any costs associated with diversions may be higher. However, it is worth noting that as the route is less constrained within the rural areas, minor alterations to the alignment may negate or minimise any diversionary works.	Medium	All options: Impacts can be mitigated.
Water quality, flooding and drainage measures	Negligible	Option 1A: Online widening of the existing highway and construction of the Park & Ride will result in additional impermeable area, with the potential to surface water pollutant runoff. There are no watercourses crossed by this option and not within flood zone 2 or 3. This option is adjacent to Madingley Wood SSSI. The area is underlain by a superficial aquifer designated as Secondary (undifferentiated) and bedrock aquifer underlain by Principal	Low	When considering mitigation measures, a holistic approach will be taken in which opportunities for improvement of ecology, landscape and other areas will be considered alongside the water environment All options: The increase in impermeable area

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Medium	aquifer. The locations for existing and proposed drainage discharges from the option are unknown at the time of reporting. This should be confirmed at the next stage of the assessment. Option 1B: Additional offline bus route, widening of existing highway and construction of the Park & Ride will result in additional impermeable area – extent dependant on alignment of the route. New junctions created from the integration of new routes could increase spillage risk. This option would cross up to five watercourses, the status of these watercourses is unknown at the time of reporting, however they are assumed to be drainage channels. This option is not within flood zone 2 or 3. This option is located adjacent to Madingley Wood SSSI. The route is underlain by a superficial aquifer designated as Secondary (undifferentiated) and bedrock aquifer underlain by Principal aquifer. The locations for existing and proposed drainage discharges from the option are unknown at the time of reporting. This should be confirmed at the next stage of the assessment.	Medium	from the Park & Ride and widening would need to be mitigated so as not to increase the risk of surface water flooding. All surface watercourses will be assessed for this impact through the Design Manual for Roads and Bridges (DMRB) tests which would also highlight the need for any mitigation measures for water quality. The implementation of attenuation and pollution prevention measures in the form of Sustainable Drainage System (SuDs) may be required to mitigate the impacts. Any watercourse diversions, culverts and other morphological changes to watercourses for the Options which dissect/cross a watercourse would need to be assessed for their impact on Water Framework Directive (WFD) criteria as part of a WFD preliminary assessment. A Flood Risk Assessment (FRA) will be required if the impermeable area >1ha.
	Negligible	Option 1C: Additional offline route and construction of the Park & Ride will result in additional impermeable area. This option would cross up to one watercourse – the status of this is unknown at the time of reporting, however it is assumed to be a drainage channel. This option is not within flood zone 2 or 3. The option is adjacent to Madingley Wood SSSI. The route is underlain by a superficial aquifer designated as Secondary (undifferentiated) and bedrock aquifer underlain by Principal aquifer. New junctions created from the integration of new routes could increase spillage risk. Construction of the new bridge has the potential to introduce a new source of pollution to the water environment. The locations for existing and proposed drainage discharges from the Option are unknown at the time of reporting. This should be confirmed at the next stage of the assessment.	Low	Groundwater tests may be required to understand the suitability of discharge to ground. During construction any discharges should be controlled by best practice mitigation techniques. It should be confirmed at the next stage of the assessment if there is any/will be any hydraulic connectivity to designated site to ensure no adverse impact. To avoid potential significant effects, works should not encroach within 8m

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
	Negligible	Option 2B: There are no water crossings and the option is within 1 km of a Groundwater Source Protection Zone. The option is underlain by a superficial aquifer designated as Secondary (undifferentiated) and Bedrock aquifer underlain by Principal aquifer.	Low	of a water feature. If this cannot be avoided then a permit will be required and the potential effects will need to be assessed and mitigation may be required.
	Medium	Option 2C: This option consists of an off-line bus-only route. Numerous watercourse crossings including crossing of a WFD assessed watercourse. The option is within 1 km of a Groundwater Source Protection Zone. The route is underlain by a superficial aquifer designated as Secondary (undifferentiated) and bedrock aquifer underlain by Principal aquifer. New junctions created from the integration of new routes could increase spillage risk. Three SSSIs are located within 1km of the option.	Medium	
Other planning policies		To enable the determining authority to grant consent for development, the final Park and Ride and associated bus route scheme will need to be assessed against planning policy. The promoter will need to be able to demonstrate that the scheme complies with development plan policy unless other consideration determine otherwise. Scheme Options currently under consideration may vary in the degree to which they comply with or depart from some planning policies. Some policies may be more relevant to some Options than others, and some policies may apply equally to each Option. Some of the policies against which the proposal will be assessed concern issues considered within the various sections of this table. Options that demonstrate less departure from planning policy, and more compliance, shall be more likely to attain consent, although weight attributed to each policy during the decision		In order to mitigate the risk of a scheme not being granted planning permission, a thorough assessment of each Option's compliance with planning policy should be made. Attention should be drawn to the ways in which each scheme contributes to the achievement of planning policy aims, and justification should be provided for departure from the development plan, where proposals conflict with policies.

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
		making process may not be equal, and demonstrable need may outweigh departures from policy in some areas. There is a risk to cost, deliverability and programme that the proposed scheme may be found unacceptable in planning terms. Delays may result from the need for further justification, technical analysis, re-design / amendment to proposals, re-application, or appeal. In order to properly assess the likelihood of each of the scheme options achieving consent, a full analysis of applicable planning policy and potential conformity with those policies would be required. An attached matrix (Appendix A) shows the adopted and emerging local planning policies against which Options are likely to be assessed and how relevant each policy is likely to be to each Option. These policies are taken from the Cambridge Local Plan (2006), Cambridge Local Plan Review (adoption anticipated 2016), South Cambridge Core Strategy DPD, South Cambridge Development control policies DPD, and emerging South Cambridge new Local Plan. Depending on the date as which an application is made, policies currently emerging may have been adopted, superseding the current Development Plan. Even if not yet adopted, emerging policy, particularly when so advanced in the adoption process, may be afforded weight in a planning determination. National planning policy, guidance, circulars, local transport plans etc. have not been considered at this stage, but require consideration as the project progresses. The park and ride site itself, which is the same for each option, is not included in the considerations provided below. Key areas of policy consideration for the Park and Ride site will include traffic and transport policy, development within the Green Belt		For each Option, the benefits that would be brought about by the scheme must be weighed against any potential harm that it may cause. Options should also be assessed comparatively against one another. Where Options conflict with specific policies, changes to the detailed design of the scheme may be made to mitigate these conflicts, particularly for example in relation to visual impact or disturbance that may be caused by noise. At this stage and until such an exercise has been undertaken, it is not appropriate to suggest detailed mitigation by Option, however likely considerations are provided below.

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
		(section above refers), the loss of agricultural land, ecological impact, and environmental impact or nuisance such as noise, visual/landscape amenity, and air quality. Key policy considerations specific to each Option is provided below. This is not an exhaustive or definitive review of planning policy compliance. Option 1A: This Option spans the Cambridge City and South Cambridge Borough planning authorities, and planning policy from both areas is applicable. This Option is 'online', along the existing highway, therefore planning considerations are likely to be limited to traffic and transport policies, and visual amenity. Green belt designation is also a consideration, although presenting little risk. Option 1B: This Option spans the Cambridge City and South Cambridge Borough planning authorities, and planning policy from both areas is applicable. Key policy considerations will include those policies relating to traffic and transport, Green Belt, loss of agricultural land, amenity (particularly visual), ecology, and cultural heritage/listed buildings. Option 1C: This Option spans the Cambridge City and South Cambridge Borough planning authorities, and planning policy from both areas is applicable. Key policy considerations will include those policies relating to traffic and transport, Green Belt, loss of agricultural land, amenity (particularly visual), ecology, and cultural heritage/listed buildings. Option 2B: This Option lies within South Cambridge District. South Cambridge planning policy will be applicable. Key policy considerations will include those policies relating to traffic and transport, loss of agricultural land, amenity (particularly visual), ecology, and allocated sites (eg Cambourne West and Bourn Airfield).		Option 1A: Construction works should be undertaken in such a way as to limit disruption and congestion during the construction period and ensure highway safety. Construction methods should be sensitive to nearby land uses, limiting amenity related impacts. Option 1B: Construction works should be undertaken in such a way as to limit disruption and congestion during the construction period and ensure highway safety. Construction methods should be sensitive to nearby land uses, limiting amenity related impacts. Development of Greenfield land should be minimised as far as practicable. Design measures that limit visual and landscape impact should be employed. Impact on nearby cultural heritage assets should be minimised. Option 1C: Construction works should be undertaken in such a way as to limit disruption and congestion during the construction period and ensure highway safety. Construction methods should be sensitive to nearby land uses, limiting amenity related impacts. Development of Greenfield land should

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
		Option 2C: This Option lies within South Cambridge District. South Cambridge planning policy will be applicable. Key policy considerations will include those policies relating to traffic and transport, Green Belt, loss of agricultural land, amenity (particularly visual), ecology, allocated sites (eg Cambourne West and Bourn Airfield), and flood risk.		be minimised as far as practicable. Design measures that limit visual and landscape impact should be employed. Impact on nearby cultural heritage assets should be minimised. Option 2B: Construction works should be undertaken in such a way as to limit disruption and congestion during the construction period and ensure highway safety. Construction methods should be sensitive to nearby land uses, limiting amenity related impacts. Development of Greenfield land should be minimised as far as practicable. Design measures that limit visual and landscape impact should be employed. Option 2C: Construction works should be undertaken in such a way as to limit disruption and congestion during the construction period and ensure highway safety. Construction methods should be sensitive to nearby land uses, limiting amenity related impacts. Development of Greenfield land should be minimised as far as practicable. Design measures that limit visual and landscape impact should be employed.
Any other issues		In addition to the factors considered above, the schemes were found to have negligible or no impact on the constraints below: • City protected open spaces • Climate change opportunity areas • COMAH sites • Crown Estate • Major hazard consent sites		

Constraint/Issue	Extents	Commentary	Impact	Possible Mitigation
		• Mineral safeguarding areas • MOD land • Heavy and high loads routing		
Summary - Can any issues be mitigated?		Option 1A: Most issues can be mitigated as limited additional area of land is affected and impacts are kept close to/within the A428 corridor. Option 1B: Most issues can be mitigated but impact on and loss of landscape would remain after mitigation. Loss of agricultural land hard to mitigate. Option 1C: Most issues can be mitigated but impact on and loss of landscape would remain after mitigation. Loss of agricultural land hard to mitigate Option 2A: This route will run along the existing roads with no infrastructure improvements to the A1303 / A428 Option 2B: Most issues can be mitigated but impact on and loss of landscape would remain after mitigation. Online section would have negligible impact. Option 2C: Most issues can be mitigated but mitigation of impact on Greenbelt is not possible. Impact on and loss of landscape would remain after mitigation		

Table 4-2 Delivery and Availability considerations

Consideration	Comments																										
Land take (indicative)	All options will require a degree of land take, the most significant of which will be for the provision of the new P&R at Madingley Mulch, followed by the offline options. Widening to Madingley Road as part of Options 1A and 1B will be carried out within the highway boundary if at all possible, but some locations where the existing highway widths are not sufficient for the safe passage of road users, cyclists and pedestrians may require land take.																										
Current or last use of the site	The A428 corridor is one of the key radial routes into Cambridge, the existing route travels through a mainly rural (grade 2, 3a & 3b agricultural land) environment which is sparsely populated and in the main avoids urban settlements, with the exceptions of Upper Cambourne at the western end and Cambridge at the eastern end.																										
Land ownership	<u>Option 1A</u> <table><tr><th>Owner</th><th>Land registry number</th></tr><tr><td>1</td><td>CB338754</td></tr><tr><td>2</td><td>CB 222862</td></tr><tr><td>3</td><td>CB 357469</td></tr><tr><td>4</td><td>CB 321434</td></tr><tr><td>5</td><td>CB 276129</td></tr><tr><td>6</td><td>CB334574</td></tr><tr><td>7</td><td>CB 185437</td></tr><tr><td>8</td><td>CB 224085</td></tr><tr><td>9</td><td>CB 36925</td></tr><tr><td>10</td><td>CB 51206</td></tr><tr><td>11</td><td>CB64761</td></tr><tr><td>12</td><td>CB 364560</td></tr></table>	Owner	Land registry number	1	CB338754	2	CB 222862	3	CB 357469	4	CB 321434	5	CB 276129	6	CB334574	7	CB 185437	8	CB 224085	9	CB 36925	10	CB 51206	11	CB64761	12	CB 364560
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11	CB64761																										
12	CB 364560																										

Option 1B

Owner	Land registry number
1	CB 338754
2	CB 119361
3	CB 355430
4	CB 334574
5	CB 64761
6	CB 364560
7	CB 320301

Option 1C

Owner	Land registry number
1	CB338754
2	CB 222862
3	CB 357469
4	CB 321434
5	CB 276129
6	CB334574
7	CB 185437
8	CB 51206
9	CB 320301
10	

Option 2A

Land ownership information not available for this report

Option 2B

Land ownership information not available for this report

Option 2C

Land ownership information not available for this report

Is CPO likely?	Option 1A: This option involves widening the carriageway to introduce an east-bound bus lane therefore may require acquisition of land/property outside the highway boundary adjacent to the proposed route. Option 1B: This option involves providing a rural part off-line route (Madingley Mulch Rbt to M11) which runs through areas of privately owned land therefore land acquisition (possibly CPO) will be required Option 1C: This option involves providing a purely off-line route which runs through rural privately owned land to the north of Coton. It would be expected CPOs may be required. Option 2A: does not involve delivering infrastructure along this section, and as a result it is not proposed to change existing facilities Option 2B: This option involves providing a rural part off-line route (Madingley Mulch Rbt to interchange Bourn airfield) which runs through areas of privately owned land therefore land acquisition will be required. It would be expected CPOs may be required where infrastructure is provided in urban areas. Option 2C: This option involves providing a purely off-line route (Madingley Mulch Rbt to Cambourne West) which runs through areas of privately owned land therefore land acquisition will be required. It would be expected CPOs may be required where infrastructure is provided in urban areas.
Legal constraints	Third Party Land and Properties - during this stage of study the detailed design features are yet to be undertaken for either the off line and /or highway work. All options will require a degree of land take, the most significant of which will be for the provision of the new P&R at Madingley Mulch, followed by the offline options. Widening to Madingley Road as part of Options 1A and 1B will be carried out within the highway boundary if at all possible, but some locations where the existing highway widths are not sufficient for the safe passage of road users, cyclists and pedestrians may require land take. It is worth noting the area surrounding the Madingley American Cemetery (located between the A1303 and Cambridge Road) is restricted to agricultural use, according to the letter sent in 1954 by prime minister Anthony Eden to the American Ambassador. The American Battle Monuments commission will need to be consulted in relation to options located in this area (1A and 1B).
Acquisition Cost	Specialist land consultants have carried out an initial high level appraisal of the possible land costs on the basis of the potential high level options currently being considered for both Tranche 1 and 2 of the City Deal study. In estimating these costs there are likely marked differences between the rural and urban character of the land use and so costs vary.

	For Tranche 1 there is a range of potential cost between £0.2M/km and £2M/km and for Tranche 2 a potential cost between £0.2M/km and £1.8M/km. Given the present stage of project progression and commercial nature of land budget figures, specific land costs are not available for inclusion in this report. However, the figures above are broadly in line with estimates for similar transport schemes (e.g. Luton Guided Busway⁹ £1.6M/km and Croyley Busway¹⁰ £1.7M/km). It should be noted that the infrastructure costs below do not include land costs.
Scheme Cost	Costs for each of the six options were estimated based on professional experience and by examining the cost per kilometre of previous similar options completed locally and nationally. Where uncertainty over costs exists, highest estimates have been presented, and it is anticipated that ongoing development will reduce this uncertainty and potentially reduce the costs. <u>Breakdown for each option</u> <u>Option 1A</u> Park and Ride - £7million Single lane widening with bus priority measures - £10million Signalisation of Madingley Mulch roundabout - £1million Total Estimated Cost for <u>Option 1A</u> - £18million <u>Option 1B</u> Park and Ride - £7million Single lane widening with bus priority measures - £5million Offline Route with bus priority measures at junctions including culverts- £7million Signalisation of Madingley Mulch roundabout - £1million Total Estimated Cost for <u>Option 1B</u> - £20million <u>Option 1C</u> Park and Ride - £7million Signalisation of Madingley Mulch roundabout - £1million Offline Route with bus priority measures at junctions including culverts- £14million

⁹ Luton Guided Busway MSBC, retrieved from:

https://www.luton.gov.uk/Transport_and_streets/Lists/LutonDocuments/PDF/Engineering%20and%20Transportation/busway/Full%20approval%20business%20case/Full%20Approval%20MSBC.pdf

¹⁰ Croyley Busway Cost Risk Review, retrieved from:

<http://www.croyleyrailink.com/downloads/app34/Appendix%20B5%20-%20Croyley%20Busway%20Cost%20&%20Risk%20Review.pdf>

	Bridge over M11 –£45million* Total Estimated Cost for <u>Option 1C</u> - £67million <i>*The bridge cost is considered a high range estimate due to unknown ground conditions. This cost could be reduced by up to 50% depending on detailed assessment outcomes.</i> <u>Option 2A</u> Total Estimated Cost for <u>Option 2A</u> - £nominal <u>Option 2B</u> Realignment in Cambourne - £0.5million Offline Route with bus priority measures at junctions including culverts- £9million Bus priority on St Neots Road - £0.5million One way system on St Neots Road- £0.5million Total Estimated Cost for <u>Option 2B</u> - £11million <u>Option 2C</u> Realignment in Cambourne - £0.5million Offline Route with bus priority measures at junctions including culverts through developers land- £12million Offline Route with bus priority measures at junctions including culverts - £15million Total Estimated Cost for <u>Option 2B</u> - £27.5million
Are there any abnormal cost factors that would significantly affect deliverability?	There are no abnormal cost factors anticipated based upon the identified issues presented within this document but the following should be noted: • A new structure across the M11 will have a significant cost, this will be dictated by the location selected. • Utility & service diversions may have significant costs dependent upon the nature and extent of the diversion required. • CPOs for any given route will vary in cost dependent upon extent and values agreed.
Is it capable of delivering the scheme in engineering terms?	Whilst the study is extensive and has identified issues that could impact upon the ability to deliver each option the following should be noted: • The issues identified are consistent and expected with projects of this nature and do not represent barriers to the progress of the project. • The implementation of appropriate mitigation measures can ensure the successful delivery of an acceptable scheme.

Summary – Is it deliverable?	Based on the analysis presented above there would not appear to be issues preventing delivery outside the normal issues associated with projects of this scale.
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Appendix B. Planning Matrix

0 = not relevant

1 = relevant

2 = important consideration

	Option 1A	Option 1B	Option 1C	Option 2B	Option 2C
Cambridge City Council Development Plan					
Local Plan 2006 (saved policies)					
3/1 Sustainable Development	2	2	2	0	0
3/2 Setting of the City	1	1	2	0	0
3/4 Responding to Context	2	2	2	0	0
3/7 Creating Successful Places	1	1	1	0	0
3/8 Open Space and Recreation Provision Through New Development	0	2	2	0	0
3/9 Watercourses and Other Bodies of Water	0	1	1	0	0
4/1 Green Belt	1	2	2	0	0
4/2 Protection of Open Space	0	2	2	0	0
4/3 Safeguarding Features of Amenity or Nature Conservation Value	1	2	2	0	0
4/4 Trees	1	2	1	0	0
4/10 Listed Buildings	1	2	2	0	0
4/11 Conservation Areas	1	1	1	0	0
4/15 Lighting	0	2	2	0	0
4/16 Development and Flooding	1	1	1	0	0
8/1 Spatial Location of Development	1	1	1	0	0
8/2 Transport Impact	2	2	2	0	0
8/3 Mitigating Measures	1	1	1	0	0
8/4 Walking and Cycling Accessibility	0	2	2	0	0
8/11 New Roads	1	2	2	0	0
8/16 Renewable Energy in Major New Developments	1	1	1	0	0

9/1 Further Policy/Guidance for the Development of Areas of Major Change	1	1	1	0	0
North West Cambridge Area Action Plan (2009)	1	1	0	0	0
Emerging Local Plan review					
Policy 1: The presumption in favour of sustainable development	2	2	2	0	0
Policy 4: The Cambridge Green Belt	1	2	2	0	0
Policy 5: Strategic transport infrastructure	2	2	2	0	0
Policy 8: Setting of the city	2	2	2	0	0
Policy 13: Areas of major change and opportunity areas – general principles	1	1	1		
Policy 18: West Cambridge Area of Major Change	1	1	2	0	0
Policy 27: Carbon reduction, community energy networks, sustainable design and construction, and water use	2	2	2	0	0
Policy 32: Flood risk	1	2	2	0	0
Policy 34: Light pollution control	0	2	2	0	0
Policy 35: Protection of human health from noise and vibration	2	2	2	0	0
Policy 36: Air quality, odour and dust	2	2	2	0	0
Policy 39: Mullard Radio Astronomy Observatory, Lord's Bridge	1	1	1	0	0
Policy 80: Supporting sustainable access to development	1	1	1	0	0
South Cambridgeshire District Council Development Plan					
Core Strategy					
ST/1 Green Belt	1	2	2	1	2
Development Control Policies					
GB/2 Mitigating the Impact of Development in the Green Belt	1	2	2	1	2
SF/8 Lord's Bridge Radio Telescope	1	1	1	1	1
GB/3 Mitigating the Impact of Development adjoining the Green Belt	1	1	1	1	1

NE/7 Sites of Biodiversity or Geological Importance	1	2	1	1	1
GB/1 Development in the Green Belt	1	2	2	1	2
Policy DP/1 Sustainable Development	1	2	2	2	2
Policy DP/2 Design of New Development	2	2	2	2	2
Policy DP/3 Development Criteria	1	1	1	1	1
Policy DP/6 Construction Methods	2	2	2	2	2
Policy DP/7 Development Frameworks	1	1	1	1	1
Policy GB/5 Recreation in the Green Belt	0	2	2	1	2
Policy NE/6 Biodiversity	0	2	2	2	2
Policy NE/9 Water and Drainage Infrastructure	1	2	2	2	2
Policy NE/11 Flood Risk	1	2	2	2	2
Policy NE/14 Lighting Proposals	0	2	2	2	2
Policy NE/15 Noise Pollution	1	2	2	2	2
Policy NE/16 Emissions	2	2	2	2	2
Policy NE/17 Protecting High Quality Agricultural Land	0	2	2	2	2
Policy CH/1 Historic Landscapes	2	2	1	0	0
Policy CH/3 Listed Buildings	1	2	1	0	0
Policy CH/4 Development Within the Curtilage or Setting of a Listed Building	1	2	1	0	0
CH/5 Conservation Areas	1	1	1	0	0
Policy CH/6 Protected Village Amenity Areas	0	0	0	1	1
Policy TR/1 Planning for More Sustainable Travel	2	2	2	2	2
Mitigating Travel Impact	2	2	2	2	2
Policy TR/4 Non-motorised Modes	2	2	2	2	2
Emerging Local Plan review					
Policy S/2: Objectives of the Local Plan	1	1	1	1	1
Policy S/3: Presumption in Favour of Sustainable Development	2	2	2	2	2

Policy S/4: Cambridge Green Belt	1	2	2	1	2
Policy S/7: Development Frameworks	1	1	1	1	1
Policy SS/6: New Village at Bourn Airfield	0	0	0	2	2
Policy CC/1: Mitigation and Adaptation to Climate Change	2	2	2	2	2
Policy CC/3: Renewable and Low Carbon Energy in New Developments	1	1	1	1	1
Policy CC/4: Sustainable Design and Construction	1	2	2	2	2
Policy CC/6: Construction Methods	2	2	2	2	2
Policy CC/7: Water Quality	1	1	1	1	1
Policy CC/8: Sustainable Drainage Systems	1	1	1	1	1
Policy CC/9: Managing Flood Risk	1	2	2	2	2
Policy HQ/1: Design Principles	2	2	2	2	2
Policy HQ/2: Public Art and New Development	1	1	1	1	1
Policy NH/2: Protecting and Enhancing Landscape Character	1	2	2	2	2
Policy NH/3: Protecting Agricultural Land	0	2	2	2	2
Policy NH/4: Biodiversity	1	2	2	2	2
Policy NH/5: Sites of Biodiversity or Geological Importance	1	2	2	2	2
Policy NH/8: Mitigating the Impact of Development In and Adjoining the Green Belt	1	1	1	1	1
Policy NH/10: Recreation in the Green Belt	0	2	2	1	2
Policy NH/11: Protected Village Amenity Areas	0	0	0	1	1
Policy NH/12: Local Green Space	0	0	0	2	2
Policy NH/14: Heritage Assets	1	2	1	0	0
Policy SC/11: Noise Pollution	1	2	2	2	2
Policy SC/13: Air Quality	2	2	2	2	2
Policy TI/2: Planning for Sustainable Travel	2	2	2	2	2

Policy TI/7: Lord's Bridge Radio Telescope	1	1	1	1	1
Policy TI/8: Infrastructure and New Developments	2	2	2	2	2

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