



Stage 2

Environmental Assessment Report

VOLUME 1: TEXT

Woodside Connection, Houghton Regis

300117/041/01 (October 2012)



Job No.: 300117

Stage 2

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Assessment Report**

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**Woodside Connection,
Houghton Regis**

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1 Introduction

1.1 General

- 1.1.1 This report relates to the proposed Woodside Connection ('the scheme'). The location of the scheme is to the north of Dunstable and Houghton Regis, and it is intended to provide a more direct route for traffic to and from the primary road network (the M1 motorway and the A5) into the Woodside area of Dunstable / Houghton Regis, a major employment area.
- 1.1.2 The Highways Agency (HA) is currently promoting a northern link road between the A5 (north of its junction with the A505) and the M1, at a new junction (referred to as Junction 11A) between the existing junctions 11 and 12. The preferred corridor for the Woodside Connection would run from this new link road (known as the A5-M1 Link) into the Woodside area.
- 1.1.3 The scheme relies on the A5-M1 Link to provide its northern connection, and cannot therefore proceed without it. As the programme for the A5-M1 Link was delayed at the end of 2010 (see section 2.1.6), the decision was taken in early January 2011 to suspend further work on the Woodside Connection. The A5-M1 Link is now being actively progressed, so work has re-commenced on the assessment and design of the Woodside Connection. This Stage 2 Environmental Assessment Report (EAR) was almost complete in December 2010, and most of the assessment work reported in it and been undertaken at that time. That work has now been reviewed and amended where necessary, as described in the individual topic chapters of the report, and the report as a whole has been edited and updated for issue in October 2012.
- 1.1.4 The scheme lies almost entirely within the administrative area of the unitary authority of Central Bedfordshire Council (CBC), with a small area at the southern end of the scheme within the area of Luton Borough Council (LBC) - see Figure 1.1.

1.2 Purpose of the Report

- 1.2.1 This report sets out the results of the environmental assessment undertaken to date for the scheme. The assessment has been undertaken in accordance with the methodology and guidance set out in the HA's Design Manual for Roads and Bridges (DMRB) Volume 11 'Environmental Assessment' (see chapter 4 for a detailed description of the methodology used).
- 1.2.2 In accordance with general HA methodology and terminology, this report is for the scheme at Stage 2 (development and assessment of options). Four options for the alignment of the scheme were developed initially, and three of those are currently under consideration; these are described in chapter 2 of this report. This EAR sets out the results of the assessment undertaken to date for each of the options, and provides a comparison between them in terms of their anticipated environmental effects. The next stage of the project development

will be Stage 3 (detailed design for the adopted option), during which a detailed and formal Environmental Impact Assessment (EIA) will be undertaken, culminating in the preparation of an Environmental Statement (ES).

1.2.3 The ES will form part of the submission to obtain Development Consent. The project is classified as a 'Nationally Significant Infrastructure Project' and is hence subject to the provisions of the Planning Act 2008, and approval will be sought from the National Infrastructure Directorate (NID) of the Planning Inspectorate - this is currently programmed for early 2013.

1.2.4 At Stage 2 one important objective of the environmental assessment is to provide information on likely environmental effects and feed it back into the scheme design, such that adverse effects can (as far as possible) be designed out in an iterative process. This process has been followed to date in the development of the scheme, and will continue into Stage 3.

1.3 Scope and Content

1.3.1 The scope of the assessment reported here has been determined with reference to the DMRB methodology and also as a result of a Scoping exercise carried out in March to May of 2010, as described in section 4.2.

1.3.2 This EAR is in 3 volumes - Volume 1 (this volume) sets out the results of the assessment, with relevant supporting Figures in Volume 1A. Volume 2 includes the results of some of the component topic assessments where these are too lengthy or technical to include in full in Volume 1. Volume 1A also contains photographs showing the area around the scheme, in support of the landscape assessment.

1.3.3 Volume 1 of the EAR describes the scheme in chapter 2, with a summary of the consultation undertaken to date in chapter 3 and of the methodology followed in chapter 4. Chapters 5 to 14 then set out the study area, baseline conditions, mitigation measures and anticipated effects for each environmental topic in turn. Chapter 15 provides an assessment of cumulative effects, and chapter 16 summarises the assessment.

1.4 Client and Project Team

1.4.1 The scheme is being promoted by Central Bedfordshire Council, in conjunction with Luton Borough Council. Project management and design of the scheme is by Bedfordshire Highways, a partnership between CBC and Amey, with highways design carried out in Amey's Crawley office.

1.4.2 The EIA has been carried out by appropriately qualified and experienced specialists in the various topic fields, including Amey staff and subconsultants where required.

2 The Project

2.1 Background to the Project

- 2.1.1 A Stage 1 assessment of options for a new route to improve access to and from the Woodside area was carried out in 2007 by the Amey Owen Williams Hereford office. Three basic routes were further developed during 2008, and were subject to public consultation in 2009. The preference expressed was for an eastern route from the proposed M1 Junction 11A to the Poynters Road/ Park Road North junction. The Luton & South Bedfordshire Joint Committee (the body then responsible for development planning within the local authority areas of Luton Borough Council and the part of Central Bedfordshire Council which was formerly South Bedfordshire Council) resolved in March 2009 that this eastern route corridor should be adopted as the preferred corridor, and this has formed the basis for the route options which have been assessed at Stage 2 of the scheme.
- 2.1.2 Three options have been assessed, these are referred to as the Blue, Green and Orange Routes (see Figures 2.1 to 2.6 for route options). The routes follow similar alignments to the south of Parkside Drive, but diverge to a greater extent to the north, before each terminating in a junction at the proposed Junction 11A on the M1.
- 2.1.3 The Luton and southern Central Bedfordshire Core Strategy envisaged substantial development in an area to the north and east of Houghton Regis, extending from the A5 in the west to the M1 in the east, and extending as far north as the proposed A5-M1 Link (this area is known as the North Houghton Regis Strategic Site Specific Allocation, or SSSA). This was in accordance with Regional Planning Guidance and the Milton Keynes and South Midlands Sub Regional Strategy. The Core Strategy has now been withdrawn, but the broad policy expectation is still that development in this area will come forward. The extent and nature of development has yet to be confirmed, but the implications for the scheme are that it is likely (in due course) to pass through an area of mixed employment and residential development, rather than the open fields which presently exist along the majority of the route. An outline planning application for the development is expected to be made in the autumn of 2012.
- 2.1.4 As the North Houghton Regis SSSA is not yet committed or formally allocated, the assessment has proceeded on the basis that the receiving environment is as it presently stands, but the assessment notes where effects would be expected to differ significantly in the event that the development takes place.
- 2.1.5 The scheme proposals rely on the existence of the proposed Junction 11A on the M1. The Public Inquiry for the A5-M1 Link road (which would include Junction 11A) was originally programmed for July 2010, but this was postponed, and the A5-M1 Link was included in the October 2010 Comprehensive Spending Review. The Public Inquiry was eventually held in February 2012 and the Inspector's Report is expected in autumn 2012, with a potential start of work on site for the A5-M1 Link in 2014. The intention is to seek Development Consent

for Woodside Connection (via the Planning Act 2008 process) in 2013, with the intention to commence work in 2014.

2.2 Planning Policy Background

2.2.1 In accordance with the recommendations of the DMRB, relevant matters of planning policy will be set out in each of the topic chapters within this EAR. A general summary of the planning policy background is set out below to set the scene for those more specific sections.

2.2.2 The route lies mostly within the area of Central Bedfordshire Council (CBC), with a small area only at the southern end of the scheme within the area of Luton Borough Council (LBC). The previous South Bedfordshire Local Plan and the Luton Local Plan 2001 - 2011 had been in the course of being replaced by the emerging Local Development Framework (LDF), though further progress on the LDF is now uncertain given the publication in March 2012 of the National Planning Policy Framework (NPPF), which states the intention of returning to the Local Plan system. Some of the policies in the two Local Plans have been saved under a direction from the Secretary of State and still form part of the Development Plan.

2.2.3 The East of England Plan (May 2008), which provides the Regional Spatial Strategy (RSS) for the East of England to 2021, was revoked on 6 July 2010, but was temporarily reinstated after a High Court challenge, and therefore also continues to form part of the Development Plan, though the government's intention is still to abolish it.

2.2.4 The planning background for the scheme therefore now consists of national policy, as set out in the new NPPF, the East of England Plan, and the saved policies of the South Bedfordshire Local Plan and Luton Local Plan.

2.3 Site Location and Description

2.3.1 The new road would run from the existing junction of Park Road North, Sandringham Drive, Wheatfield Road, Poynters Road and Porz Avenue in Houghton Regis to the north east, through a narrow corridor of mixed amenity woodland, developing scrub and rough grass, between houses along Sandringham Drive to the north and Wheatfield Road to the south (see photographs A to D below). The route options are all similar at this point, and each of them runs alongside two overhead electricity transmission lines as far as a small substation just to the south of Parkside Drive, a single carriageway road which is now closed to traffic. The area beneath and around the electricity transmission lines has not been developed, and their presence appears to be the reason why this undeveloped corridor extends out into the countryside to the north east. Parkside Drive is accessible to pedestrians and cyclists, and provides a link to other cycle and pedestrian routes. It appears to be well used by local

residents, and is part of National Cycle Network Route 6 (see Figures 2.1 to 2.6 and also 14.1). The following photographs provide an overview of the area around the site - see Volume 1A (Figure 10.14) for detailed photographic coverage.



A. View north east along the line of the routes, with Sandringham Drive on the left.



B. View north west across the line of the routes to the new area of housing around Holyrood Avenue, to the west of Sandringham Drive.



C. View east across the line of the routes from south of Parkside Drive.



D. View west from Parkside Drive showing the electricity substation. The route options run behind the trees.

2.3.2 To the north of Parkside Drive the overhead electricity transmission lines diverge and there is more difference between the route options, as set out below. Here the options cross a gently sloping area of large arable fields, extending to the M1 motorway in the east. The motorway traffic is visible (and usually audible) across the flat, open landscape, and this section of the M1 is currently being improved by the HA as part of the M1 Junctions 10 to 13 improvement scheme. This is a Hard Shoulder Running (HSR) scheme, in which the hard shoulder is used as an additional traffic lane during peak periods, with new signs and gantries to control and direct traffic. The scheme also includes some improvements to Junctions 11 and 12, which are also currently under way.



E. View north along the line of the routes from just to the east of Parkside Drive.



F. View north east along the line of the route - the Houghton Brook runs along the line of trees on the left of the view.



G. View north towards the northern end of the route - Chalton Cross Farm is in the centre of the view.

2.3.3 The area around the route corridor is broadly flat (though with some significant local variations in topography) as far as Parkside Drive, and then rises gently to the north, towards Chalton Cross Farm and a local high point of around 135m AOD (above Ordnance Datum, or mean sea level) close to the location of the proposed Junction 11A.

2.3.4 A more detailed description of the landscape around the scheme is given in chapter 10 of this EAR.

2.4 The Proposed Scheme

2.4.1 At the time of completing this EAR (October 2012) the design of the scheme has moved on towards the adoption of a preferred route. However, in order to set the scene for the reporting of the assessment of the route options, the following description is of the scheme design (for the three route options) as it was at the time when the three options were under consideration.

2.4.2 The new route would be to wide single carriageway standard, consisting of two 5.0m lanes and 1.0m hardstrips. Verges would be 2.5m minimum width, and the design speed of the road is 100kph. All of the options would connect into the Highways Agency's (HA's) proposed roundabout which forms part of the Junction 11A scheme. This link will be designed to a dual carriageway standard comprising a 2.5m central reserve and two 3.65m lanes, with a 1.0m hardstrip and 2.5m verge to each side. Chainage measurements in the following route descriptions are from zero at the south western end of the scheme.

Blue Route

2.4.3 At the southern end of the scheme the new route would connect into the existing road network at Poynters Road by means of a new four arm roundabout. This would replace the existing junction (see Figure 2.16, and note that this proposed junction arrangement is subject to review and possible revision at Stage 3). As direct access to Wheatfield Road would be removed from the roundabout, a new priority junction would be provided 250m to the north. These proposals for the existing roundabout and Wheatfield Road would be common to all three options.

2.4.4 From Poynters Road the route heads in a north easterly direction following the corridor of open land running between housing estates to the north and south. The road is mainly on embankment throughout this section varying between 0.5m and 1.5m in height but increasing to 3.8m as it crosses the Houghton Brook (Chainage 850). The route shares the corridor with two high voltage overhead power lines services, one a 400kV supply and the second a 132kV supply, both of which influence the horizontal alignment of the road.

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- 2.4.5 After the first 1km the road, which is still on embankment, leaves the periphery of Houghton Regis and enters open agricultural (arable) land. At this point provision has been made for a connection to Parkside Drive, a possible future link. This would connect to the main line by a priority junction.
- 2.4.6 The road crosses the Houghton Brook for a second time (Chainage 1100) before heading in a northerly direction on a left hand 510m radius curve. Whilst on this radius the road would continue to be carried on embankment approximately 2.5m in height before crossing the Houghton Brook for a third time (Chainage 1650).
- 2.4.7 The vertical alignment of the road as it crosses the Houghton Brook valley has been fixed to ensure the carriageway does not flood in the 1 in 100 year flood event, and the highway drainage system does not surcharge in the 1 in 5 year flood event (see also chapter 6). At the structures a minimum 600mm freeboard is needed to meet the requirements of the Environment Agency. In addition the headroom under the structures must be sufficient to allow access for maintenance.
- 2.4.8 As the road continues to head north away from the watercourse, the existing ground level gradually begins to rise. From Chainage 1850 the road begins to cut into the existing landscape, to a maximum depth of approximately 2.9m.
- 2.4.9 At Chainage 2350 a three arm roundabout would be constructed. The northern arm, which would consist of a 400m length of dual carriageway section, heads north and connects at grade into the HA's Junction 11A proposals. In order for this link to tie in to the proposed HA roundabout the link changes from cutting to embankment of approximately 2.4m in height. The west arm, consisting of a 600m long wide single carriageway, would connect into Sundon Road by means of a new roundabout. This section of road would be in cutting to a maximum depth of 1.5m.
- 2.4.10 The total length of the Blue Route would be 2.78km, with a further 0.6km for the link to Sundon Road.

Green Route

- 2.4.11 The first 1.1km of the route shares the same alignment as the Blue Route and crosses the Houghton Brook at the same locations (Chainage 850 and 1100). As with the Blue Route, provision for a connection to Parkside Drive has been made.
- 2.4.12 Whereas the Blue Route sweeps northwards on a left hand radius, there is a break in the alignment at Chainage 1200 for the Green Route where a two arm roundabout would be constructed. The purpose of this is to accommodate a possible future link to Pastures Way, if later required.

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- 2.4.13 From the roundabout the road heads in a northerly direction, running parallel to an existing 33kV overhead power line. The road is carried on embankment, approximately 3.4m above existing ground level, the height of which has been influenced by the flooding criteria for Houghton Brook, as described for the Blue Route. At Chainage 1550 the road crosses the Houghton Brook for a third time.
- 2.4.14 As the road continues to head north away from the brook, the existing ground level gradually begins to rise and the road begins to cut into the existing landscape (Chainage 1850) to a maximum depth of approximately 1.9m.
- 2.4.15 As with the Blue Route a three arm roundabout would be constructed (Chainage 2350), this would be approximately 200m west of the Blue Route option. The northern arm, which would consist of a 400m length of dual carriageway, would connect into the HA's Junction 11A proposals. The west arm, consisting of a 400m length of wide single carriageway, would connect to Sundon Road by means of a new roundabout. This section of road would be in cutting to a maximum depth of 1.0m.
- 2.4.16 The total length of the Green Route would be 2.70km, with a further 0.4km for the link to Sundon Road.

Orange Route

- 2.4.17 As with the previous two options, the Orange Route starts from Poynters Road and heads in a north easterly direction following the corridor of open land running between the two housing areas. This route also makes provision for a connection to Parkside Drive.
- 2.4.18 The road is mainly on embankment throughout this section varying between 0.5m and 1.5m in height but increasing to 3.0m as it crosses the Houghton Brook (Chainage 900).
- 2.4.19 For 200m north of the river crossing the road continues to head in a northerly direction and passes below a cluster of overhead power lines, then runs parallel to the east of the existing 33kV overhead power supply. The main difference here between the options is that the Orange Route takes a line further to the west, closer to the edge of Houghton Regis, and stays to the west of the overhead power lines.
- 2.4.20 As the road continues to head north away from the Houghton Borook, the existing ground level gradually begins to rise and the road begins to cut into the existing landscape (from around Chainage 1950) to a maximum depth of approximately 0.6m.
- 2.4.21 As with the Blue and Green Routes a three arm roundabout would be constructed (Chainage 2150), this would be approximately 300m west of the Blue Route option. The northern arm, which would consist of a 465m length of dual carriageway, would connect into the HA's Junction 11A proposals. The west arm, consisting of a 300m length of wide single carriageway, would connect to Sundon Road by means of a new roundabout. This section

of road would be at grade with the existing ground level.

- 2.4.22 The total length of the Orange Route would be 2.60km, with a further 0.3km for the link to Sundon Road.

Structures

- 2.4.23 Where the routes cross the Houghton Brook watercourse the Environment Agency has expressed a preference for clear span structures to be used as opposed to culverts. The structures would not only span the watercourse but also the adjacent river bank to allow a wildlife corridor to continue beneath the new road. All of the river crossings would provide capacity for a 1 in 100 year flood event.
- 2.4.24 Where the routes cross existing ditches, culverts would be used to divert the ditch beneath the carriageway. Opportunities to maintain wildlife connectivity through these culverts will be explored during the Stage 3 Assessment.
- 2.4.25 Central Bedfordshire Council have expressed a wish to provide a grade separated crossing for an Non-Motorised User (NMU) route in the proximity of Parkside Drive / Pastures Way. The viability of incorporating this provision as part of the river crossing will be investigated during the Stage 3 Assessment, as this would increase the headroom and span of the structure (see also section 2.4.29 below).
- 2.4.26 A 70m long, 2.5m high retaining wall would be provided (for all options) opposite the new Wheatfield Road priority junction (Chainage 200 to 270) to prevent the proposed embankment from encroaching into the existing cycle track running adjacent to Sandringham Drive.

Road Lighting

- 2.4.27 The first 1.0km of all three routes would be lit due to the presence of priority junctions and pedestrian at-grade crossing facilities. For the north eastern end of the route only the junctions would be lit. The proposed lighting would consist of 10m high columns with full cut-off lanterns to minimise light overspill and environmental intrusion.

Noise Barriers

- 2.4.28 The first 1.0km of all three routes passes close to existing residential properties. It is assumed that noise barriers will be installed along the majority of this section of road to reduce traffic noise levels; such barriers would also provide some visual screening and separation for nearby properties. See chapter 13 for further information.

Provision for Non Motorised Users

- 2.4.29 Where each route option crosses existing public rights of way or other significant pedestrian routes, at grade crossing points would be provided. Where practicable the crossing points

would be located at the junctions. Details are shown on Figures 2.1 to 2.6, and are also described in chapters 11 and 14.

- 2.4.30 Consultation with Central Bedfordshire Council has identified a potential need to provide a grade separated crossing facility at Parkside Drive/ Pastures Way, probably by making use of one of the proposed river crossings. This crossing would provide for the National Cycle Network Route 6 which currently uses Parkside Drive, as well as making provision for pedestrian use. The viability of incorporating this NMU route as part of the river crossing will be investigated during the Stage 3 Assessment.

Exchange Land

- 2.4.31 The area to the south of Houghton Brook between Sandringham Drive and Wheatfield Road has no formal open space designation, but is used for informal recreation. It was designated as a proposed urban open space in the South Bedfordshire Local Plan Review (2004) (see chapter 10). Policy R3 of the Local Plan describes the proposal, for '*land between Houghton Brook, Sandringham Drive and Wheatfield Road*', totalling 7.43ha, as:

'ENHANCEMENT AND APPROPRIATE MANAGEMENT OF EXISTING OPEN AREA FOR A MIX OF FORMAL AND INFORMAL RECREATION IN ACCORDANCE WITH DETAILED PROPOSALS TO BE DRAWN UP BY THE DISTRICT PLANNING AUTHORITY'

- 2.4.32 The view has therefore been taken in this assessment that the land subject to this policy is currently informal Public Open Space.

- 2.4.33 Where a road scheme would result in the loss of '*land forming part of a common, open space, or fuel or field garden allotment*', there is provision under the Highways Act (1980) for land to be acquired which will be provided as open space in exchange for the land to be lost - this is known as Exchange Land. In this case, while the land to the south of Houghton Brook is not a formal Public Open Space, parts of it are an open space in the general sense, as they are used by the local community and the area is proposed to be developed as an urban open space. The decision has therefore been taken that Exchange Land should be provided, of an equivalent area and character, for the land taken by the scheme to the south of Houghton Brook which was proposed as an open space in the Local Plan.

- 2.4.34 The area of landtake to the south of Houghton Brook is around 5.0ha for the road and associated drainage ponds (not all of the area designated for future open space would be taken), and an equivalent area of Exchange Land to provide for formal and informal recreation would therefore be required. The landscape proposals drawings (see chapter 10) show approximate locations and areas where this could be provided. No attempt has been made at this stage to accurately calculate the areas required, or to show exactly where this land would be provided - that exercise would form part of the Stage 3 work. However, the landscape drawings do show that it would be possible in principle to provide the appropriate area of land, and also show how that land could be laid out to integrate with the scheme

landscape proposals and also with wider aspirations for Green Infrastructure provision in the area surrounding the scheme.

- 2.4.35 There is also a small area of similar open space at the south end of Wheatfield Road which is within the LBC area. This is not subject to the above policy, but is contiguous on the ground with the land discussed above, and is used in the same way. The Luton Local Plan contains Policy LC1, which seeks to protect green spaces, and states that development will not be permitted on green spaces unless (under criterion B):

‘the existing green space is replaced by an alternative which is:

- (i) of at least equivalent size, quality and accessibility; and*
- (ii) in a suitable location within the vicinity; and*
- (iii) operational prior to the development being commenced.’*

- 2.4.36 For these reasons the area of open space within LBC will be included in the detailed calculation of the area of Exchange Land to be provided - this will be undertaken as part of the Stage 3 work.

2.5 Scheme Implementation and Programme

- 2.5.1 The current programme is for design development to continue over the autumn of 2012, with a view to preparing the Stage 3 design and assessment, including an ES and other information needed for an application for Development Consent, by early 2013.
- 2.5.2 Subject to completion of the statutory process, any required advance mitigation measures (including archaeological works) could commence in 2014, and be completed by 2015. Construction of the new road could then commence in 2015 or 2016, dependent on approval for the construction funding and also on how the construction would be linked to that of the A5-M1 Link, which is programmed to commence in 2014.
- 2.5.3 Once completed, the road would be maintained by Bedfordshire Highways as part of the local highway network.

2.6 Alternatives Considered

- 2.6.1 The Stage 1 assessment considered three route options, one to the east and two to the west of Houghton Regis, and each with some minor variations. These routes were subject to extensive public consultation in 2009. The preference from the consultation was for an eastern route.
- 2.6.2 The Stage 1 environmental assessment also concluded that an eastern route would be preferable in terms of likely effects, and it is this eastern option which now forms the preferred route corridor, with the objective of the Stage 2 assessment being to choose between the three route options currently under consideration within that corridor. A fourth

option was discounted early in the Stage 2 assessment as it was very similar to the Blue Route.

2.7 Mitigation and Enhancement

- 2.7.1 An important part of the environmental assessment process is that it should be iterative, with continued feedback of the results of the assessment into the scheme design, with the intention of designing out, as far as possible, adverse effects. This can be by amendment of the design such that adverse effects are avoided, or by the incorporation within the scheme of measures designed to mitigate (or reduce) the effects. Finally, where effects cannot be avoided or reduced, it may be possible to provide some compensation for adverse effects by the provision of an appropriate benefit elsewhere.
- 2.7.2 There is also the possibility of environmental enhancement - the new NPPF (section 11, see also chapter 9) notes that gains in biodiversity should be provided where possible, in addition to minimising adverse effects. This has been considered in the scheme design, and areas where enhancement is likely are noted in the various topic chapters of this EAR. Land can only be acquired if it is required for construction of the scheme or for mitigation of adverse effects. However, it would still be possible to treat the land which is required for mitigation in such a way that some enhancement also results.
- 2.7.3 The EAR reports the assessment and mitigation measures as they currently stand - as the iterative design and assessment process continues into Stage 3, it is likely that the mitigation measures will be further developed and refined, with the aim of further reducing adverse effects.
- 2.7.4 It should also be noted that the mitigation measures set out in this EAR are at the moment outline only, and will be developed as the assessment and scheme design proceed in parallel.

2.8 Environmental Assessment Undertaken to Date

- 2.8.1 A Stage 1 Environmental Assessment was undertaken by Owen Williams in 2007, and reported in the 'Environmental Assessment Stage 1 Report', April 2007. This was a desk-based study, covering the main environmental topics set out in Volume 11 of the DMRB, and involved the production of outline Appraisal Summary Tables (ASTs) for each of the route options then under consideration, to summarise the results of the assessment.
- 2.8.2 The Stage 1 assessment concluded that a route to the east of Houghton Regis would be preferable in terms of likely environmental effects.

2.9 Further Environmental Assessment

- 2.9.1 The next stage in the environmental assessment for the scheme will be the Stage 3 assessment, which will proceed in tandem with the developing design. The Stage 3 assessment has already (as at October 2012) commenced, and a formal Scoping Report was produced in September 2012, for comment by the statutory consultees.

3 Consultation

3.1 General

- 3.1.1 Volume 11 of the DMRB suggests that the statutory environmental bodies (i.e. the 'principal council' (in this case Central Bedfordshire Council), Natural England, English Heritage and the Environment Agency) and also local authorities and other public authorities with environmental responsibilities and other key stakeholders should be consulted to check that the proposed scope of assessment and issues to be addressed are appropriate.
- 3.1.2 It is also generally recognised good practice to inform and consult the local community during the development of proposals for significant projects.

3.2 Consultation Undertaken to Date

- 3.2.1 A number of statutory and local bodies were consulted during the Stage 1 Environmental Assessment, as noted above, and the results of that consultation were incorporated into the Stage 2 Scoping Report where appropriate.
- 3.2.2 A Scoping Report for the Stage 2 environmental assessment was prepared and circulated to a range of environmental bodies in April 2010. The purpose of this exercise was to seek views on the proposed scope of assessment, rather than on the merits or otherwise of the scheme and individual route options. The scoping exercise is described in chapter 4 of the EAR, with detailed comments received set out in Appendix 1.

3.3 Proposed Consultation

- 3.3.1 It is proposed to undertake the following further consultation during Stage 3 of the scheme design and assessment:
- A Scoping Report for the Stage 3 environmental assessment and the preparation of the ES has been prepared and submitted to the National Infrastructure Directorate (NID) in September 2012. Once that report has been approved by the NID it will be circulated to the consultation bodies by the NID, for information and comment on the proposed scope of assessment - any comments can be taken on board as the assessment proceeds. These bodies include local authorities within whose area the scheme is located (CBC and LBC) and any local authorities whose areas border CBC or LBC, and also the bodies listed (where relevant) in Schedule 1 of the Infrastructure Planning (Applications; Prescribed Forms and Procedure) Regulations, including:
 - Natural England
 - English Heritage

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- Environment Agency
 - Commission for Architecture and the Built Environment
 - Highways Agency
 - Town and Parish Councils
 - Internal Drainage Boards
 - Chilterns Area of Outstanding Natural Beauty (AONB) Conservation Board
- A number of other bodies not included in Schedule 1, who were consulted as part of the Stage 2 scoping exercise, will also be consulted by Amey as part of a parallel process, again for information and comment on the proposed scope. These include:
 - CPRE (Campaign to Protect Rural England)
 - Bedfordshire Wildlife Trust
 - British Horse Society
 - Ramblers
 - Friends of the Earth
 - Sustrans

3.3.2 Further consultation will then take place during Stage 3 of the scheme design and assessment. This will include continuing informal consultation with the statutory environmental bodies and key stakeholders as the environmental assessment proceeds towards publication of the Environmental Statement for the scheme, in order to obtain information for the assessment and to seek the views of those bodies on the appropriate level of assessment and the emerging effects. It will also include a public information/consultation exercise in November 2012.

3.3.3 On completion of the Environmental Statement a Statutory Consultation and Community Consultation will be undertaken by CBC, as required by the Planning Act 2008, and a wider range of bodies will be consulted at that stage to establish whether they have any comments on the proposed scheme.

4 Methodology

4.1 Design Manual for Roads and Bridges

- 4.1.1 The general methodology and guidance for the environmental assessment of the scheme is that set out in the HA's Design Manual for Roads and Bridges (DMRB), with Volume 11 ('Environmental Assessment') of the DMRB providing specific relevant guidance. The DMRB is intended for the assessment of trunk roads and motorways, but is the most relevant and applicable set of guidance for the assessment of all highways projects, and has therefore been adopted for the assessment of the scheme.
- 4.1.2 Volume 11 is in the process of updating and revision by the HA, with some topics having been updated relatively recently (for example Noise and Vibration in November 2011), while others are now somewhat outdated. Sections 1 and 2 of Volume 11, which provide overall guidance on environmental assessment and the structuring of environmental reports, have been revised, and some of the individual topic guidance does not now conform with this overall advice. In order to cope with this situation, the HA have issued Interim Advice Note (IAN) 125/09, 'Supplementary Guidance for Users of DMRB Volume 11'.
- 4.1.3 This IAN states that the new reporting structure should be followed, introducing new topic headings such as 'Effects on All Travellers', and that where new guidance to match those topic headings has not been prepared, a combination of relevant aspects of the existing topic guidance should be followed as appropriate. Where the existing topic guidance is dated, the IAN suggests that other industry best practice or published guidance may be used. This advice has been followed for the assessment reported in this EAR.
- 4.1.4 Other IANs which have been taken into account in the assessment include:
- IAN 130/10, 'Ecology and Nature Conservation: Criteria for Impact Assessment'
 - IAN 135/10, 'Landscape and Visual Effects Assessment'
 - IAN 153/11, 'Guidance on the Environmental Assessment of Material Resources'.
- 4.1.5 The latest DMRB guidance is for the level of environmental assessment at each stage of the project to be determined according to what is appropriate and necessary in order to establish the likely level of environmental effects which may inform a project decision, and that this level of assessment may vary between topics. Volume 11 now uses the terms Simple and Detailed assessments, each of which can take place at various stages of the project. For example, if it is established at an early date that a given project will have no effects in terms of ecology, it may not be necessary to carry out further, more detailed assessment as the project proceeds, or (conversely) if it is evident from the outset that significant effects in terms of water quality are likely to occur, then a Detailed assessment may be appropriate at an early stage. A combination of Simple and Detailed assessments has therefore been used in the preparation of the EAR, as set out in the methodology sections of the individual topic chapters in this EAR.

WebTAG

- 4.1.6 For some topics, where the current Volume 11 guidance is somewhat out of date, some aspects of the HA's Transport Analysis Guidance (TAG), available on the HA's WebTAG web site, were also followed for the assessment.

4.2 Scoping

- 4.2.1 A Scoping Report for the Stage 2 environmental assessment was prepared and circulated to a range of environmental bodies in April 2010. The purpose of this exercise was to seek views on the proposed scope of assessment, rather than on the merits or otherwise of the scheme and individual route options.

- 4.2.2 The Scoping Report was sent to the following bodies:

- English Heritage
- Environment Agency
- Natural England
- Central Bedfordshire Council
- Luton Borough Council
- Campaign to Protect Rural England (Bedfordshire)
- Chilterns Area of Outstanding Natural Beauty (AONB) Conservation Board
- Dechert LLP (Agents for The Crown Estate)
- Friends of the Earth
- Ramblers
- Sustrans
- The Wildlife Trust (Bedfordshire)
- The Wildlife Trust (Hertfordshire)

- 4.2.3 The detailed comments received are set out in Appendix 1, which also includes a summary table showing the main points raised by the consultees, together with the way in which the comments were taken on board in the assessment.

4.3 Significance Criteria

- 4.3.1 The assessment has focused on the likely significant effects on the environment, in accordance with the guiding legislation for EIA in the UK (EC Directive 85/337/EEC, as amended by Directive 97/11/EC), which states that '*the likely significant environmental effects*' should be taken into account in decision making. While it is necessary to assess all

potential effects to some degree in order to determine which of them may be significant, the assessment has sought to identify which of the effects assessed should be regarded as of enough significance to be taken into account in the decision making process. Each of the following topic chapters therefore sets out the criteria under which the significance of the effects for that topic has been assessed. Where possible this is by reference to published guidance or good practice, and the DMRB Volume 11 Section 2 Part 5 'Assessment and Management of Environmental Effects' (HA 205/08) provides guidance in chapter 2 on determining the significance of environmental effects. Table 4.1 below is a reproduction of Table 2.4 in that chapter, based on the interaction between the sensitivity of the resource affected and the magnitude of the change affecting it.

4.3.2 It should be noted that some of the guidance on which individual topic chapters are based uses the term 'magnitude of impact' to describe the change brought about by the scheme, whereas other guidance use 'degree of change'. In either case, this is then combined with the sensitivity of the resource affected to determine the significance of the resultant effects, as set out in Table 4.1.

4.3.3 The Summary of Significant Effects in section 16.2 of the EAR takes any effects of moderate or greater significance (whether beneficial or adverse) as being of significance to the decision making process, and summarises those effects for ease of reference.

Table 4.1 ~ Determining the Significance of Effects (General)						
		Magnitude of Impact (Degree of Change)				
		No change	Negligible	Minor	Moderate	Major
Environmental Sensitivity	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Slight or Moderate	Moderate or Large
	Lower	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Notes:

1. The above is reproduced from DMRB Volume 11 Section 2 part 5 (HA 205/08).

5 Geology & Soils

5.1 Introduction, Methodology & Study Area

Introduction

- 5.1.1 Geological strata directly influence the geomorphological character of an area, through the evolution of landforms. Soils are derived from the underlying geology and the composition of the bedrock and superficial deposits are reflected in the chemistry and structure of the soil. These in turn contribute to the type of vegetation, to biodiversity, to the habitat type and its potential for agriculture and/or horticulture.
- 5.1.2 Deep and shallow excavations associated with construction works may result in the destruction or loss of geological strata and/or soils. In some instances opportunities may arise for the creation of new and valuable geological exposures that can be used for scientific and educational purposes. Soils adjacent to construction works and the highway, once completed, may also be affected by spray or airborne pollutants. Previous land uses on a site may have led to ground contamination which may determine what developments and working methods are appropriate for the site and how it must be treated. These potential effects will be considered in the assessment.

Methodology

- 5.1.3 The geology and soils assessment has been undertaken according to Highways Agency guidance in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 11.
- 5.1.4 A ground investigation was undertaken by Geotechnics Ltd between 1 and 18 March 2010. Available reporting for this includes a Preliminary Sources Study Report (Amey, 2009) and a Ground Investigation Report (Amey, 2010). The Preliminary Sources Study Report includes an Envirocheck Report (Landmark Information Group, 2009). Published geological and soils records including mapping and other publications have also been consulted. Online records of Natural England and the Joint Nature Conservation Committee have been interrogated and liaison with Natural England has been undertaken.
- 5.1.5 The purpose of the ground investigation was to determine preliminary information on the ground conditions underlying the proposed scheme and to allow recommendations for geotechnical parameters for design. For this reason the factual logs included in the subsequent report were logged to geotechnical standards (British Standards Institution, 2007) and therefore stratigraphical information was limited.

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- 5.1.6 The ground investigation included 5 cable percussive boreholes, 32 trial pits, and 16 cone penetration tests (see Figure 5.1). Borehole depth varied from 13.4 to 15.0m. Trial pits were undertaken to depths of between 2.0 and 4.5m. Insitu testing and sampling were undertaken in the boreholes and trial pits to allow subsequent geotechnical and contamination laboratory testing. Cone penetration tests were undertaken to depths of between 4.34 and 18.36m and used a gamma cone to differentiate superficial deposits from chalk.
- 5.1.7 Contamination assessments to date have been undertaken in accordance with the Highways Agency's guidance note HD22/08 for purposes of geotechnical design. Those completed to date may not meet the requirements of the NPPF and/or CLR11 (see sections 5.1.17 and 5.1.19 below). A Phase 1 contaminated land assessment will need to be undertaken as part of the Stage 3 environmental assessment.
- 5.1.8 Hydrology and hydrogeology, including groundwater source protection zones and aquifer designations, which are sensitive issues in this area, are discussed in chapter 6 (Road Drainage and the Water Environment).

Study Area

- 5.1.9 The study area lies to the south and east of Houghton Regis, Bedfordshire. It comprises agricultural land associated with Chalton Cross Farm, enclosed by Sundon Road to the north, the M1 motorway to the east, and by urban development at Dunstable and Houghton Regis to the south and west, respectively. It also includes a narrow wedge of land to the south of Parkside Drive, enclosed by Sandringham Drive to the north and Wheatfield Road to the south.

Regulatory and Policy Framework

- 5.1.10 **Groundwater Regulations 2009.** The European Groundwater Directive (80/68/EEC) has been incorporated into UK law through the Groundwater Regulations 2009. The European Groundwater Directive (80/68/EEC) aims to protect groundwater from pollution by controlling discharges and disposals of certain dangerous substances to groundwater. In the UK, the directive is implemented through the *Environmental Permitting (England and Wales) Regulations 2010*. The existing Groundwater Directive is to be repealed by the Water Framework Directive 2000/60/EC (WFD) in 2013.
- 5.1.11 **The Contaminated Land (England) Regulations 2006 SI 1380.** These regulations set out provisions for the identification and remediation of contaminated land. The regulations identify sites that require regulation as 'special sites' and add land contaminated by radioactive substances to the classification.

5.1.12 **The Environment Act 1995.** This act established the Environment Agency and gives it responsibility for regulating pollution control, water, general environmental and recreational duties, environmental duties relating to SSSIs, regional and local fisheries and flood prevention control. Part II sets out a system to identify and repair or remediate contaminated land and amends the *Water Resources Act 1991* to make significant changes to laws on water pollution from abandoned mines.

5.1.13 **The Environmental Protection Act 1990** establishes businesses' legal responsibilities for the duty of care of waste, contaminated land and statutory nuisance.

5.1.14 National planning policy guidance on development involving agricultural land is now set out in the **National Planning Policy Framework** (NPPF, 2012). This states in paragraph 112 that:

'Local planning authorities should take into account the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality.'

5.1.15 The NPPF also contains guidance on ground conditions and pollution in paragraph 121, stating that a site should be *'suitable for its new use'*, and also that *'adequate site investigation information, prepared by a competent person'*, should be presented

5.1.16 The study area falls under the planning jurisdiction of CBC and LBC. All the farmland the proposed route passes through is in the CBC area. Until a new Local Development Framework is adopted under the government's planning regime, relevant local plan policy is set out in the South Bedfordshire District Local Plan Review (SBDLPR) (2004). On 27 September 2009 the Secretary of State directed which policies of the SBDLPR will continue to form part of the Development Plan under Paragraph 1(3) of Schedule 8 to the Planning and Compulsory Purchase Act (2004). With regard to agricultural land, Policy NE10 was saved and therefore remains as local planning policy, as follows:

'The District Planning Authority will give favourable consideration to proposals to diversify farm units and change the use of agricultural land to other uses provided that the proposed development: ... (iv) does not result in the irreversible loss of the best and most versatile agricultural land (Grades 1-2-3a)...'

Best Practice Guidance

5.1.17 Standards the scheme should follow are CLR 11 (Defra & Environment Agency, 2004) and BS10175 (British Standards Institution, 2001). CLR 11 sets out the UK approach to the assessment and management of land contamination, taking into account the land use and environmental setting of the site. BS10175 covers a technical approach to land contamination assessment and evaluation of risk.

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- 5.1.18 The Soil Strategy for England (Defra, 2009) aims to protect and improve soils to meet an increasing demand for food and to help mitigate the adverse effects of climate change. Paragraph 6.14 of the Strategy states that Defra and the Department for Communities and Local Government will review:

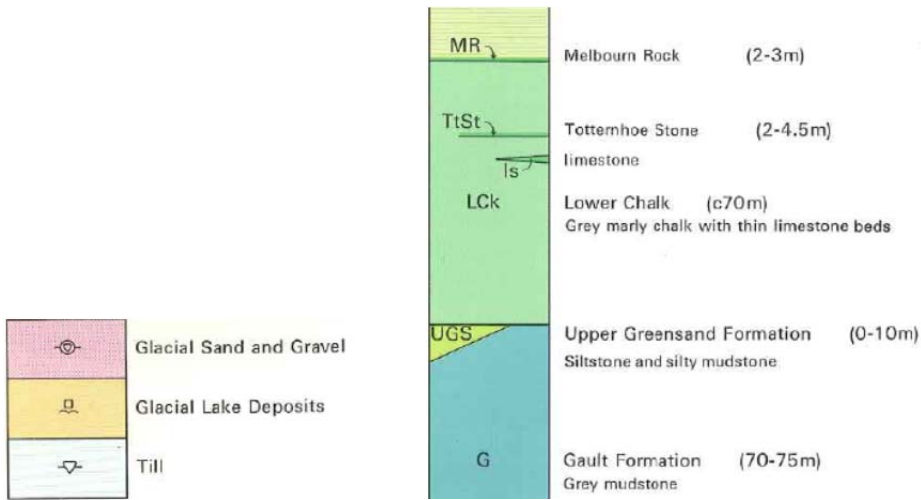
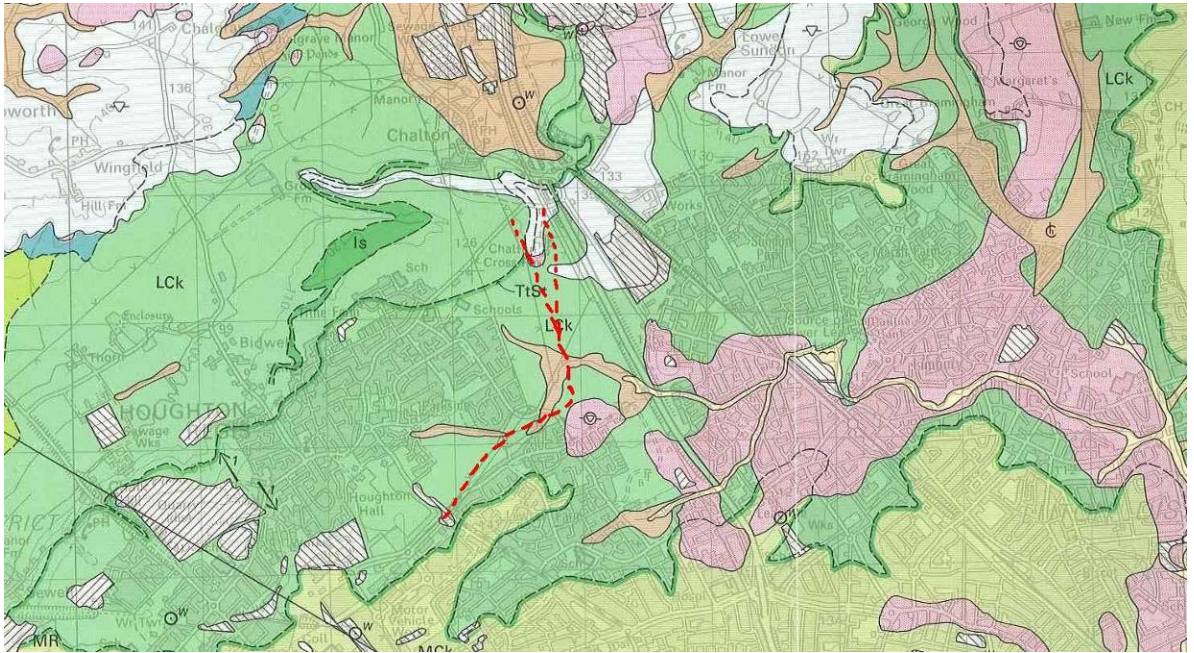
'Planning policy on agricultural land requires local planning authorities to take account of the presence of best and most versatile agricultural land (BMV) (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) alongside other sustainability considerations (e.g. biodiversity and the quality and character of the landscape) when determining planning applications.'

- 5.1.19 The Soil Strategy was published in tandem with a 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' (Defra, 2009).

5.2 Baseline Conditions

Bedrock Geology

- 5.2.1 An extract of the British Geological Survey geological map (BGS, 1992) of the area around the proposed scheme at Stage 1 is shown in the figure below. The bedrock geology underlying the route(s) is shown to belong to the Lower Chalk of the Upper Cretaceous. Since the publication of the geological map, the term Lower Chalk has been superseded.
- 5.2.2 In November 1999 a meeting was held co-sponsored by the BGS and the Stratigraphic Commission of the Geological Society to standardise chalk nomenclature in the United Kingdom (Hopson, 2003). As a result the terms 'Lower, Middle and Upper Chalk' were superseded by a formational framework, which was applied to two stratigraphically distinct regions; the Northern Province and the Southern Province. A Transitional Province was designated covering the chalk between the Southern Province of south east England and the Northern Province of Yorkshire and north Norfolk. In the Transitional Province, terminology from the Southern or Northern Provinces may be applied, although the framework for the Southern Province is generally accepted. The site of the proposed scheme lies within the Transitional Province.
- 5.2.3 The new formational framework (Hopson, 2003) partially replaced the Lower Chalk with the Grey Chalk Subgroup, the lower of two subgroups within the Chalk Group. The upper part and remainder of the Chalk Group is the White Chalk Subgroup. The Grey Chalk was in turn subdivided into the Zig Zag Chalk Formation and the West Melbury Marly Chalk Formation, which form the lower and upper subdivisions respectively.



▲ Extract of BGS (1992) showing bedrock and superficial geology underlying and surrounding the proposed Woodside Connection. The approximate line of the scheme is shown as a red, dashed line.

[C10/014-CCSL] British Geological Survey © NERC. All rights reserved.

5.2.4 Also shown on the geological map (BGS, 1992) are the Melbourne Rock and the Totternhoe Stone. The Totternhoe Stone has a south west to north east strike and runs along the northern outskirts of Houghton Regis. The northern extents of the proposed scheme cross over the Totternhoe Stone. The Melbourn Rock lies on a similar strike about 20m south west of the southern end of the scheme.

5.2.5 The Totternhoe Stone forms a distinct member, the Totternhoe Stone Member, which forms the lower boundary of the Zig Zag Chalk Formation with the underlying West Melbury Chalk Formation. The Melbourn Rock is now also referred to as a distinct member, the Melbourn

Rock Member, within the Holywell Nodular Chalk Formation, the lowermost formation of the White Chalk Subgroup. The Melbourn Rock Member is underlain by the Plenus Marls Member (not shown) and this forms the boundary between the Grey Chalk Subgroup and the White Chalk Subgroup. The Chalk comprising the bedrock geology underlying the site is summarised in Table 5.1 below.

5.2.6 For the purposes of the ground investigation (Amey, 2010) the chalk was not differentiated to Formation level. Chalk was encountered underlying the majority of the scheme summarised as ‘a grey medium density chalk’ with ‘a high clay content and flints are uncommon’. The Totternhoe Stone was not encountered in any exploratory holes.

Table 5.1 ~ Characteristics of Chalk Bedrock						
Group	Subgroup	Formation	Thickness	Member	Thickness	Description
Chalk Group	White Chalk Subgroup	Holywell Nodular Chalk Formation	10 to 15 m			Typically hard nodular chalks with thin flaser marl. In parts significant proportions of shell debris occur.
				Melbourn Rock Member	2 to 7 m	Hard to very hard, grey, blocky, fractured chalk with many nodular chalk beds and thin flaser marls. Can be distinguished from overlying beds by its lack of shell material.
				Plenus Marls Member	1 to 1.5 m	Interbedded marls and chalks
	Grey Chalk Subgroup	Zig Zag Chalk Formation	35 to 50 m			Generally firm pale grey and greyish white blocky chalk. The lower part is characterised by rhythmic alternations of marls, marly chalks and firm white chalk. Thin gritty silty, chalk beds act as marker horizons.
				Totternhoe Stone Member	0.3 to 6 m	Brownish grey, hard, fine grained, thinly to thickly bedded, fossiliferous calcarenite. Dark brown phosphatic pellets and nodules occur with a diameter of a few millimetres to several centimetres.
	West Melbury Formation	15 to 25 m			Beige, grey and white, soft, marly chalk and pairs of hard grey limestones.	

Superficial Geology

- 5.2.7 As shown on the geological extract, deposits of Quaternary glacial sand and gravel, till and head are shown to underlie localised parts of the study area.
- 5.2.8 A small outcrop of till, dating to the Anglian glaciation and contemporaneous with the Lowestoft Till and North Sea Drift, lies at the northern extent of the study area. This is a lodgement till, formed by deposition (by plastering) of the load carried by a moving glacier (Trenter, 1999) and is likely to comprise blueish grey overconsolidated clay with clasts of chalk, flint, sandstone and limestone. The sandstone and limestone are derived from the Triassic Sherwood Sandstone Group and from the Jurassic respectively. Igneous erratics, with a much more northerly provenance, may also occur. The proportion of clasts to clay is likely to increase toward the base of the deposit.
- 5.2.9 Superficial deposits of glacial sand and gravel lie less than 100m south east of the route options, falling within the study area. These are typically variable and contain sands and gravels, which contribute to a high permeability, with smaller amounts of silts and clays. The deposit dates to the Anglian glaciation and is related to the slightly older till. The glacial sands and gravels were deposited by glacial streams and outwash marginal to a retreating glacier.
- 5.2.10 A band of head roughly following Houghton Brook, a tributary to the River Lea, and less than 100m wide, crosses the study area at two locations. Head comprises slope deposits formed by solifluction and hill wash and is derived from locally occurring older strata. In this area head is derived from earlier Quaternary deposits of glacial sand and gravel and till and is likely to be composed of grey brown, sandy gravelly clays. Any chalk clasts are likely to have been lost by solution (Shephard-Thorn et al, 1994). Some fractured flints may occur.
- 5.2.11 For the purposes of the ground investigation (Amey, 2010) the superficial deposits were not differentiated. They were encountered in the area around Chalton Cross Farm, where they were described as '*sand and gravel*', probably till. Undifferentiated superficial deposits, probably alluvium, were encountered in low lying areas around Houghton Brook. Here they were described as '*generally poorly stratified containing clay, silt, sand and gravel of chalk and flint*' and were encountered with a thickness of less than 1m.

Designated Sites

- 5.2.12 A search for designated sites was conducted and Natural England was consulted. There are no geological Sites of Special Scientific Interest (SSSIs) or Geological Conservation Review sites in the study area.
- 5.2.13 Nearby geological designated sites lying outside the study area include the following (Natural England, 2010 and Joint Nature Conservation Committee, 2010):

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- Totternhoe Stone Pit Quarry SSSI and GCR lies north of the village of Totternhoe, about 4km west of the study area. This contains the only locality where the Totternhoe Stone Member is well exposed and represents an important fish fossil bearing horizon, which has yielded many taxa of small sharks.
 - Kensworth Chalk Pit SSSI and GCR lies 3km south of the study area. This is a working quarry in which the New Pit Chalk Formation and the Lewes Nodular Chalk Formation, including the Chalk Rock Member, Kensworth Nodular Chalk Members and the overlying Top Rock Bed, are exposed. The site is one of the three most important remaining sources of Chalk Rock ammonites.

Soils

- 5.2.14 Soil records (Soil Survey of England & Wales, 1983) indicate the soils underlying the study area belong to the Wantage 1 and Swaffham Prior Soil Association. The Wantage 1 Association underlies the central section of the study area and comprises well drained calcareous silty soils.
- 5.2.15 The Swaffham Prior Association underlies the northern and southern extents of the study area and comprises well drained calcareous coarse and fine grained loams over chalk rubble. It may become non-calcareous where it is deep and it has a slight risk of water erosion. This Association typically overlies chalk and superficial deposits containing chalk.
- 5.2.16 The records of Defra (Ministry of Agriculture, Fisheries & Food, 1996) show the agricultural land within the study area to be very good quality, Grade 2 (see chapter 11 and Figure 11.1 for further details).
- 5.2.17 This map was originally produced during the 1960s when MAFF created a series of maps showing the provisional Agricultural Land Classification (ALC) grade of agricultural land throughout England and Wales. Since 1976, selected areas have been re-surveyed in greater detail and to revised guidelines and criteria. Information based on detailed ALC field surveys in accordance with current guidelines is the most definitive source. Revisions to the ALC guidelines and criteria have been limited and kept to the original principles, but some assessments made prior to the revision may need to be checked against current criteria. The guidelines introduced in 1988 with improved criteria for climatic limitations and climate-soil interactions adopted only two Subgrades for Grade 3 (Natural England, 2009).
- 5.2.18 All of the agricultural land within the Study Area is part of a single agricultural holding known as Chalton Cross Farm. The land is let on an agricultural tenancy to a contract farm business, Sentry Farms Ltd, whose registered address is Chalton Cross Farm, Houghton Road, Luton, Beds LU4 9TX.

Contamination

- 5.2.19 During scoping studies for this project (Amey, 2010) the Environmental Health department of the former South Bedfordshire District Council confirmed that no land within the district had at that time been formally designated as contaminated under Part 2A of the Environmental Protection Act 1990. However, they advised that this should not be taken to imply that the land or adjoining land is free from contamination and any risk should be assessed on a site-by-site basis.
- 5.2.20 Subsequent to local government reorganisation and the creation of Central Bedfordshire Council (CBC), Amey were advised (by CBC) that contaminated land data is held on its geographical information system (GIS). CBC requested that a Phase 1 contaminated land investigation be undertaken as part of the Stage 3 environmental assessment and be submitted with the application for Development Consent for the scheme.
- 5.2.21 Discharge consents, local authority pollution and prevention controls, pollution incidents and landfill records identified by the Envirocheck report (Landmark Information Group, 2009) are summarised in Table 5.2 below.
- 5.2.22 Other sources of pollution identified during the Preliminary Sources Study Report (Amey, 2009) include the following
- Chalton Cross Farm buildings.
 - A builder's yard/plant yard near Chalton Cross Farm.
 - Made ground at the southern end of the scheme.
 - Agricultural land with residual pesticides and fertilisers.
- 5.2.23 During the ground investigation (Amey, 2010), made ground was encountered in 3 trial pits at the south end of the scheme, near Poynters Road. This was described as '*locally-derived material i.e. sandy gravelly clays with occasional extraneous matter*'.

Table 5.2 ~ Discharge Consents and Local Records

Address	Distance from site	Feature	Description	Date
Homestead Farm Partners, Chalton Cross Farm, Houghton Road, Luton	On site	Discharge consent	Trade discharge (agriculture and surface) onto land	27/03/00
Mr B Trustam, 1 Chalton Cross, Luton Road, Chalton	105m east	Discharge consent	Sewage discharge (final treated effluent) into land	10/01/85
Mr WFA Nisson, 4 Chalton Cross, Luton Road, Chalton	112m north east	Discharge consent	Sewage discharge (final treated effluent) into land	24/07/87
FR Searle, Long Meadow Farm, Chalton Cross, Chalton	186m north	Registered Landfill Site	No known restriction on source of waste	01/04/85
Frederick Richard Searle, Long Meadow Farm, Chalton Cross, Chalton	249m north	Historical Landfill Site	Deposited waste including inert waste	03/04/85 to 10/05/86
Long Meadow Farm, Sundon Road, Chalton	249m north	Local Authority Landfill Site	Category A	Closed 31/12/92
n/a	296m north	Substantiated Pollution Incident	Category 2 significant incident with land impact involving inert materials and wastes (soils and clay)	25/01/03
Scapa (UK) Ltd., Humphreys Road, Houghton Regis, Dunstable	365m south west	Local Authority Pollution Prevention and Control	PG6/32 Adhesive coating	05/10/93
Mr R Scanes, Windermere, Sundon Road, Chalton	395m north east	Discharge consent	Sewage discharge (final treated effluent) into land	11/07/85
Apelis Developments Ltd., Houghton Hall Parkl, Off Porz Avenue, Dunstable	406m south west	Discharge consent	Land/soakaway into Lower Chalk	17/09/90 to 16/06/94
Mr & Mrs Jamin, Hampstead House, Sundon Road, Chalton	412m north east	Discharge consent	Sewage discharge (final treated effluent) into land	01/03/05
Mr D Foster, Hazelhurst, Sundon Road, Chalton	438m north east	2 no. discharge consent	Sewage discharge (final treated effluent) into land and into land via borehole	30/06/05 to 27/02/06 and 05/07/05
Wilbury Filling Station, Poynters Road, Dunstable	467m south	Local Authority Pollution Prevention and Control	PG1/14 Petrol filling station	14/05/99

5.2.24 Contamination tests were undertaken on soil, soil eluate (leachability) and on water samples taken during the ground investigation. Laboratory testing included the following;

- Metal suite (As, Cd, Cr, Hg, Pb, Se, Cu, Ni, Zn).
- pH and soil organic matter.
- Petroleum hydrocarbons (total petroleum hydrocarbon criteria working group (TPHCWG - aliphatic/aromatic split).
- Speciated semi-volatile organic compounds (SVOC, to include pesticides and phenol).

-
- Others, where suspected (asbestos screen, BTEX, PAH).

Results are summarised below.

Near Surface Materials (less than 0.5m depth)

5.2.25 Soil samples retrieved from depths of less than 0.5m indicated the presence of heavy metals and organic contaminants above the limit of detection (LOD) at many locations. The contaminants included:

- Heavy metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.
- Petroleum hydrocarbons: aliphatic and aromatic hydrocarbons in the carbon range of C12 and C44.
- Polycyclic aromatic hydrocarbons (PAH) -TP1, TP2A, and TP26 only (near Poynters Road).

5.2.26 Selenium, BTEX compounds, phenols, MTBE, organochlorine and organophosphorous pesticides, triazine herbicides and asbestos were not encountered above the LOD in any location. Soil pH ranged from 8.06 to 8.81. Soil organic matter (SOM) was between <0.35 and 3.12%.

5.2.27 The results of the testing on the soil eluate indicated the presence of the following leachable contaminants in near surface ground materials:

- Heavy metals: arsenic, chromium, copper, lead and zinc.
- Selenium - TP1 and TP29 only.
- Polycyclic aromatic hydrocarbon (PAH) species - TP1, TP25,TP26 and TP29 (near Poynters Road).

5.2.28 Leachable mercury, cadmium, nickel, phenols, BTEX compounds, MTBE, petroleum hydrocarbons, organochlorine and organophosphorous pesticides and triazine herbicides were not encountered.

Subsurface Ground Materials (greater than 0.5m depth)

5.2.29 Soil samples retrieved from depths of greater than 0.5 m indicated the presence of heavy metals and organic contaminants above the LOD at many locations. The contaminants included:

- Heavy metals: arsenic, cadmium, chromium, copper, lead, mercury nickel and zinc.
- Petroleum hydrocarbons: aliphatic and aromatic hydrocarbons in the carbon range of C12 and C44.

-
- Polycyclic aromatic hydrocarbons (PAH) - TP1 samples only.
- 5.2.30 Selenium, BTEX compounds, phenols, MTBE, organochlorine and organophosphorous pesticides, triazine herbicides and asbestos were not encountered above the LOD in any sample. Soil pH ranged from 7.97 to 9.02. SOM was between 0.683 and 1.4%.
- 5.2.31 The results of the testing on the soil eluate indicated the presence of the following leachable contaminants in sub-surface ground materials:
- Heavy metals: arsenic, chromium, copper, lead, nickel and zinc.
 - Selenium - TP1 only.
 - Polycyclic aromatic hydrocarbons - TP4 and TP26 only.
 - Extractable petroleum hydrocarbons (EPH) - TP26 and TP27 only (near Poynters Road).
- 5.2.32 Leachable cadmium, mercury, phenols, BTEX compounds, MTBE and organochlorine and organophosphorous pesticides and triazine herbicides were not encountered above the LOD in any sample. The pH of the soil eluate ranged from 7.68 to 8.00.

Groundwater

- 5.2.33 The results of the analytical testing on groundwater samples indicated the presence of the following leachable contaminants:
- Heavy metals: arsenic, chromium, copper, lead, nickel and zinc.
 - Selenium.
 - Polycyclic aromatic hydrocarbons in BH3 and BH4.
 - Petroleum hydrocarbons - aliphatic hydrocarbons between carbon range C21 to C35 in BH4 only.
- 5.2.34 The contaminants cadmium, mercury, phenols, BTEX compounds and MTBE and organochlorine and organophosphorous pesticides and triazine herbicides were not encountered above the LOD in any sample. Groundwater pH ranged from 7.34 to 7.55.

Risk Assessments

- 5.2.35 As part of the Geotechnical Design Report (Amey, 2010), risk assessments were undertaken for human health, controlled waters and for waste categorisation (see chapter 6).

Human Health Risk Assessment

- 5.2.36 The results of the mean value tests for each determinand were compared with published soil guideline values (SGV) produced by the Environment Agency (EA) for human health risk

assessment (Defra & EA, 2004, EA, 2009a-c), using the industrial/commercial land use scenario. SGVs currently available and relevant to this investigation are arsenic, cadmium, mercury, nickel, selenium, phenols and BTEX compounds. SGVs for organic contaminants are applicable where soil conditions exhibit soil organic matter content (SOM) of around 6%, assuming a sandy loam.

- 5.2.37 Where published SGVs were not available or applicable to the soil conditions, the ATRISK soil database of soil screening values (SSV) was used (Atkins, 2010). These values represent generic assessment criteria (GAC) developed under the current UK approach to risk assessment. The SSVs available are for 6% SOM in a sandy loam, or 1% SOM in sand. These data sets are fully compliant with the parameters specified in the EA's SR series of guidance documents (EA, 2009a-c) and associated guidance.
- 5.2.38 Generic assessment criteria (GAC) represent 'trigger values' that may indicate if concentrations of contaminants encountered in the ground represent a significant possibility of significant harm (SPOSH) to human health. Where soil concentrations encountered are below the GAC and where the land use scenario is representative of, or conservative for, the site being investigated, it can be assumed that it is unlikely that SPOSH exists.
- 5.2.39 Environmental parameters intrinsic to the CLEA risk assessment model and the derivation of SGVs include an assumption for soil organic matter (SOM) at 6% and a sandy loam soil. A lower SOM may result in an under-protective GAC, particularly for organic compounds, whilst a less sandy soil may result in an over-protective GAC.
- 5.2.40 The ground conditions encountered typically represent both cohesive and granular materials (including made ground, slightly sandy, slightly gravelly clays and chalk). Based on this soil type, it is considered that the GAC are acceptable for use as a first tier of risk assessment, and selection of data set can be based on the SOM obtained for that sample.
- 5.2.41 The risk to human health from asbestos was assessed using the threshold published by the Inter-departmental Committee on the Redevelopment of Contaminated Land (ICRCL, 1990). Soil pH was initially assessed using the most stringent upper and lower limits from the UK drinking water standards (DWS), The Water Supply (Water Quality) Regulations 2000 Amendment Regulations 2007, and environmental quality standards (EQS), (Environment Agency, 2010).
- 5.2.42 In summary no organic or inorganic contaminant exceeded their respective GAC at any location. Several contaminants were encountered in amounts above the limit of detection but below their respective GAC. As the GAC is the point at which the contaminant becomes a risk, those that meet this definition do not necessarily present a risk.

Controlled Water Risk Assessment

- 5.2.43 The results of soil eluate tests were compared to the UK DWS and, where absent, EQS in accordance with the ground and surface water risk assessment set out in Level (Tier) 1 of the EA's Remedial Targets Methodology (Environment Agency, 2006).
- 5.2.44 Results of groundwater analysis were also subject to comparison with water quality standards commensurate with Level 2 of the methodology.
- 5.2.45 Where the DWS or EQS is exceeded a tiered approach is available. Either site remediation can be planned, or additional site-specific and physico-chemical data can be obtained. Continuation beyond Level 1 of the methodology has not been undertaken as part of this investigation.
- 5.2.46 In summary, concentrations of leachable PAH species and total PAH exceeded their threshold in near surface ground materials (less than 0.5m below ground level) in TP1. Concentrations of leachable PAH species were observed to exceed the DWS in subsurface ground materials (more than 0.5m below ground level) in TP26. Further testing to delineate the area and allow a level 2 assessment is recommended at Stage 3. However, without further testing, materials excavated from within a 65m radius of these exploratory holes should be considered Class U1b unacceptable earthworks materials and must not be re-used in earthworks without treatment. Treatment may include, but is not limited to, excavation and disposal to landfill, encapsulation within impermeable barrier systems and solidification technologies.
- 5.2.47 An exceedance of water quality standards for flouranthene and benzo(a)pyrene and total PAH was observed in water samples retrieved from BH3. No soil eluate samples were taken from trial pit locations surrounding BH3 and therefore it is not possible to derive a correlation between leachable PAH in ground materials underlying the scheme and the presence of PAH in groundwater. Further investigation of groundwater contamination should be undertaken at Stage 3. This may include the ongoing monitoring of groundwater to assess seasonal fluctuations of contamination concentration and analysis of soil eluate from ground materials taken in proximity to BH3. Additionally, further testing may aid in the identification of any potential liability issues.
- 5.2.48 In summary, a possible risk to controlled waters has been indentified in the areas surrounding TP1 (near surface) and TP26 (sub-surface). Excavated ground materials from these locations should be considered Class U1b and can be treated for re-use.

5.3 Project Proposals Including Mitigation Measures

- 5.3.1 Geology and agricultural soils may potentially be lost, destroyed or otherwise affected as a result of the scheme. Construction activities that could potentially impact on geology and soils include; groundworks for buildings, structures, highways, utilities and compounds; landscaping and earthworks including cuttings and embankments; rutting caused by movement of construction plant. Cuttings and excavations could also create new permanent or temporary geological exposures. Areas where geology and soils will be affected include those where permanent excavations are proposed for highway cuttings, and temporary excavations for the construction of foundations, culverts, and other structures.
- 5.3.2 Soils adjacent to construction works and the highway, once completed, may also be affected by spray, runoff or airborne pollutants.
- 5.3.3 There is some possibility for soils to be retained and re-used, either as part of the scheme landscape works or elsewhere. The level of damage and deterioration in soil quality during storage and transit will depend on the types of earthworks machinery used, methods of handling, weather and storage conditions.
- 5.3.4 There is still potential for some undetected areas of made or contaminated ground to be present. In these areas and those already known about, the risk of mobilising any contaminants should be considered. A Phase 1 contaminated land assessment will need to be undertaken as part of the Stage 3 assessment.

5.4 Assessment of Effects

- 5.4.1 The value of environmental assets is defined by Highways Agency guidance (DMRB volume 11, Section 2, Part 5, HA 205/08 Assessment and Management of Environmental Effects). These definitions have been interpreted from a geological and pedological perspective, and are summarised in Table 5.3 below.

Table 5.3 ~ Value (Sensitivity) of Assets

Value (sensitivity)	Description
Very High	<p>Defined as ‘<i>Very high importance and rarity, international scale and very limited potential for substitution</i>’.</p> <p>At international scale, a geological site may be designated as a UNESCO World Heritage Site. To earn this designation, the site must be able to fulfil one of ten criteria, which include the following</p> <p>‘(vii) to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance’ and</p> <p>‘(viii) to be outstanding examples representing major stages of earth’s history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features’.</p> <p>Where a site has achieved designation by criteria (vii) and this can be interpreted as geological, or a site has achieved designation through criteria (viii), the Very High value has been applied.</p> <p>If a site annexes and has the potential to yield similar or improved geologically valuable sites (through managed works associated with the construction of earthworks or structures) as a UNESCO World Heritage Site, the Very High value may also be applied.</p>
High	<p>Defined as ‘<i>High importance and rarity, national scale and very limited potential for substitution</i>’</p> <p>At national scale, a geological or pedological site may be designated as a Site of Special Scientific Interest (SSSI). This designation is notified by Natural England and where the site is of geological value it is usually based on the Geological Conservation Review (GCR). The GCR began in 1977 with the aim to record geological sites of national and international importance needed to show the key scientific elements of the Earth heritage of Britain.</p> <p>Where a site has achieved designation as a geological SSSI and as a GCR, the High value has been applied.</p> <p>If a site annexes and has the potential to yield similar or improved geologically valuable sites (through managed works associated with the construction of earthworks or structures) as a geological SSSI and GCR, the High value has also be applied.</p> <p>Most geological SSSIs are also designated as National Nature Reserves (NNR) or Local Nature Reserves (LNR). Geology and soils may also be factors that contribute to an area’s designation as a National Park or Area of Outstanding Natural Beauty (AONB).</p>
Medium	<p>Defined as ‘<i>High of medium importance or rarity, regional scale, limited potential for substitution</i>’</p> <p>Where a site has achieved designation as a GCR but has not yet notified as a geological SSSI, the Medium value has been applied.</p> <p>For agricultural land, ALC Grades 1 and 2 have been classified as Medium value.</p> <p>If a site annexes and has the potential to yield similar or improved geologically or pedologically valuable sites (through managed works associated with the construction of earthworks or structures) as a GCR, the High value has also be applied.</p>
Lower	<p>Defined as ‘<i>Low importance and rarity, local scale</i>’</p> <p>At local scale, a geological site may be designated as a Regionally Important Geological/geomorphological Site (RIGS), also synonymous with Local Geological Site in England, Local Geodiversity Site in Scotland and Regionally Important Geodiversity Site in Wales. RIGS are selected according to their value for the following;</p> <ol style="list-style-type: none"> 1. Educational fieldwork in primary and secondary schools, at undergraduate level and in adult education courses 2. Scientific study by professional and amateur Earth scientists and demonstrate the geology and/or geomorphology of an area. 3. Historical significance in terms of important advances in Earth science knowledge 4. Aesthetic qualities in the landscape, particularly in relation to promoting public awareness and appreciation. <p>Where a site has been designated as a Regionally Important Geological/geomorphological Site (RIGS) or similar in the provinces, a Lower value has been applied.</p> <p>For agricultural land, ALC Grade 3 (including 3a and 3b) has been classified as Lower value.</p> <p>If a site annexes and has the potential to yield similar or improved geologically valuable sites (through managed works associated with the construction of earthworks or structures) as a RIGS, the Lower value has also be applied.</p>
Negligible	<p>Defined as ‘<i>Very low importance and rarity, local scale</i>’</p> <p>For agricultural land, ALC Grade 4 and 5, have been classified as Medium value.</p>

5.4.2 Impacts may affect the material and mass characteristics of geology and soils assets and/or affect their geomorphological setting. The magnitude of this impact is defined by Highways Agency guidance (DMRB volume 11, Section 2, Part 5, HA 205/08 Assessment and Management of Environmental Effects). These definitions have been interpreted from a geological and pedological perspective, and are summarised in Table 5.4 below.

Table 5.4 ~ Magnitude of Impacts		
Magnitude of impact		Potential Criteria Descriptors
Major	Beneficial	Large scale or major improvement of geological sites including creation of permanent new exposures and extensive restoration or enhancement of existing exposures.
Moderate		Benefit to material and mass characteristics of geology and soils assets and/or their geomorphological setting. This may include the creation of permanent or temporary exposures, which contribute to scientific knowledge. In the case of temporary exposures the allocation of time and resources to allow experts access to record information may be necessary.
Minor		Minor benefit to material and mass characteristics of geology and soils assets and/or their geomorphological setting. Some beneficial impact on a reduced risk of negative impact occurring.
Negligible		Very minor benefit to or positive addition to material and mass characteristics of geology and soils assets and/or their geomorphological setting
No change		No loss or alteration of material and mass characteristics of geology and soils assets and/or their geomorphological setting. This would suggest that no earthworks and no temporary or permanent excavations are required.
Negligible	Adverse	Very minor loss or detrimental alteration to material and mass characteristics of geology and soils assets and/or their geomorphological setting. This is likely to include any form of excavation or earthwork
Minor		Minor measurable change in material or mass characteristics of geology and soils and/or geomorphological setting.
Moderate		Loss of resource, but not adversely affecting the integrity. May include partial loss of or damage to material and mass characteristics of geology and soils assets and/or their geomorphological setting
Major		Loss of site resource and/or quality and integrity of resource, including severe damage to material and mass characteristics of geology and soils assets and/or their geomorphological setting

5.4.3 The significance of environmental effects is determined using Table 2.4 of the DMRB Volume 11, Section 2, Part 5. This is reproduced in Table 4.1 in section 4.3 above.

5.4.4 As there are no designated geological sites, and therefore no receptors within the study area, **no adverse impacts on geological sites are identified**. The impact on ALC Grade 2 soils, which are of medium value, has a moderate adverse magnitude and **slight or moderate adverse** significance. This impact could be mitigated by careful handling of soils



during construction works.

- 5.4.5 However, due to the nature of geological designated sites (about 1 in 3 geological SSSIs are man-made), the potential for discovering valuable strata should be considered. In particular the likelihood of encountering the Totternhoe Stone Member during the earthworks stage of the highway construction could be considered. If encountered, the Totternhoe Stone could yield a valuable geological exposure and similar fossil records to that at the nearby Totternhoe Stone Pit Quarry SSSI. If monitored and managed effectively this could contribute to a **major beneficial impact** with significance of up to large or even very large.
- 5.4.6 Other important stratigraphic marker horizons that may be encountered and may offer major beneficial impacts include the Plenus Marls and Melbourn Rock Members.

5.5 Summary

- 5.5.1 There would be no adverse geological impacts arising from the proposed development as there are no existing designated geological sites in the study area. During the earthworks phase of the construction works, geologically important sites may develop as strata are exposed for cuttings, drainage ponds and structures. Due to the occurrence of geologically important sites nearby but not within the study area, such as Totternhoe Stone Pit SSSI, any new sites are unlikely to be unique.
- 5.5.2 If geological features are detected, they should be compared with existing designated sites and their potential values should be assessed. In order to undertake this, geological monitoring should be considered during the earthworks phase of construction as appropriate. This may include the creation of new permanent exposures, and/or the allocation of time and resources to geological experts for the recording of scientific knowledge in temporary exposures.
- 5.5.3 The possible loss of some agricultural soils and potential loss of quality in any soils which are retained for re-use would be an impact of slight or moderate adverse significance. However, careful soil handling should ensure that there would be no absolute loss of agricultural soils and that any loss of quality would be minimised.
- 5.5.4 Contaminative land assessment undertaken to date has identified a potential risk to controlled waters in the area around TP1 and TP26, and an exceedance of water quality standards around BH3. Further investigation of groundwater contamination should be undertaken to assess seasonal fluctuations of contamination concentration. A Phase 1 contaminative land assessment will be undertaken as part of the Stage 3 assessment. CBC have confirmed (June 2012) that this course of action will be acceptable, given they have no records of specific or proven contaminated land in the area around the scheme.

6 Road Drainage and the Water Environment

6.1 Introduction, Methodology and Study Area

6.1.1 This chapter summarises existing conditions in terms of drainage and the water environment and assesses any effects of the three alternative route alignments on this environment. References are listed at the end of the chapter.

Methodology

6.1.2 The assessment for road drainage and the water environment has been undertaken in accordance with the DMRB Volume 11, Section 3, Part 10 (HD 45/09) in order to determine the following:

- A baseline description of the area of interest in terms of its physical characteristics and the nature of the catchment into which it drains.
- An assessment of the proposed effects of the route alignments on the water environment.
- Calculation of the predicted risk of serious pollution incidents and the impact on water quality.
- Identification of any problem areas, recommendations for mitigation and scope of further assessment.

6.1.3 The following sources were used to gain an appreciation of existing conditions:

- Environment Agency (EA) website (Ref 3).
- British Geological Survey website (Ref 4).
- Thames River Basin Management Plan (Ref 5).
- Luton Flood Risk Management Strategy (Ref 6).
- Water Cycle Strategy Luton and South Bedfordshire Phase I (Ref 7).
- Water Cycle Strategy Luton and South Bedfordshire Phase II (Ref 8).
- Luton Borough Council and South Bedfordshire Council Level 1 Strategic Flood Risk Assessment (SFRA) (Ref 9).
- Institute of Geological Sciences: Hydrogeological Map of England and Wales (1977), Scale 1:625,000.
- Ordnance Survey mapping.

Study Area

- 6.1.4 The study area for this assessment is taken as 500m from the centreline of each route alignment, extending where appropriate to include such features as aquifers or surface watercourses that could potentially be affected.

Consultations

- 6.1.5 Consultation with the Environment Agency (EA) was undertaken on numerous occasions regarding the design and the approach to this Stage 2 assessment. In terms of Stage 2 assessment, the EA confirmed that hydraulic modelling was not a requirement at this stage and should be undertaken only when the preferred option has been determined. In addition, the EA confirmed that Method F of DMRB HD 45/09 (Hydraulic Assessment) is not a requirement at Stage 2. A copy of the consultation is included in Appendix 6.1.

Regulatory/Policy Framework

- 6.1.6 In terms of the water environment, the Water Framework Directive (WFD) is the overriding piece of legislation in place. The WFD is transposed to English law through the implementation of The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.
- 6.1.7 At a national level, the central government strategy document 'A Better Quality of Life - A Strategy for Sustainable Development for the United Kingdom' recognises the fundamental importance of good water quality to health and the environment. It identifies the major challenges to water quality which it states are; growing demand for water supplies, pollution pressures from new development, diffuse pollution inputs, changed weather patterns and loss of habitats.
- 6.1.8 In addition the route alignments are liable for consideration by the EA under the Land Drainage Act (1991) and the Water Resources Act (1991). Consent from the EA is required for any proposed discharges to controlled waters. Consent would also be required for any development within 8m of a watercourse and for any permanent or temporary works within the flood plain, such as temporary/ permanent culverting, under the Land Drainage Act.
- 6.1.9 However, the Highways Act (1980, Section 299) gives a highway authority the right to discharge water; consent is needed to '*interfere*' with watercourses, and the Act states that this consent should not be '*unreasonably withheld*'. There is also a duty on highway authorities not to pollute. In summary, the overall position is that there is a general presumption that discharges to watercourses will be acceptable, but that this needs to be agreed with the EA, and appropriate mitigation provided.
- 6.1.10 Other important legislation this chapter refers to includes the Water Act 2003 and the Groundwater (England and Wales) Regulations 2009.
- 6.1.11 The National Planning Policy Framework (NPPF) was published by the Government in 2012 and sets out a revised framework for the planning process in England. This document replaces PPG 23: Planning and Pollution Control and PPG 25: Development and Flood Risk. Contained within the NPPF are guidelines for planning authorities with regard to

development in areas at risk of flooding and consideration of climate change. Paragraph 100 of the NPPF states:

'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.'

6.1.12 Paragraph 103 states:

'When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and*
- development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems.'*

6.1.13 In conjunction with the NPPF, the Government published the 'Technical Guidance to the National Planning Policy Framework' which provides additional guidance to local authorities to ensure the effective implementation of planning policy on development in areas at risk of flooding. This document elaborates on the requirements for the Sequential and Exception Tests with regard to new development.

6.1.14 Other relevant planning policy documents include:

- Saved policies within the Luton Local Plan 2001 - 2011 (Ref 1).
- Saved policies within the South Bedfordshire Local Plan Review 2004.
- The Milton Keynes and South Midlands Sub-Regional Strategy (Ref 2).

6.2 Baseline Conditions

Watercourses - Macro Environment

6.2.1 The study area falls within the Upper River Lee catchment within the Thames River Basin District, one of the most populated districts in Britain which covers an area of 16,133 km² (Ref 5). It covers an area from the source of the River Thames in Gloucestershire through London to the North Sea. The eastern and northern parts of the district are heavily urbanised whereas the areas to the west of London are predominantly rural. The Upper

River Lee catchment covers an area of approximately 36km² and includes 32 river water bodies and tributaries such as the River Mimram and River Beane, and Stevenage Brook.

- 6.2.2 Historically the area around the scheme consisted of a series of meadows with a small chalk stream running through them, but with progressive development the valley floor is now occupied by the majority of the urban areas of Dunstable, Houghton Regis and Luton (Ref 6).
- 6.2.3 The main watercourses within the study area are the Ouzel Brook and Houghton Brook and tributaries. There are also a number of other minor drainage ditches which are not marked on Ordnance Survey mapping.
- 6.2.4 The Houghton Brook appears to originate near Houghton Hall to the west of the study area. It flows in a general easterly/ south easterly direction across arable land then under the M1, north of Junction 11 and east of the route alignments. The watercourse is approximately 4.4km long from its source to its confluence (downstream of the study area) with the River Lee. Houghton Brook is the only designated Main River within the study area.
- 6.2.5 The Ouzel Brook rises in agricultural land west of Chalton Cross Farm, draining in a general westerly/south westerly direction to the River Ouzel, and is fed by springs and land drainage ditches in the upper catchment. Figure 6.7 provides an overview of the watercourses in the study area.
- 6.2.6 A natural open channel runs through agricultural fields in the northern portion of the study area collecting drainage from a number of field drains. This stream connects to the Houghton Brook in the middle of the study area.
- 6.2.7 The rivers within the study area no longer show typical chalk river characteristics of sustained and moderate flow, nor support the flora and fauna associated with chalk rivers. This is due to physical modifications which constrain the channel, previous dredging works and the urban pollution associated with runoff from roads and mis-connections between the sewer and surface water systems (Ref 6).

Watercourses - Micro Environment

- 6.2.8 The EA undertakes water quality sampling at regular intervals to monitor chemistry, biology and nutrient levels. Chemistry and biology samples are classified between the range of Class A 'Very Good' to Class F 'Bad'.
- 6.2.9 No water quality monitoring is undertaken by the EA within the study area. The nearest EA water quality monitoring point is of the River Lee approximately 12 km downstream of the study area. Monitoring indicates chemical water quality in 2008 was Class B 'Good' and biological water quality was Class A 'Very Good'. The previous five years of monitoring data indicate water quality has not significantly changed.
- 6.2.10 In terms of the WFD, Houghton Brook has been classified as a Heavily Modified Water Body (due to flood protection and urbanisation) with moderate ecological potential overall. Water quality, flow conditions and ecological quality all fail to meet good potential, as defined under WFD. It is expected that the WFD objective of good potential will also not be met by 2015,

due to reasons of technical infeasibility and disproportionate cost in implementing the measures required to achieve this.

Fisheries

- 6.2.11 Records from the Department for Environment, Food and Rural Affairs (Defra, Ref 10) indicate that no waters within the study area are designated as either Cyprinid or Salmonid Waters under the EC Freshwater Fisheries Directive. There is a fishery to the west of Houghton Hall in the disused Houghton Regis quarry located off Houghton Road.

Groundwater

- 6.2.12 Reference to the Hydrogeological Map of England and Wales indicates that the study area is underlain by an extensive and highly productive aquifer. The aquifer has good yields of around 150 l/sec. The EA has recently reclassified the naming of aquifers to provide compliance with the Water Framework Directive. Under the WFD classification the aquifer is classed as a Principal aquifer, noted to have high intergranular and/or fracture permeability usually providing a high level of water storage. Principal aquifers may support water supply and/or river base flow on a strategic scale. In most cases, Principal aquifers are aquifers previously designated as Major aquifers.
- 6.2.13 Superficial deposits within the study area along the Houghton Brook have been designated as secondary undesignated deposits (Ref 4). This indicates the superficial deposits are variable in nature and could not be assigned as either category.
- 6.2.14 The majority of the eastern and central portion of the study area lies within a groundwater Source Protection Zone (SPZ), Zone III (Total Catchment). This is the total area needed to support the discharge from the protected groundwater source, and is designed to protect water quality within aquifers which are used for abstraction.
- 6.2.15 A number of boreholes with standpipes to include groundwater monitoring have been installed as part of the ground investigation of the study area. More detail on the site investigation and monitoring is provided in the 2010 Amey Ground Investigation Report (Ref 11) and Ground Design Report (Ref 12). Ongoing groundwater monitoring indicates the depth to groundwater is variable throughout the study area although generally it was found to be near the ground surface, about 1m below ground level (mbgl) over the majority of the route alignments. It deepens to about 7 to 8 mbgl at the northern and southern extent of the route alignments, where the ground surface is higher. The water table is between 117 to 128m above Ordnance Datum (AOD) throughout the extent of the route alignments (Ref 11). Groundwater monitoring was undertaken on a monthly basis from March 2010 through to May 2011, to observe seasonal fluctuations. Ongoing monitoring confirms that water levels are variable over the route alignments, and range from less than 1mbgl to around 11-12 mbgl.
- 6.2.16 The site also lies within a Nitrate Vulnerable Zone (NVZ). NVZs are areas which have been designated to protect drinking water supplies from nitrate pollution, where water is being polluted or is at risk of being polluted by nitrates (usually derived from agricultural fertilisers).

Flood Risk

- 6.2.17 Reference to the EA Flood Zone Map indicates that parts of the study area are mapped as Zone 2, indicating the flood risk from rivers is 1%. Figure 6.7 illustrates the extent of the flood zone.
- 6.2.18 The Luton Borough Council and South Bedfordshire District Council Strategic Flood Risk Assessment (SFRA, Ref 9) confirms the area around the confluence of Houghton Brook with the Upper River Lee (within the Luton Borough Council administrative boundary) is known to experience flooding problems.
- 6.2.19 The SFRA states that due to expansion of urban developed area in the upper reaches of the River Lee catchment, flooding from Lewsey Brook and Houghton Brook has resulted in widespread flooding of several properties in the area. This is caused in part by culvert incapacity (through poor design and/or debris blockage) and rapid delivery of rainwater to the brooks via the storm water sewer system. Detailed records of flooding from the EA and the Bedford Group of Drainage Boards include:
- FL_EA_3-10 - Flooding from Houghton Brook on 28 June 2005 affected internal areas of properties 1 to 9 (excluding No. 8) at The Hedgerow, Luton. Flood water approached the properties from the front and the back via disabled access routes. All possessions on the ground floors were lost due to flood water damage.
 - FL_EA_17 - Houghton Brook was observed to be out of bank at a footbridge with a low soffit. No flooding of local properties (The Hedgerow) was experienced, although flood water did approach properties. Residents protected their property with sand bags. (Date uncertain, but thought to be May 2005).
 - FL_EA_15 - The area of Barley Lane in Luton was inspected for flooding on 30 June 2005. There was evidence of a small amount of flooding in the park area downstream of Nayne Avenue arising from the left bank of Lewsey Brook.
- 6.2.20 The study area does not contain any major flood defence structures, however the EA are currently assessing the utilisation of an area upstream of the M1 culvert as a flood storage area. The assessment of the Houghton Brook Flood Storage Area (FSA) is currently ongoing, however an indicative location of the proposed area is included in Figure 6.7. It should be noted that this plan is preliminary at this stage, and the location and extent of this FSA may change. The EA is also considering an additional flood storage area to the south of the proposed scheme in the vicinity of playing fields south of Ravenhill Way. Funding has been allocated for 2012/13 for this Lewsey Park Flood Storage Area and an indicative location is shown on Figure 6.7. There is a small area of natural flood relief plain north of the proposed scheme near Parkside Drive, along the southern bank of the Houghton Brook. This is an area of scrub and grassland which is allowed to become inundated during periods of

high water levels.

6.2.21 The Milton Keynes and South Midlands Sub-Regional Strategy (Ref 2) has identified growth areas to the north of Luton, Houghton Regis, Dunstable, Leighton Buzzard and Leighton-Linslade.

6.2.22 The Phase II Outline Water Cycle Strategy (Ref 8) highlights the need for infrastructure improvements in line with any development in a number of areas in the region. The following improvements are recommended prior to planning approval of any development in the area north of Houghton Regis:

- Opportunities to be investigated for strategic Sustainable Drainage System (SuDS) measures.
- Investigate opportunities for river enhancement/ restoration.
- Process improvements to Dunstable Wastewater Treatment Works and a number of other improvements to the sewer network.

Value (Sensitivity) of Resource

6.2.23 As outlined above, the study area contains several attributes that are important in terms of the water environment. Table 6.1 summarises these attributes and information gathered on the quality of such attributes.

Table 6.1 ~ Summary of Water Features, Attributes and Indicators of Quality			
Feature	Attribute	Indicator of Quality	Possible Measure
Houghton Brook	Water quality	Chemical water quality	Maintain or improve Moderate Ecological Status.
	Conveyance of flow & material	Presence of watercourses	Flow of Houghton Brook to River Lee.
	Biodiversity	Biological water quality	Maintain or improve Moderate ecological status.
Floodplain	Conveyance of flood flow	Presence of Houghton Brook floodplain and rate of flood flow	Flooding events - 1 in 100 year chance or greater of flooding by a river each year. Construction of structures within floodplain.
Groundwater	Water supply/ quality	Principal aquifer used for water supply	Groundwater quality and quantity within SPZ III
	Conveyance of flood flows	Groundwater levels	Ongoing groundwater monitoring

6.3 Potential Effects

6.3.1 An overview of the potential effects of each route alignment on the water environment is provided below. Table 6.2 summarises the constraints for the three route alignments. Following on from this overview, a general assessment of potential effects in terms of the four principal areas of surface water, groundwater, spillages and flood risk is provided. It should be noted that these are the potential effects, considered in order to determine what mitigation measures may be appropriate. The mitigation measures are described in section 6.4, and the effects anticipated to arise from the scheme complete with mitigation are set out in section 6.5.

Table 6.2: Summary of Constraints in Terms of the Water Environment			
Route Alignment	Blue	Green	Orange
Clear Span Structure	Ch 840, Ch 1100 and Ch 1640	Ch 840, Ch 1100 and Ch 1540	Ch 900
Culvert	Upgrade/ extend existing culvert at north end of route	Culvert at Ch 1810 Upgrade/ extend existing culvert at north end of route.	Culvert at Ch 1550 Upgrade/ extend existing culvert at north end of route.
Ditch Diversion	Divert to pre-earthworks drainage network at Ch SL2450 and Ch SL2600.	Divert to pre-earthworks drainage network at Ch 2200 and SL2400	Divert to pre-earthworks drainage network at Ch2150
Flood Plain	Ch 700 to 840 Ch 1540 to 1730	Ch 700 to 840 Ch 1440 to 1780	Ch 800 to 900 Ch 1370 to 1600
Source Protection Zone III	Ch 0 to SL2580 Ch 0 to 2600	Ch 0 to SL2300	Ch 0 to 2100

Blue Route

6.3.2 The Blue Route alignment crosses three separate minor catchments within the overall Houghton Brook catchment. It crosses the Houghton Brook three times at Chainages 840, 1100 and 1640 and at least one other drainage ditch in the northern portion of the route alignment. The Sundon Road link crosses two minor drainage ditches at Chainages SL2450 and SL2600. Both these ditches would be diverted into a pre-earthworks drainage system. An existing culvert located at the north end of the route, where it joins with Sundon Road, may require extending or upgrading as part of the works. It is proposed that clear span structures will be constructed across Houghton Brook to span the watercourse and 3m of river bank. Open span structures would be provided, giving adequate clearance and capacity for the 1 in 100 year flood events.

6.3.3 The Houghton Brook itself is designated under the Water Framework Directive (WFD) as of moderate ecological potential. The north end of this route alignment is located within 600m of Ouzel Brook, which is not designated under the WFD.

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- 6.3.4 The Blue Route crosses the flood plain of Houghton Brook, mapped as Flood Zone II, between Chainages 700 and 840 and Chainages 1540 and 1730. In total, this route alignment crosses approximately 330m of flood plain.
- 6.3.5 The majority of the Blue Route alignment is located within Zone III (total catchment) of a groundwater Source Protection Zone, from the start of the route to Chainage SL2580 (to the west) and Chainage 2600 (to the east).

Green Route

- 6.3.6 The Green Route alignment crosses four minor catchments within the overall Houghton Brook catchment and crosses the Houghton Brook three times. It crosses at least one drainage ditch, part of the network of ditches in the northern portion of the study area. This route alignment crosses the brook at Chainages 840, 1100 and 1540 and a clear span structure to span the watercourse and 3m of adjacent river bank is proposed at each crossing point. Culverting of an existing drainage channel in the northern portion of the route alignment would be required at Chainage 1810. As with the Blue Route the Sundon Road link crosses a minor drainage ditch at chainage SL2400. This ditch would be diverted into a pre-earthworks drainage system. An existing culvert at the north end of the route in the northwest corner may require extending or upgrading.
- 6.3.7 As outlined above, the Houghton Brook itself is designated under the WFD as of moderate ecological potential. The north end of this route alignment is located within 600m of Ouzel Brook, which is not designated under the WFD.
- 6.3.8 The Green Route crosses the flood plain of Houghton Brook, mapped as Flood Zone II, between Chainages 700 and 840 and Chainages 1440 and 1780. In total, this route alignment crosses approximately 480m of flood plain.
- 6.3.9 The first 2.3km of the Green Route alignment, up to the location of the proposed roundabout in the north, is located within a groundwater SPZ III.

Orange Route

- 6.3.10 The Orange Route alignment crosses two minor catchments within the Houghton Brook catchment. It crosses Houghton Brook once at chainage 900 where a clear span structure is proposed to span the watercourse and 3m of adjacent river bank. Two existing drainage channels are crossed at Chainages 1550 and 2150. The drainage channel at Chainage 1550 would be culverted whilst the channel at 2150 would be diverted to a pre-earthworks drainage system. Between chainages 2000 and 2150 the route alignment is in close proximity to an existing drainage ditch in the northern portion of the route. This ditch will potentially be culverted during construction or permanently as part of the works. An existing culvert located at the end of the route, where it joins with Sundon Road, may require extending or upgrading as part of the works.
- 6.3.11 The Houghton Brook is designated under the WFD as of moderate ecological potential. The north end of the Orange Route is located within 600m of Ouzel Brook, which is not designated under the WFD.
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- 6.3.12 The Orange Route crosses the flood plain of Houghton Brook, mapped as Flood Zone II, between Chainages 800 and 900 and Chainages 1370 and 1600. In total, this route alignment crosses approximately 330m of flood plain.
- 6.3.13 The first 2.1km of the Orange Route is located within Zone III of a groundwater SPZ, from the start of the route to just before the proposed roundabout in the north.

Potential Effects on Surface Water

- 6.3.14 There would be potential for pollutants to enter the Houghton Brook during the construction phase. The potential for pollutants to enter the brook would be highest during the construction of any of the bridge structures. Even with the option of wide span bridge structures, installation of piles and the construction of piers and abutments would be required in proximity to the brook. Details of the construction methodology would be provided at Stage 3, however general effects in terms of runoff to surface water can be assessed at this stage. Potential pollutants to surface water runoff include:
- Concrete, cement or admixtures spillage from construction of the new carriageways and bridges.
 - Sediment run-off from earthworks required for construction of new carriageways, bridges and culverts.
 - Sediment runoff water or wind-blown dust from spoil heaps.
 - Leakage or spillage of fuel, oil or chemicals.
- 6.3.15 Sedimentation can have an adverse impact on water quality and, in turn, affect in-stream flora and fauna. Suspended solids can also significantly reduce dissolved oxygen levels within the water and this could have adverse effects on fish and other aquatic organisms.
- 6.3.16 Spillage and leakage of oils, fuels and chemicals during construction (commonly during delivery and/or refuelling) could potentially affect surface and groundwaters. Spillages could seep into the ground and enter the groundwater or be washed into nearby ditches through site runoff. Small quantities of oil have the ability to form extensive thin films which cover a large surface area of receiving waters. During turbulent conditions, the oil film can form an emulsion with the water. Oil also has the ability to bind to the surface of sediments, strata, flora and fauna. Even at relatively low concentrations, oil can be toxic to aquatic species and make the water unsafe for human consumption.
- 6.3.17 Uncured concrete has been shown to increase the pH of a watercourse and this change could seriously affect aquatic life.
- 6.3.18 The Houghton Regis Marl Lakes Site of Special Scientific Interest (SSSI) is located upstream of Houghton Brook and therefore would not be affected by the scheme.
- 6.3.19 The potential impact on Houghton Brook within the study area has been determined using the methods and calculations set out in Volume 11, Section 3, Part 10 of the DMRB. The recently updated DMRB guidance considers it necessary to run the Highways Agency Water

Risk Assessment Tool (HAWRAT) when the Annual Average Daily Traffic (AADT) is greater than 10,000. HAWRAT has been developed to predict the effects of road drainage on receiving watercourses.

6.3.20 HAWRAT adopts a tiered consequential approach to assessment and can report the results at three different stages depending upon the level of assessment required for any given site. These are:

- Step 1, the runoff quality (prior to any pre-treatment and discharge into a water body).
- Step 2, in river impacts (after dilution and dispersion).
- Step 3, in river impacts post-mitigation.

6.3.21 At Step 1, HAWRAT predicts the statistical distribution of key pollutant concentrations in untreated and undiluted highway runoff (the 'worst case' scenario) over a long release period. The distribution uses a statistical model, developed through research, which is based on a ten year rainfall series relevant for the chosen site and its climatic region.

6.3.22 As part of the scheme proposals a surface water drainage system has been proposed for each route option, as illustrated in Figures 6.1 to 6.6. Within the drainage system a number of outfalls are proposed for each route alignment, and HAWRAT was used to assess the impact of each outfall individually at a point downstream. The assessment tool also assesses the cumulative impact of each outfall within the same river reach. HAWRAT uses a 'pass/ fail' reporting methodology against toxicity thresholds which represent a guideline emission standard in the absence of any pre-treatment within the drainage system or in-river dilution and dispersion, whereby:

- 'Fail' indicates either an unacceptable impact, a need to carry out further assessment steps, or a need to refer the situation to specialist judgement;
- 'Pass' indicates that there will be no short-term impact associated with road runoff.

6.3.23 For the initial assessment run for each of the outfalls for the three route alignments, the assessment tool predicted a fail indicating the runoff concentrations exceed the toxicity thresholds. The assessment at Step 1 does not account for any pre-treatment or dispersion/ dilution effects from discharging to a water body. Therefore, a Step 2 river impact assessment is needed.

6.3.24 The second step assesses the long-term impact of each route alignment on Houghton Brook and its ecology, the annual average concentrations of dissolved copper and zinc are then compared with published Environmental Quality Standards (EQS). A summary of the second stage assessment is provided in Tables 6.3 to 6.5 and copies of the output worksheets from the pollution risk assessment are provided in Volume 2 of the EAR, Technical Appendix 6.1.

6.3.25 HAWRAT was used to estimate the in-river annual average concentrations for both dissolved copper and zinc, including contribution from road runoff, and as Tables 6.3 to 6.6 show there was found to be no exceedance of the relevant EQS. Assessment at this stage accounts for the dispersion effects of run-off entering the Houghton Brook. The results show no significant increase in the average concentration of dissolved pollutant concentrations from any of the route alignments, thereby indicating neutral impact to river water quality in the long-term.

Table 6.3 ~ Summary of Water Quality for Blue Route				
HAWRAT Assessment Run	HAWRAT Annual Average Concentrations (µg/l)		Environmental Quality Standard for Water Hardness Band >250mg/l CaCO ₃	
	Dissolved Copper (µg/l)	Dissolved Zinc (µg/l)	Dissolved Copper (µg/l)	Dissolved Zinc (µg/l)
Outfall 1	0.02	0.05	28	7.8
Outfall 2	0.02	0.05	28	7.8
Outfall 3	0.05	0.12	28	7.8
Combined 2 + 3	0.07	0.16	28	7.8

Table 6.4 ~ Summary of Water Quality for Green Route				
HAWRAT Assessment Run	HAWRAT Annual Average Concentrations (µg/l)		Environmental Quality Standard for Water Hardness Band >250mg/l CaCO ₃	
	Dissolved Copper (µg/l)	Dissolved Zinc (µg/l)	Dissolved Copper (µg/l)	Dissolved Zinc (µg/l)
Outfall 1	0.02	0.06	28	7.8
Outfall 2	0.01	0.01	28	7.8
Outfall 3	0.01	0.03	28	7.8
Outfall 4	0.05	0.11	28	7.8
Combined 1 + 2	0.03	0.07	28	7.8
Combined 3 + 4	0.06	0.15	28	7.8

Table 6.5 ~ Summary of Water Quality for Orange Route				
HAWRAT Assessment Run	HAWRAT Annual Average Concentrations (µg/l)		Environmental Quality Standard for Water Hardness Band >250mg/l CaCO ₃	
	Dissolved Copper (µg/l)	Dissolved Zinc (µg/l)	Dissolved Copper (µg/l)	Dissolved Zinc (µg/l)
Outfall 1	0.02	0.06	28	7.8
Outfall 2	0.05	0.13	28	7.8
Combined 1 + 2	0.07	0.18	28	7.8

6.3.26 HAWRAT was used to assess the risk of sediment accumulation for individual outfalls and also for a cumulative assessment of more than one outfall. The assessment indicates that the sediment deposition for both the Green Route and Blue Route alignments is acceptable,

however the cumulative assessment for the Orange Route alignment resulted in a fail (see Technical Appendix 6.1 in Volume 2).

- 6.3.27 The Orange Route appears to be accumulating sediment, therefore the sediment-bound pollutants fail the cumulative assessment at both outfalls. This failure is potentially due to the Orange Route option including two accumulation ponds for the length of the scheme proposals, in comparison to at least three ponds for the other route alignments.

Potential Effects on Groundwater

- 6.3.28 With the exception of suspended solids, all the potential pollutants that have been described thus far are capable of having an impact on the quality of the groundwater. In particular, hydrocarbons are classified under the Groundwater Directive (80/68/EEC) as List I substances, (substances that are prohibited from being discharged into groundwater) and as such must be prevented from discharging into groundwaters. The result of such pollution events could lead to a reduction in surface water quality that, in turn, could affect the quality of groundwater and river base flow. These impacts can last far longer because of the often slow movement of water and the slow rates of diffusion.
- 6.3.29 Parts of all the route alignments are located in a groundwater Source Protection Zone, the area needed to support discharge from groundwater resource and this area is designed to protect water quality within aquifers used for abstraction. Potential impacts during construction include the temporary degradation of the quality of groundwater resource.
- 6.3.30 In accordance with Method C of HD45/09 the risk of pollution to groundwater has been determined, as shown in the following table. The predicted risk of pollution to groundwater is equivalent for each route alignment.

Table 6.6 ~ Risk of Impact of Pollution to Groundwater				
Property or Parameter	Weighting Factor	Site Data	Risk Score	Component Score
Traffic density	15	10,200 (AADT)	1	15
Rainfall volume	15	700mm	1	30
		43mm FEH 1 hour rainfall	2	
Soakaway geometry	15	At least two attenuation ponds for each route alignment	2	30
Unsaturated zone	20	0m (3no. artesian wells)	3	60
Flow type	20	Fracture flow	2	40
Effective grain size	7.5	Fine	1	7.5
Lithology	7.5	<1% clay minerals	3	22.5
Overall Risk Score: 205				

- 6.3.31 The overall risk score assigned to groundwater is 205, categorised as a medium risk of impact.
- 6.3.32 On completion, all drainage from the new link road will be directed through the new drainage system to Houghton Brook.

Flood Risk

- 6.3.33 The risk of flooding to part of the study area is at least 1%, which equates to a 1 in 100 chance or greater of flooding by a river each year. Figure 6.7 illustrates the extent of the area at risk of flooding.
- 6.3.34 As outlined above all three route alignments involve crossing the flood zone to varying extents. The Green Route crosses the greatest extent of flood zone of all three route options, for approximately 480m in length. The other two route options each cross approximately 330m of flood zone. Crossing of the flood zone with new structures would result in loss of flood storage, thus increasing the flood risk for the immediate area and also for other areas downstream.

Spillage Risk Assessment

- 6.3.35 In order to determine the spillage risk associated with a particular stretch of road, the DMRB requires information concerning predicted traffic flow on the proposed road, the percentage of traffic with a HGV classification, the road length and the type of junction, and takes into account the time it would take the emergency services to respond to an emergency situation. As for the pollution risk assessment, the spillage risk assessment was undertaken using the HAWRAT tool.
- 6.3.36 Traffic flow was predicted for future years with the new road in place. Annual Average Daily Traffic (AADT) flow with percentage HGV's was provided for the opening year 2016 and future year of 2031. AADT flow and other parameters such as length of road draining to an individual outfall were input to the HAWRAT tool to assess the spillage risk.
- 6.3.37 The spillage risk was calculated for each section of the route alignment which drains to a particular outfall and then compared to the acceptable threshold value of 0.01, which is expressed as a return period and equates to the probability of a serious pollution risk occurring once every 100 years. Tables 6.7 to 6.9 provide an overview of the results from the spillage risk assessment for the opening year and a future year with the new drainage system in place. The assessment was undertaken for risk of pollution to surface water and groundwater. Copies of the output worksheets from the spillage risk assessment are provided in Volume 2 of the EAR, Technical Appendix 6.2.

Table 6.7: Spillage Risk Assessment for Blue Route Alignment				
Outfall	Year	Risk of Pollution Incident to Surface Water	Risk of Pollution Incident to Groundwater	Threshold Level
South	2016	0.00001	0	0.01
South	2031	0.00003	0	0.01
North	2016	0.0005	0.0004	0.01
North	2031	0.0016	0.0006	0.01

Table 6.8: Spillage Risk Assessment for Green Route Alignment				
Outfall	Year	Risk of Pollution Incident to Surface Water	Risk of Pollution Incident to Groundwater	Threshold Level
1 (South)	2016	0.00001	0	0.01
1 (South)	2031	0.00003	0	0.01
2 (South-Central)	2016	0	0	0.01
2 (South-Central)	2031	0.00001	0	0.01
3 (North-Central)	2016	0.00009	0.0001	0.01
3 (North-Central)	2031	0.0003	0.0001	0.01
4 (North)	2016	0.0003	0.0002	0.01
4 (North)	2031	0.001	0.0004	0.01

Table 6.9: Spillage Risk Assessment for Orange Route Alignment				
Outfall	Year	Risk of Pollution Incident to Surface Water	Risk of Pollution Incident to Groundwater	Threshold Level
1 (South)	2016	0.00001	0	0.01
1 (South)	2031	0.00003	0	0.01
2 (North)	2016	0.0004	0.0003	0.01
2 (North)	2031	0.0013	0.0005	0.01

6.3.38 The results show the probability of a serious pollution incident occurring for both assessment years for any of the route alignments would be less than 1 in 100 (i.e. less than 1%).

6.4 Project Proposals Including Mitigation Measures

Surface Water

6.4.1 During construction surface water would be managed by a temporary drainage network strategy until the operational drainage system is constructed. As part of these temporary works any existing drainage channels would be diverted directly to Houghton Brook.

6.4.2 A Construction Environmental Management Plan (CEMP) will be developed as part of the Stage 3 detailed design. The CEMP is an active document to be updated prior to the start of construction by the contractor and it lists best practice measures which the contractor will adhere to as a minimum, including:

- Pollution Prevention Guidance (PPG) 1 - General guide to the prevention of pollution.
- PPG 5 - Works and maintenance in or near water.
- PPG 6 - Working at construction and demolition sites,
- PPG 18 - Managing fire water and major spillages.
- PPG 21 - Pollution incident response planning.
- PPG 22 - Dealing with spillages on highways.

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- Construction Industry Research and Information Association (CIRIA) - Control of Water from Construction Sites.

6.4.3 In order to mitigate any potential adverse effects to surface waters and groundwater during the construction phase, the following measures are recommended:

- Management of construction works so as to comply with the necessary standards and consent conditions as identified by the EA, CBC and LBC.
- All construction workers will be briefed on the importance of maintaining water quality, the location of surface water features and the location and use of spill kits as part of the site induction.
- The construction drainage network will incorporate measures (e.g. potentially an interceptor) to prevent the discharge of hydrocarbons to surface or ground water systems.
- In areas where there is increased risk of hydrocarbon/chemical spillage and around hazardous substance stores, additional precautions will be taken. These will include bunding (in accordance with EA PPG 8: Safe storage and disposal of used oil), impermeable bases, suitable drainage systems and siting away from any open drainage channels.
- Any stockpiled materials will be stored within enclosed areas to enable the runoff to be stored and treated where required.
- Any concrete works will be carefully controlled and where required any concrete tankers will be washed out in controlled areas.
- All plant and machinery will be maintained in a good condition and any maintenance required will be undertaken within safe areas.
- A Pollution Prevention and Spill Response Procedure should be developed by the contractor and a spill kit and clean up equipment maintained on site.
- Wheel washers and dust suppression measures will be used to prevent the migration of pollutants.
- Monitoring of the surface watercourses before, during and after construction to ensure no adverse impact on water quality.

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- 6.4.4 Given that the scheme requires work that could potentially affect a Main River, as designated by the EA, there is a need to obtain a Flood Defence Consent for works in, over or under a Main River under the Water Resources Act (1991) and Land Drainage Act (1991). The Flood Defence Consent is required prior to any construction work taking place and is currently being applied for from the EA as part of the detailed design stage of the scheme. In addition, the EA must be given 7 days written notice of any intention to temporarily divert the flow of any watercourse, carry out works within the river channel or commence any operations in the river channel so that the appropriate arrangements can be made concerning aquatic life.
- 6.4.5 Detail on the drainage proposals for each route alignment is provided in the Amey Stage 2 Engineering Report for the scheme and in Figures 6.1 to 6.6. In summary, the principles behind a Sustainable Drainage System (SuDS) will be adopted in the design for each route alignment.
- 6.4.6 Where possible, grass swales would be used for runoff collection. In areas where this is not practicable, for example at junctions and roundabouts, a kerb and gully system would be adopted. Where gradients dictate, a combined kerb and gully system would be used. Offline attenuation ponds would be used to control the outfall flow which would discharge into the Houghton Brook. A positive drainage system would be provided throughout each route alignment. The network design would include the following components:
- Carrier, filter and fin drains
 - Gullies
 - Kerb and drainage systems
 - Catchpits and manholes
 - Pollution control valves
 - Oil and petrol interceptors
 - Forebays
 - Attenuation ponds
 - Headwalls
 - Culverts.

Groundwater

- 6.4.7 Offline attenuation ponds would be used to control the outfall flow which would discharge into the Houghton Brook. Where space permits, forebays would be provided adjacent to the attenuation ponds. All drainage from the new link road would be directed through the drainage system to Houghton Brook.
- 6.4.8 As the majority of the length of all three route alignments is located within a Zone III Source Protection Zone, potential impacts to groundwater need to be controlled. The drainage proposals for the route alignments will provide protection to groundwater resources, and detailed mitigation measures will be set out at Stage 3.

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- 6.4.9 A Foundation Works Risk Assessment (FWRA) may be undertaken for the construction phase of each route alignment should the EA require it, if piling is proposed for the construction of the permanent structures. The FWRA is used to determine the significance of the piling and other construction works in terms of risk of groundwater pollution.

Flood Risk

- 6.4.10 The Luton Borough Council and South Bedfordshire District Council SFRA (Ref 9) states that Houghton Brook responds too quickly to rainfall events to enable the EA to issue flood warnings based on monitoring of river flows and levels (as commonly practiced for other flood warning services). Consequently the only warning that can be provided is by monitoring weather forecasts and estimating the effect which forecasted rain may have.
- 6.4.11 An emergency flood plan should be developed for the construction phase of the scheme. Requirements for such a plan are detailed in the Luton Borough Council and South Bedfordshire District Council SFRA (Ref 9).
- 6.4.12 Storage of fuel oils, chemicals etc will be within the temporary construction compound, which should be located outside the floodplain. During construction, access across Houghton Brook is recommended to be by means of temporary Bailey bridges where required. Such bridges would provide access to both river banks without increasing flood risk, which could be the case with temporary culverting.
- 6.4.13 Discussions with the EA indicate that Houghton Brook experiences flooding problems in Luton upstream of the railway embankment and they are assessing the feasibility of attenuation facilities upstream of the M1 motorway culvert. One potential measure is the proposed Houghton Brook Flood Storage Area (FSA), for which the approximate location at this stage is shown in Figure 6.7. As the EA has indicated that compensatory storage would need to be provided for any crossing of the flood zone with new structures as part of this proposal, there is the possibility of combining potential storage with the EA's proposed Houghton Brook FSA. The FSA is at feasibility stage and ongoing consultation with EA would be needed regarding design and programmes. In addition to the Houghton Brook FSA there is potential for connecting to the existing attenuation area near Parkside Drive (just to the south of the Houghton Brook - see Figure 6.1 for location). This attenuation area, around 1km to the south west of the proposed Houghton Brook FSA, consists of a linear depression which holds overspill from Houghton Brook during extreme rain events.
- 6.4.14 Any proposals should maintain ground levels as near existing as possible, in order to maintain existing flood storage levels.

6.5 Assessment of Effects

Surface Water

- 6.5.1 Any potential effects from construction of the scheme would be temporary in nature and with the best practice measures described above in place the effects are envisaged to be **neutral**.

6.5.2 It is envisaged that, with mitigation in place, there would be **no significant effects** from either the Green or Blue Route options once completed, in terms of surface water runoff. The cumulative impact of both outfalls for the Orange Route is **potentially significant**, however further assessment using HAWRAT is required to confirm this.

Groundwater

6.5.3 The impact to groundwater is assessed as **potentially moderate adverse** during the construction phase, mainly due to all three route alignments being located in SPZ III. However, this is a provisional assessment only, pending the development of more detailed and specific mitigation measures - these will be developed at Stage 3 for inclusion in the CEMP, which will reduce the risk of pollution to the groundwater, and significant adverse effects can then be avoided. The potential impact on completion of the new link road is assessed as **neutral**.

Flood Risk

6.5.4 All route alignments require construction of permanent structures, such as carriageways or bridges, within Flood Zone II. The impact on flood risk on completion of the new link road is assessed to be **minor adverse**. However, it is anticipated that, once the local flood risk is more fully understood as a result of the FRA to be undertaken as part of the Stage 3 assessment, these effects will be able to be further reduced.

6.6 Further Work

6.6.1 Should the Orange Route be the preferred option then a further assessment step is required to be undertaken for sediment impact using HAWRAT. A cumulative assessment for Step 2 Tier 2 would need to be undertaken and further mitigation measures included if the assessment still results in a fail. A detailed site walkover would be needed as part of the next step in the assessment process.

6.6.2 Scoping discussions will be undertaken with the EA as part of the next stage of assessment in order to confirm the level of assessment required, and will include:

- Availability of existing hydraulic models for the Study Area.
- Extent and type of hydraulic modelling required for the preferred option (Method F, DMRB HD 45/09).
- Requirement of hydrological flow assessment (Method E, DMRB HD 45/09) and validation of the preferred hydrological technique.
- Requirement for a Surface Water Drainage Strategy.
- Extent of surface water monitoring regime.

-
- 6.6.3 It is proposed that as part of the Stage 3 detailed design and assessment, a review of any existing hydraulic models will be undertaken prior to scoping the level of assessment needed for flood risk. It is envisaged that hydraulic modelling will be undertaken as part of the Stage 3 assessment, when the preferred option has been determined. The assessment at Stage 3 will take the form of a Flood Risk Assessment (FRA) which will be included as a Technical Appendix to the Environmental Statement. The FRA will comply with the requirements of the NPPF and the supporting Technical Guidance.
- 6.6.4 At Stage 3 an assessment of compensatory flood storage will be undertaken in order to provide an estimate of the area required for floodplain compensation. Any compensation should provide the same volume, on a 'level for level' or 'direct' compensation basis, as the lost storage. Any loss of flood storage would be due to construction of the new carriageway and bridge structure in the floodplain and ideally any replacement storage would be created immediately next to the new permanent structure (Ref 13). The land acquired for the construction of the scheme will need to provide adequate space for the flood storage areas.

6.7 Summary

- 6.7.1 The study area contains a number of surface watercourses and associated Flood Zone 2 flood plain. With the proposed drainage system in place none of the route alignments are envisaged to have a significant impact on surface water quality, though further assessment would be required for the Orange Route in order to determine the significance of sediment impact from both outfalls.
- 6.7.2 All three route alignments cross an area within Source Protection Zone III. Temporary impacts to groundwater are currently predicted during construction in the SPZ III, for all route alignments. Detailed mitigation measures will be developed at Stage 3 to ensure that these effects are brought within acceptable limits.
- 6.7.3 All three route alignments cross the floodplain, with the Green Route requiring the greatest area of flood compensation. The precise degree of compensation required would be determined at Stage 3, and with appropriate compensation there should be no adverse effects in terms of flooding.

References

- Ref 1: Luton Borough Council (2000). Luton Local Plan 2001 - 2011.
- Ref 2: Government Offices for the Southeast Midlands and East of England (2005). The Milton Keynes and South Midlands Sub-Regional Strategy.
- Ref 3: EA website (<http://www.environment-agency.gov.uk/>) Accessed September 2010.
- Ref 4: British Geological Survey website (<http://www.environment-agency.gov.uk/>) Accessed September 2010;
- Ref 5: Environment Agency (2007). Thames River Basin Management Plan.
- Ref 6: Environment Agency (2009). Draft Luton Flood Risk Management Strategy.
- Ref 7: Luton and South Bedfordshire Joint Committee (2008). Water Cycle Strategy Luton and South Bedfordshire Phase I.
- Ref 8: Luton and South Bedfordshire Joint Committee (2010). Water Cycle Strategy Luton and South Bedfordshire Phase II.
- Ref 9: Luton Borough Council and South Bedfordshire District Council (2008). Level 1 Strategic Flood Risk Assessment.
- Ref 10: Department for Environment, Food and Rural Affairs website <http://www.defra.gov.uk/environment/quality/water/waterquality/fwfish/index.htm> Accessed September 2010;
- Ref 11: Amey (2010). Ground Investigation Report, Woodside Connection. Amey, Lewes.
- Ref 12: Amey (2010). Ground Design Report, Woodside Connection. Amey, Lewes.
- Ref 13: Construction Industry Research and Information Association (CIRIA) (2004). Development and Flood Risk - Guidance for the Construction Industry.

Chapter 6 Road Drainage and the Water Environment ~ Appendices

Appendix 6.1 ~ Consultation with the Environment Agency

Fitzpatrick, Orla

From: Ireland, Adam [adam.ireland@environment-agency.gov.uk]
Sent: 02 September 2010 15:26
To: Fitzpatrick, Orla
Subject: RE: Woodside Connect Stage 2 Road Drainage and Water Environment chapter to EAR.

Orla,

With regards to your enquiry I can advise the following. Having discussed this with our Development and Flood Risk Engineer for the area, we are in agreement that the Method F requirement of the DMRB is unreasonable for this proposal.

We do not expect you to model all of the potential routes. We think that the best option in order to progress with the scheme analysis would be for you to appraise the flood risk issues at this stage and also list the further work that would need to be done to address these. That way you can be sure that you are aware of the requirements of each route and the issues to be addressed in the detailed FRA (including modelling) of the chosen preferred option. You may be able to make inferences as to the cost implications of each route as a result of the flood risk issue identified which should enable flood risk to appropriately be considered as a key issue in the determination of the preferred route.

I would also suggest that you would need to make conservative estimations as to any areas required for Floodplain Compensation. This would be dependant upon the form of construction of the road and any interaction with the floodplain as identified on the EA Flood Map. Compensation would be required on a level for level, volume for volume basis. These principles, other requirements for the crossing of the road over watercourses, and also the Luton Flood Alleviation Scheme were discussed in our meeting with your colleagues on 10th March 2010.

I hope this is useful to you. If you have any further queries then please let me know.

Regards

Adam

From: Fitzpatrick, Orla [mailto:Orla.Fitzpatrick@amey.co.uk]
Sent: 31 August 2010 13:49
To: Ireland, Adam
Subject: RE: Woodside Connect Stage 2 Road Drainage and Water Environment chapter to EAR.

Adam,

In relation to your email below I would like guidance on the level of detail needed for Method F. It has been confirmed that FRA is not required, however I am not clear on how to fulfil Method F without undertaking some degree of modelling. As Adam has outlined, time constraints are difficult for this project and therefore any guidance is greatly appreciated.

Regards,

Orla Fitzpatrick

Senior Environmental Consultant

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Rushmere House | 46 Cadogan Park | Belfast | BT9 6HH

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From: Glass, Adam
Sent: 17 August 2010 13:29
To: Fitzpatrick, Orla
Subject: FW: Woodside Connect Stage 2 Road Drainage and Water Environment chapter to EAR.

From: Ireland, Adam [adam.ireland@environment-agency.gov.uk]

11/10/2010

Sent: 17 August 2010 13:10

To: Glass, Adam

Subject: RE: Woodside Connect Stage 2 Road Drainage and Water Environment chapter to EAR.

Hi Adam,

In relation to your earlier enquiry, below, I can confirm that we find your proposals for the levels of assessment of Flood Risk acceptable.

Essentially, until you have determined your final route option, it would be unreasonable for us to require you to undertake a detailed assessment for each option as this will just be wasted work for whichever options are not selected.

Should you need any further information then please do not hesitate to contact me.
In addition, I would be grateful to receive any updates on the progress of the scheme.

Regards

Adam Ireland

Principal Planning Officer
(Anglian Region, Central Area)

✉ Environment Agency, Bromholme Lane, Brampton, Huntingdon, Cambs. PE28 4NE

☎ Internal: 750 3962

☎ External: 01480 483962

✉ adam.ireland@environment-agency.gov.uk



Please consider the environment before printing this email

From: Glass, Adam [mailto:Adam.Glass@amey.co.uk]

Sent: 09 August 2010 13:58

To: Ireland, Adam

Cc: Fitzpatrick, Orla

Subject: Woodside Connect Stage 2 Road Drainage and Water Environment chapter to EAR.

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Adam,

I understand from the Scoping Report and subsequent consultation with the EA that for the Woodside Connect Stage 2 assessment of Road Drainage and Water Environment a Detailed Assessment and Flood Risk Assessment was agreed. However, the design is not yet completed and the time constraints in producing the Stage 2 EAR before the end of September means that it will not be feasible to produce the FRA for the three options in this time frame for Stage 2.

It is proposed that the Stage 2 Road Drainage and Water Environment Chapter contain a Detailed Assessment of the 3 options if there is existing water sample data for Method B. If there is not existing water sample data the Method B assessment (Detailed) assessment would be produced for the preferred option at Stage 3, after the water data has been collected (if necessary), and a Simple Assessment of the three options be produced for Stage 2. Methods E and F of HD45/09 give an element of Flood Risk Assessment and would both be produced as part of a Simple or Detailed Assessment at Stage 2 for the 3 options.

At Stage 3 the full FRA would be produced for the Preferred Option and the Detailed Assessment updated or produced based on the final design.

This approach would also allow further consideration of the possibility to join the Woodside Connection and Flood Risk Management Strategy together to provide a better environment for all as well as cost benefits for both projects

Is this approach acceptable to you?

Kind Regards,

Adam Glass

Senior Environmental Engineer, Environmental & Geotechnical
Consulting | Amey

11/10/2010

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The Simple Assessment for water requires Method E and F which gives an element of flood risk assessment.

For the assessment of flood risk the results of Method E and Method F should be reported. The minimum documentation to be included is listed in paragraph E.10. For Method E the report should include, for any water courses within the scheme, the flow rate expected for a flood of 1% annual probability (plus an allowance for climate change) and whether this changes as a result of the scheme. If there is an increase in the expected flow rate the report should consider what mitigation is needed, whether attenuation of the road runoff is required and if so what the required storage volume will be. For Method F the report should include a statement of the expected change in water surface elevations that will result from the scheme (the afflux), the approximate change in floodplain volume and the change in flood potential resulting from a change in runoff. If there is an adverse change then the report should identify mitigation options.

Method B (the only Detailed Assessment method) requires, at least five water samples spread over a six month period. However, existing data may be used if DOC and pH show little variation over time. The sample analysis results should be run through the BLM assessment to determine whether there is likely to be an impact. I will find out from our Water person if there is existing water data that is suitable for Method B. If there is existing data we might be able to produce the Method B assessment and thus have a detailed assessment, if not we will have to start the sampling soon if we are to be able to include it for Stage 3. I will let you know when they let me know.

Environment Agency (Winnington)	1.4.10	12.5.10	<ol style="list-style-type: none"> 1. Consider effects on proposed Houghton Brook flood storage area to the south east. 2. Scope of Flood Risk Assessment agreed. 3. Recommends water vole survey. 4. Recommends survey for white clawed crayfish. 5. Consider requirements of the Water Framework Directive. 	<ol style="list-style-type: none"> 1. Assessment will include this. 2. Noted. 3/4. Water vole and crayfish surveys included in assessment. 5. Assessment will include this.
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7 Materials

7.1 Introduction, Methodology and Study Area

Introduction

7.1.1 Interim Advice Note 125/09 (see section 4.1.2) requires an assessment of the effects of road schemes in terms of materials usage and waste production. The assessment undertaken for Stage 2 was completed prior to the publication by the HA of IAN 153/11, 'Guidance on the Environmental Assessment of Material Resources', and followed the guidance issued on behalf of the Environmental Protection Agency (EPA & CAAS Environmental Services Ltd, 2002) on what constitutes '*Natural Resources of Economic Value*'. These resources, also referred to as '*material assets*', are defined as '*Resources that are valued and that are intrinsic to specific places*'...'*They may be of either human or natural origin and their value may arise for either economic or cultural reasons*'. Water resources, although they match the above definition, are discussed in Chapter 6.

7.1.2 The assessment undertaken to date has been reviewed against the guidance set out in IAN 153/11, and has been found to be in general accordance with the recommendations for a Simple assessment, covering as it does the principal areas of resource consumption and waste generation and minimisation. An assessment in full accordance with IAN 153/11 will be undertaken at Stage 3, at which time one of the route options will have been adopted and the requirements of the scheme in terms of resource usage will be clearer.

7.1.3 Materials are assessed in this chapter under the following headings:

- Resource management
- Waste management

Methodology

7.1.4 Information required for the assessment reported in this chapter was obtained through publicly available sources and consultation with the relevant bodies. The following sources were reviewed as part of the baseline assessment for this chapter:

- Bedfordshire and Luton Minerals and Waste Local Plan 2000-2015 (Central Bedfordshire Council, 2010).
- Department of Environment, Food and Rural Affairs Waste Strategy for England 2007 (Defra, 2007).
- Waste and Resources Action Programme (WRAP) website and publications (WRAP, 2010).

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- 7.1.5 A ground investigation was undertaken by Geotechnics Ltd. between 1 and 18 March 2010. Relevant reporting for this section includes a Preliminary Sources Study Report (Amey, 2009) and a Ground Investigation Report (Amey, 2010). The Preliminary Sources Study Report includes an Envirocheck Report (Landmark Information Group, 2009). See chapter 5 for further information.

Regulatory and Policy Framework

- 7.1.6 Minerals and waste planning is the control of mineral extraction and waste management developments, through forward planning, determining planning applications, monitoring and enforcement.
- 7.1.7 Many of the relevant UK acts and regulations incorporate European Community (EC) directives into UK Law. These include Directive 2008/98/EC on waste (the Waste Framework Directive) and European Council Directive 99/31/EC on the landfill of waste.
- 7.1.8 The Waste Framework Directive defines 'waste' and forms the legislative framework for its collection, transport, recovery and disposal. The directive requires member states to encourage the following:
- The prevention or reduction of waste production.
 - The recovery of waste through recycling, re-use, reclamation or any other process with a view to extracting secondary raw materials.
 - The use of waste as a source of energy.
- 7.1.9 The European Council Directive 99/31/EC on the landfill of waste has implications for those producing and disposing of waste. The directive aims to:
- 'prevent or reduce as far as possible negative effects on the environment in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health, from the landfilling of waste, during the whole life-cycle of the landfill.'*
- 7.1.10 The Controlled Waste Regulations 1992 (SI 588) define household, industrial and commercial waste for waste management licensing purposes. The Controlled Waste (Amendment) Regulations 1993 (SI 566) amend 1992/588 in relation to scrap metal.
- 7.1.11 Part I of the Environment Act 1995 established the Environment Agency and gives it responsibility for regulating pollution control, water, general environmental and recreational duties, environmental duties relating to SSSIs, regional and local fisheries and flood prevention control. Part II sets out a system to identify and repair or remediate contaminated land and amends the Water Resources Act 1991 to make significant changes to laws on water pollution from abandoned mines. Part V of the Act requires the Secretary of State to

prepare a national waste strategy for England and Wales and enables regulations to be made that impose responsibility for waste onto the producer of the waste.

- 7.1.12 Part IIA of the Environmental Protection Act 1990 establishes businesses' legal responsibilities for the duty of care for producing, collecting and disposing of or treating controlled waste. Part I of the same act, which dealt with waste management licences such as integrated pollution control (IPC) and Local Authority Pollution Control (LAPC) regimes, has been replaced by the Environmental Permitting (England and Wales) Regulations 2007. These were subsequently replaced by the Environmental Permitting (England and Wales) Regulations 2010, which standardise environmental permitting and compliance to protect human health and the environment.
- 7.1.13 The Environmental Protection (Duty of Care) Regulations 1991 (SI 2839) impose a duty of care on any person who imports, produces, carries, treats or disposes of controlled waste to ensure there is no unauthorised or harmful depositing, treatment or disposal of waste. These were amended but not superseded by the Environmental Protection (Duty of Care) Regulations 2003 (SI 63), which allow waste collection authorities to serve notices on people required to keep written descriptions of waste and transfer notices, and to require them to produce such documents to the authority within a specified time.
- 7.1.14 The Hazardous Waste (England and Wales) Regulations 2005 (SI 894) detail requirements for controlling and tracking the movement of hazardous waste, and ban mixing different types of hazardous waste. These were amended but not superseded by the Hazardous Waste (England and Wales) (Amendment) Regulations 2009 SI 507, which increase the maximum limit of hazardous waste that can be produced in any year without registering with the regulator from 200kg to 500kg. Parts of the 2005 Regulations that were unclear are also clarified in this amendment.
- 7.1.15 The Site Waste Management Plans Regulations 2008 (SI 314) require the production of a Site Waste Management Plan (SWMP) for any construction projects with an estimated construction cost of over £300,000.
- 7.1.16 Relevant UK planning policy is set out in the National Planning Policy Framework (NPPF, 2012), which promotes the prudent use of natural resources and minimisation of waste, taking into account climate change, flood risk and waste management.
- 7.1.17 The Waste Strategy for England 2007 (Defra, 2007) sets out the government's key objectives for sustainable waste management as follows.
- To decouple waste growth (in all sectors) from economic growth and put more emphasis on waste prevention and re-use.
 - To meet and exceed the Landfill Directive diversion targets for biodegradable municipal waste in 2010, 2013 and 2020.

-
- To increase diversion from landfill of non-municipal waste and secure better integration of treatment for municipal and non-municipal waste.
 - To secure the investment in infrastructure needed to divert waste from landfill and for the management of hazardous waste.
 - To get the maximum environmental benefit from that investment, through increased recycling of resources and recovery of energy from residual waste using a mix of technologies.

Local Planning Policy

7.1.18 Central Bedfordshire Council (CBC) and Luton Borough Council (LBC) are the authorities responsible for the Minerals and Waste Planning in their areas and are presently reviewing their policies, and producing a Minerals and Waste Development Framework.

7.1.19 The Minerals and Waste Development Framework will cover the administrative areas of Bedford Borough Council, CBC and LBC. It will set out the Councils' policies for planning control of mineral extraction and waste management in the local authority areas, including identification of potential sites. The Minerals and Waste Development Framework currently consists of the following documents:

- The Minerals and Waste Development Scheme - this is the Councils' project plan and programme for the production of all documents to be included in the Minerals and Waste Development Framework.
- The Statement of Community Involvement (adopted 2006, though does not include Luton) sets out how people can become involved with planning applications.
- The Minerals Core Strategy and Site Allocations Plan guides mineral planning in the local authority areas and identifies potential sites for extraction.
- Strategic Environmental Assessment/Sustainability Appraisal (SEA/SA) is required to test the Minerals and Waste Development Framework against an agreed set of economic, social and environmental criteria throughout the preparation process.
- The Waste Core Strategy and Site Allocations Plan address how much waste capacity is needed and where waste facilities should be located.
- The Supplementary Planning Document '*Managing Waste in New Developments*' (adopted 2006) provides guidance on reducing, recycling and recovering waste during demolition, construction and occupation of new developments in line with policies W5 and W6 of the adopted Bedfordshire and Luton Waste Local Plan (see below).

-
- The Annual Monitoring Report reports the status of the development plans to the Secretary of State as required by the *Planning and Compulsory Purchase Act* (2004).

7.1.20 The Bedfordshire and Luton Minerals and Waste Local Plan 2000-2015 (CBC, 2010) has been developed for the transition to the new planning system. During this period, due to end in December 2015, the policies of the Minerals and Waste Local Plan, 2005, with the exception of two waste policies, remain in force. The two expired policies are Policy W10 (Household Waste Recycling Centres) and Policy W15 (Pre-landfill treatments for biodegradable waste), which both expired on the 23 January 2008.

7.1.21 The main functions of the plan are as follows.

- To identify the need, amount and location for mineral extraction and waste disposal sites.
- To balance the allocation of these sites with the environmental constraints.
- To ensure sensible and prudent use of the minerals and waste resources.
- To prevent sterilisation of these resources.
- To encourage reduction in use of raw materials and greater recycling of waste products.
- To minimise the effect of extraction and waste disposal on the environment.
- To exploit the full potential of site restoration for public and environmental benefit.

7.2 Baseline Conditions

Resource Management

Aggregate Materials

7.2.1 The National and Regional Guidelines for Aggregates Provision in England 2005-2020 (Department of Communities and Local Government, 2009) set out the government's national framework for aggregate planning. This is broken down regionally and, for land-won sand and gravel, apportioned at a sub-regional county level.

7.2.2 In terms of quantity (tonnage) the major mineral resource in Bedfordshire is aggregate sand and gravel. This is primarily sourced from the superficial deposits in the river valleys of the Ivel and the Ouse and from glacial sand and gravels north and west of Biggleswade. The *Minerals Core Strategy* identifies four main production concreting sand and gravel plant sites in the county, located at Broom, Willington, Warren Villas (Sandy), and Whitsundoles Farm (Salford). None of these sites lie in the vicinity of the study area. The nearest is Salford,

which lies more than 15km northwest of the study area. There is also capacity for processing sands at Grovebury Farm in Leighton Buzzard, which lies more than 10km west of the site.

Specialist Silica Sands

- 7.2.3 Silica sands have been worked extensively in the county for industrial purposes such as glass making, foundry casting and water filtration. Today they are used for water filtration, horticulture and in sports. The sands are sourced from the Woburn Sands deposit of the Greensand Ridge, in particular at Heath and Reach near Leighton Buzzard, one of the few places where they are free from impurities. Heath and Reach lies 10km northeast of the study area.

Chalk

- 7.2.4 Chalk is extracted from Kensworth Quarry near Dunstable, from where it is transported via a slurry pipeline to cement works in Rugby. Kensworth Quarry lies about 4km south of the site. Sundon Chalk Pits lie northeast of study area and just fall within the study area, although the pits are no longer operational.
- 7.2.5 The Minerals Core Strategy, in its current form, states '*there are large permitted reserves remaining, sufficient for foreseeable needs well beyond the end of the Plan-period*' for chalk operations.

Brick Clay

- 7.2.6 Traditionally the Oxford clay has yielded much brick-making resource, though this is now in decline. The last brick works closed at the end of 2008 due to non-compliance with Integrated Pollution Prevention and Control requirements.
- 7.2.7 The Minerals Core Strategy, in its current form, states '*there are large permitted reserves remaining, sufficient for foreseeable needs well beyond the end of the Plan-period*' for brick clay operations.

Fuller's Earth

- 7.2.8 Fuller's earth has previously been worked at Woburn and Clophill. The last operation, at Woburn, ceased in 2004. The sole remaining known deposit was subject to a planning application for extraction, but this was refused, and overturned on appeal, on the basis of over-riding environmental objections.
- 7.2.9 No mining / quarrying activity is recorded along the line of the route options (Landmark, 2009) and there is no information on mining in the geological memoir (Shephard-Thorn et al, 1994) to suggest mining on site has occurred.

Waste Management

- 7.2.10 It is national policy that most waste should be treated or disposed of within the region in which it is produced (Defra, 2007). The construction industry is the single largest producer of waste arising in England, sending approximately 90 million tonnes of inert waste to landfill that would otherwise be suitable for re-use as aggregates. Government policy aims to halve the amount of construction waste sent to landfill by 2012, by increasing recycling and re-use and reducing waste production (WRAP, 2010).
- 7.2.11 CBC encourages initiatives to minimise waste at source, primarily by promotion of materials recycling. However, local authority control of commercial and industrial waste is limited to the supply of appropriate management facilities, except for a small amount of commercial waste collected on request. The council has a duty to collect commercial waste if requested. In practice, however, companies requiring a waste collection service are advised to seek quotes from the public sector as this is invariably the most cost effective solution.

Waste Categorisation

- 7.2.12 As part of the ground investigation, ground materials were assessed as to whether they should be classified as waste, based on threshold limits and calculations for the 14 hazardous waste criteria as detailed in the Technical Guidance WM2 (Environmental Agency, 2008). The waste categorisation makes use of a first tier, worst-case assessment using the maximum value from a range of contaminant concentrations provided in the laboratory results.
- 7.2.13 In summary, no exceedance of the hazardous waste thresholds was indicated at any location.
- 7.2.14 The only potential exceedance of hazardous waste thresholds observed in samples retrieved from all locations was for property H2 Oxidising, due to the presence of chromium. The guidance provided in WM2 stipulates that in cases where there is a possibility of hazard H2 Oxidising being present, further testing should be undertaken. However, levels of chromium encountered were generally low, with a maximum concentration of 0.011% in the samples taken. No commercial laboratory is able to offer the necessary testing methodology to further assess hazard H2. Consequently it is anticipated that any excavated material could be regarded as non-hazardous waste on the basis of this property.

- 7.2.15 In the unlikely event that excavated material is scheduled for removal to landfill it could therefore be disposed of as non-hazardous waste, subject to agreement with the appointed waste carrier regarding the property H2. No waste acceptance criteria (WAC) testing is required for non-hazardous waste under the Landfill (England & Wales) Regulations 2002, the Landfill (England & Wales) (Amendment) Regulations 2004, and the Hazardous Waste (England & Wales) Regulations 2005, unless it becomes necessary to prove the material is suitable for disposal at inert landfill.
- 7.2.16 Prior to scheduling excavated material for removal to landfill, pre-treatment options (including but not limited to sorting/separation) should be considered in line with current waste legislation. All waste handling and movements should be undertaken in accordance with the requirements of all relevant waste management legislation.
- 7.2.17 Based on the testing carried out to date, no material will be classified as Class U2 unacceptable materials. This, combined with the anticipated overall shortfall of material for embankments (see below), means that no site-won material will need to be removed from site.

7.3 Project Proposals Including Mitigation Measures

Resource and Waste Management

- 7.3.1 The earthworks estimate and number of structures for the scheme varies depending on the route option. There are no existing structures or other substantial features due to be demolished, which would allow materials to be won or re-used. In general, and as a result of the generally flat topography along the line of the routes coupled with the potential for flooding in some areas, the new road will need to (on average) be raised above existing levels. Based on the current design the number of structures and earthworks estimates are outlined in Table 7.1 below.

Table 7.1 ~ Structures and Earthworks		
Route	No. of structures	Earthworks balance
Blue	3	19,500 m ³ shortfall
Green	3	48,200 m ³ shortfall
Orange	1	51,400 m ³ shortfall

-
- 7.3.2 Due to the large shortfall in construction material, fill will need to be imported for the scheme. Where available, materials including concrete, steel and earthworks fill will be imported from local sources. Where possible materials such as sub-base and bitumen (from any existing roads) can be broken up and re-used as required. Any material re-used as fill on site or on other road schemes must be in accordance with Series 600 of Volume 1 of the Highway's Agency's Manual of Contract Documents for Highway Works, Specification for Highway Works. The exact materials to be used cannot yet be specified, as no contractor has been appointed, but there are a number of local quarries producing sand, gravel and chalk which could be potential sources of materials.
- 7.3.3 If, during construction, any unexpected material is encountered and becomes available on site or re-use of materials becomes an option, it should be considered by the contractor.
- 7.3.4 Where existing field gates and boundaries used by local landowners are due to be removed, materials such as fencing and gate posts would be considered for re-use as appropriate. Any felled wood should be either sold for firewood or chipped on site for incorporation into the landscape works, at the discretion of the contractor.
- 7.3.5 A Site Waste Management Plan (SWMP) will be produced, a mandatory requirement in England for schemes with a value exceeding £300,000. The SWMP will be updated regularly by the contractor. All site personnel and specialist contractors will be briefed on the content and requirements of the SWMP. Net Waste Tool is a freely accessible online resource available through the WRAP website (WRAP, 2010).
- 7.3.6 Maximising the re-use of materials won on site will lead to a reduction in the volume of materials needing to be imported onto the site and number of haulage journeys. Where possible, any additional fill materials that are required should be sourced from local quarries and suppliers to reduce the length of the haulage route. This practice will have its own cost benefits and will aid in the reduction of airborne pollutants and greenhouse gas emission from transport. A reduction in waste leaving the site for landfill also has significant cost savings and long term environmental benefits.
- 7.3.7 The World Business Council for Sustainable Development (WBCSD, 2009) reports that concrete is the second most consumed material after water. The Cement Sustainability Initiative was launched by the WBCSD and its members (including UK producers Cemex and Lafarge) to identify actions cement companies can take to progress sustainable development. As a result several cement operating companies participating in the scheme (and not limited to its members) offer concrete recycling programmes. Concrete can be recycled from fresh (wet) concrete from ready-mix trucks, production waste at pre-cast production facilities and waste from construction and demolition.

- 7.3.8 Vegetation that is removed to allow construction of the earthworks, drainage and structures should be chipped on site and used as a mulch to help establish new planting once construction is completed.
- 7.3.9 Materials that cannot be re-used within the construction of the scheme or another project are termed waste. The disposal of waste materials needs to be assessed in terms of where and how they can be disposed and the associated impact of this disposal. Materials which may be classified as waste include the following.
- Construction and demolition materials not suitable for re-use such as hazardous waste.
 - Excavated material classified as hazardous waste due to the presence of contaminants.
 - Petrol runoff and sediments collected by interceptors.
 - Waste products arising from the presence of construction staff on site e.g. effluent from portable toilets, food waste and packaging.
- 7.3.10 All waste materials would be segregated into waste streams. Waste materials would then be transported by a licensed waste carrier and either treated or disposed of at an appropriate site. All documentation would be provided to ensure compliance with the current waste legislation, and there is a Duty of Care under Part II of the EPA on those responsible for waste. There are a number of waste transfer, disposal and treatment centres within the local area.

7.4 Assessment of Effects

- 7.4.1 The value of environmental assets is defined by Highways Agency guidance (DMRB volume 11, Section 2, Part 5, HA 205/08 Assessment and Management of Environmental Effects). These definitions have been interpreted from a materials perspective, and are summarised in Table 7.2 below.

Table 7.2 ~ Value (Sensitivity) of Assets	
Value (sensitivity)	Description
Very High	Very high importance and rarity, international scale and very limited potential for substitution
High	High importance and rarity, national scale and very limited potential for substitution
Medium	High of medium importance or rarity, regional scale, limited potential for substitution
Lower	Low importance and rarity, local scale
Negligible	Very low importance and rarity, local scale

7.4.2 Impacts may affect nearby natural resources and other materials assets, their quality and their integrity. The magnitude of this impact is defined by DMRB volume 11, Section 2, Part 5. These definitions have been interpreted from a materials perspective, and are summarised in Table 7.3 below.

Table 7.3 ~ Magnitude of Impacts		
Magnitude of impact		Potential criteria descriptors
Major	Beneficial	Large scale or major improvement to materials resource attributes and/or quality.
Moderate		Benefit to materials resource attributes and/or quality.
Minor		Minor benefit to materials resource attributes and/or quality. Some beneficial impact on a reduced risk of negative impact occurring.
Negligible		Very minor loss or detrimental alteration to materials resource attributes and/or quality.
No change		No loss or alteration of materials resource attributes and/or quality.
Negligible	Adverse	Very minor benefit to or positive addition to materials resource attributes and/or quality.
Minor		Minor measurable change in materials resource attributes and/or quality.
Moderate		Loss of materials resource, but not adversely affecting the integrity. May include partial loss of or damage to materials resource attributes and/or quality.
Major		Loss of materials resource and/or quality and integrity of resource, including severe damage to materials resource attributes and/or quality.

7.4.3 The significance of environmental effects is determined using table 2.4 of the DMRB volume 11, Section 2, Part 5. This is reproduced in Table 4.1 in section 4.3 above.

7.4.4 As there are no significant materials resources identified in the study area and therefore no receptors, **no adverse impacts** are identified in this respect.

7.4.5 There is the potential for residual impacts from any additional fill which will need to be sourced for the scheme. Sourcing materials from other sites has the potential to have impacts on unidentified resources outside of the study area and transport-associated impacts on localised air quality and noise environments alongside construction routes (see chapters 12 & 13). Design development during Stage 3 will seek to minimise the importation of fill as far as possible.

7.4.6 Landfilling of surplus materials unsuitable or unable to be recycled would also have residual impacts on the environment. These impacts will be derived from the transport and disposal of that waste. With ongoing development in waste legislation including the Minerals and Waste Development Framework and stricter requirements for landfill sites, it is likely that impacts will be **minor adverse on a local scale**. Regional scale impacts would also be

minor adverse due to the lack of available landfill space and the Government's requirements to meet high levels of material recycling.

7.5 Summary

- 7.5.1 Due to the level nature of the topography around the proposed route, there is an earthworks imbalance resulting in a shortfall. The current best estimate of this is between 19,500m³ and 51,400m³, depending on the preferred route, though the Stage 3 design will seek to minimise this requirement. Due to this shortfall, large quantities of suitable earthworks materials will need to be imported from local sources. Similarly, there are no substantial structures that will need to be demolished and therefore the opportunity to re-use materials is low.
- 7.5.2 Where possible, materials such as sub-base, bitumen, gates and boundary fencing will be re-used as part of the scheme. If opportunities to re-use other materials become available, during route selection, design and construction, they should be considered.
- 7.5.3 Even with minor mitigation in place, it has been concluded that the scheme will have a minor adverse impact locally and regionally, relating to the sourcing, production and transport of materials for construction.

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8 Cultural Heritage

8.1 Introduction and Methodology

8.1.1 This chapter assesses cultural heritage potential within land affected by construction of the proposed scheme. As no routes had been finalised at the time of the assessment, it was undertaken on the basis of a broad corridor which encompasses the lines of the Green, Orange and Blue Routes; this corridor is referred to below as the Development Area (DA).

8.1.2 The assessment identifies Heritage Assets (HAs) and provides an assessment of the effects of the proposed development in relation to them. It describes the significance of these issues for the planning, design, construction and operation of the proposed road scheme and sets out how its effects will be mitigated.

8.1.3 The assessment has:

- Synthesised all relevant, existing sources of information relating to the cultural heritage potential of the proposed road scheme.
- Used that synthesis to model the archaeological potential of the proposed development, dividing it into a series of Heritage Assets (HAs).
- Assigned a relative archaeological potential/value to each HA (section 8.2).
- Assessed the development impacts in the DA (see Figure 8.1) against the HA and identified appropriate mitigation measures.

Terminology

8.1.4 All planning applications submitted after March 2012 will need to be assessed in line with the new National Planning Policy Framework (NPPF). This assessment uses the term 'cultural heritage'. It has been undertaken in accordance with DMRB Volume 11 Section 3 Part 2, where 'cultural heritage' is considered coterminous with the term 'historic environment' used within the NPPF.

8.1.5 Within the NPPF, 'historic environment' is defined as:

'All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.'

This definition mirrors that of 'cultural heritage' as defined in DMRB Volume 11 Section 3 Part 2, 2/1.

8.1.6 This assessment uses the term 'Heritage Asset'. In the NPPF, this is defined as *'A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage asset includes designated heritage assets and assets identified by the local planning authority*

(including local listing).’ Heritage Assets are identified and assessed in section 8.2 below (Baseline Conditions).

8.1.7 Potential cultural heritage concerns arising from the construction of the proposed scheme are as follows:

- Physical damage or destruction to sub-surface archaeological remains, extant historic hedgerows, boundaries and footpaths and non-statutory historic buildings.
- Damage to the setting of statutory and non-statutory historic buildings.
- Negative effects on historic landscape character (historic hedgerows, boundaries, footpaths and historic buildings).

Methodology

8.1.8 The extent of the proposed Development Area (DA) is shown in Figure 8.1. The chosen road corridor (CRC) will lie within the DA, but will not occupy all of it. Because the impacts of construction will affect the CRC to a much greater extent than the rest of the DA, this chapter distinguishes between the DA (subject to some evaluative works) and the CRC (which will be subject to all evaluative works). In order to ensure that resources are targeted effectively (on land that will be most affected by the proposals) a phased approach has been taken to the collection of baseline data.

8.1.9 **Phase 1 - Walk-over Survey.** The walk-over survey comprised a rapid but systematic field-by-field survey of the entire DA. Its aim was to identify any upstanding earthworks and to record local topography and current land-use. This information was then incorporated into the Phase 2 desk-based assessment.

8.1.10 **Phase 2 - Desk-Based Assessment (DBA)** (see Appendix 8.1). The DBA summarises the known or potential archaeological resource within the whole DA. It collates existing archaeological, historical and topographical information in order to identify the likely extent, character and quality of the known or potential archaeological resource.

8.1.11 The potential for cropmark analysis was considered during Phase 2 of this project. The National Monuments Record (NMR) held by English Heritage in Swindon was consulted along with internet mapping websites (<http://maps.google.co.uk/maps> and <http://www.flashearth.com>) and it was decided that there was little or no potential based on these sources. Therefore, this technique was not pursued.

8.1.12 The National Monuments Record (NMR) was consulted to search for listed buildings within a 500m radius of the proposed development. In line with the definition of cultural heritage in DMRB Volume 11 Section 3 Part 2, 2/1, and the NPPF, an assessment of the significance of undesignated buildings within the DA has also been undertaken.

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- 8.1.13 **Phase 3 - Archaeological Field Evaluation** (see Appendices 8.2 and 8.3). This phase includes the following:
- i. non-intrusive fieldwalking (see Appendix 8.3)
 - ii. non-intrusive geophysical survey (detailed magnetic survey - see Appendix 8.2)
 - iii. monitoring of intrusive geotechnical test-pits (see Appendix 8.3)
 - iv. intrusive trial trenching, targeted on potential sub-surface archaeological remains identified by the non-intrusive surveys.
- 8.1.14 The above strategy was designed in response to a brief issued by Central Bedfordshire Council's (CBC) County Archaeological Officer (CAO) (CBC 2009). The scope and purpose of these techniques was agreed with and approved by the CAO prior to commencement of the works. To date, Phase 3 techniques i to iii have been carried out only within the proportion of land approved by the CAO, and not within the entire DA. The extent of land subject to these techniques is shown and discussed in Appendices 8.2 and 8.3. No land has been subject to Phase 3 technique iv (trial trenching).
- 8.1.15 Additional evaluative work will be undertaken, in the above order, once a chosen road corridor (CRC) has been defined. The order in which these techniques will be applied ensures that each will build upon the results of its predecessors. This guarantees that potential sub-surface remains are subjected to progressively more intensive testing, producing high quality results.
- 8.1.16 Fieldwalking involves the systematic recovery of artefacts from the ground surface, providing information on the location and date of potential sub-surface archaeological remains. Artefact distribution (particularly concentrations of artefacts) may indicate the location of former occupation sites. Given suitable conditions (including soil, weathering, crop growth and light), artefacts can be seen within ploughed soil. They are brought to the surface by the cultivation of soil overlying buried archaeological features/deposits. Selected parts of the DA under arable cultivation were subject to this technique (Appendix 8.3, Figures 5-8).
- 8.1.17 Detailed magnetic survey was used to define the extent of sub-surface remains and determine their location, extent and character (e.g. settlement, field system etc.). Selected parts of the DA were subject to this technique (Appendix 8.2, Appendix 8.3, Figures 9-12).
- 8.1.18 Trenching will be used to gather information on the character, complexity, depth, extent, date (through datable artefactual materials) and significance of suspected, or known, archaeological sites/remains, identified by non-intrusive techniques described above. It will also test areas of the CRC where remains were not identified by non-intrusive survey. This will be undertaken as part of the Stage 3 assessment.
- 8.1.19 Thirty-one geotechnical test-pits, located throughout the DA, were subject to archaeological monitoring to identify any sub-surface archaeological deposits (Appendix 8.3, Figure 13). It is not anticipated that any further geotechnical test-pits will be required.
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- 8.1.20 Although only partial in their extent, the Phase 3 works to date have been instrumental in the identification of above and below ground Heritage Assets within the DA. Additional Phase 3 evaluative works will be undertaken for inclusion within the Stage 3 DMRB report in order to fully evaluate the archaeological potential of the CRC. Those additional evaluative works will include trial trenching. This will take place over all suitable land within the CRC. The layout of trenches will be discussed and agreed with the CBC CAO. Works will be monitored in the field by the CAO.
- 8.1.21 The combined results of non-intrusive and intrusive evaluative fieldwork will provide sufficient information for the CAO to advise CBC on the sub-surface archaeological potential of the proposed development.

8.2 Baseline Conditions

- 8.2.1 Work to date has allowed land within the proposed development to be divided into Heritage Assets (HAs). HA numbers have been assigned to significant elements of the historic environment. They may represent an individual or combined aspect of the historic environment, such as: a listed building, an area of sub-surface archaeological remains, an historic boundary or part of a preserved ridge and furrow landscape.
- 8.2.2 The HAs (sub-surface archaeology, built heritage and historic landscapes) have been defined on the basis of the non-intrusive evaluation. Their value is determined by combining the relative 'importance' and relative 'significance / potential' of each asset.

Table 8.1 ~ Criteria Used to Assess Archaeological and HA Importance	
Importance	Definition
Statutory	Demonstrates national or international importance that is recognised by legal designation.
International	Demonstrates connections with international archaeology and the historic environment. (Well preserved monuments of international significance will be recognised by statutory designation, see above).
National	Demonstrates connections with British archaeology and the historic environment. (Well preserved monuments of National significance will be recognised by statutory designation, see above).
Regional	Demonstrates connections with the archaeology and historic environment of the Bedfordshire and the eastern region.
Local	Demonstrates connections with the archaeology and historic environment of Luton, Houghton Regis, and Chalton.
Neutral	Has no particular significance as above, but not actually negative.
Negative	Detracts from other, more significant elements of the archaeological and cultural heritage resource.
Unknown	Further investigation is required before a reliable assessment can be made.

Importance

- 8.2.3 The relative importance of a HA is determined using the criteria defined in Table 8.1 above.

Significance/ Potential

- 8.2.4 In addition to relative importance, HAs are also assessed on their relative significance or potential (high, medium and low) where 'significance' indicates assessment of known assets or remains and 'potential' refers to assessment of the likely significance of as yet unknown remains.
- 8.2.5 As such, each HA has been issued with a combined value (i.e. **high local** value, or **low national** value). For the purposes of this assessment, these values have been translated into the following criteria in line with DMRB Volume 11 Section 3 Part 2: **very high**, **high**, **medium**, **low**, and **negligible**. Table 8.2 below illustrates the process by which importance and significance/ potential are used to determine cultural heritage value.

Table 8.2 ~ Determination of Asset Value		
Importance of Asset	Significance/ Potential of Asset	Cultural Heritage Value
Statutory	n/a	Very High
International	High	
	Medium	
	Low	
National	High	High
	Medium	
	Low	
Regional	High	Medium
	Medium	
	Low	
Local	High	Low
	Medium	
	Low	
Neutral	Negligible/ None	Negligible/ None
Negative	n/a	n/a
Unknown	n/a	n/a

Sub-Surface Archaeology

- 8.2.6 The National Monuments Record (NMR) was consulted to search for HAs within a 500m radius of the proposed development. Searches revealed that no monuments or HAs under statutory designation were present within the DA.
- 8.2.7 Consultation with the NMR, desk-based assessment (DBA) and evaluative fieldwork have revealed no sub-surface remains of international or national significance within the DA.

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- 8.2.8 The DBA has identified that the proposed development has the potential to affect sub-surface remains from various periods. Research showed there was a high potential for finding prehistoric remains, although they are unlikely to be associated with permanent settlement. Outside the DA, the presence of early-late Iron Age remains (HER15820 and 15839) indicate moderate potential for the DA to contain remains from this period. Previous fieldwalking evaluation has revealed evidence for the remains of several Roman farmsteads in the vicinity of the DA (HER15501, 15812 and 15839). These indicate high potential for remains of this period to exist within the DA.
- 8.2.9 Within the DA, there is little archaeological evidence for remains from the Anglo-Saxon and medieval periods. However, there is moderate potential to find remains associated with the agricultural landscape which is known to have existed in the area. This is likely to take the form of ridge and furrow cultivation. Similarly, there is moderate potential for the DA to contain remains associated with the agrarian landscape of the post-medieval period. Cropmark evidence for small-scale quarrying exists adjacent to Chalton Cross Farm (HER12120 and 1792) in the northern part of the DA. The southern end of the DA lies within the previous extent of the 17th-century landscaped grounds of Houghton Hall (HER7024).
- 8.2.10 The results of geophysical survey will be augmented through trial trenching, the results of which will be included within the Stage 3 DMRB assessment report. These results will be further developed should mitigation fieldwork take place in any of the HAs described below.
- 8.2.11 **Heritage Asset 1** lies partly within the northern part of the DA and has been identified by geophysical survey and fieldwalking undertaken within the scope of the original development corridor (Figure 8.2). Sub-surface remains comprise a number of discrete features, possibly related to pitting, single linear features, demarcating the location of fields and a pair of north west to south east aligned parallel linear features representing a probable routeway. The alignment of these parallel remains matches the position of an extant footpath which first appears on the 1797 Toddington inclosure map. The remaining linear features do not appear on the inclosure map of 1797 and are likely to represent the remains of the field systems prior to their inclosure in the 18th century. The recovery, through fieldwalking, of early post-medieval (16th-17th century) pottery and medieval/post-medieval ceramic building material from surrounding plough soil support the pre 19th-century date. Cartographic and fieldwalking evidence indicate these remains represent field-systems that pre-date the 1880 1st Edition Ordnance Survey map. Although only a small part of these remains lie within the DA, as an indicator of potential sub-surface archaeology within the DA, HA1 is considered to be of **medium regional** value.
- 8.2.12 **Heritage Asset 2** lies in the central part of the DA, within the southern extent of Phase 3 geophysical survey (Figure 8.2). It comprises two components, broadly within the same geographical location: Roman remains identified by fieldwalking survey (HA2.1) and sub-surface remains identified by geophysical survey (HA2.2).

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- 8.2.13 **HA 2.1** comprises HER15812, the site of a suspected Roman farmstead, identified from roof tile, ceramic building materials and iron smelting slag found during fieldwalking. It lies partially within the central part of the DA, adjacent to the Houghton Brook. As indicators of sub-surface archaeological potential, they are considered to be of **low regional** value.
- 8.2.14 **HA 2.2** comprises a number of discrete and linear sub-surface geophysical anomalies likely to represent pitting and field boundaries and small enclosures respectively. Within HA2.2, two parallel, broadly north - south aligned linear features identified by geophysical survey match with the parish boundary and an associated routeway, recorded in the HER as 'Mear Way' (HER12407) and shown on the Houghton Regis estate map of 1762. Like those of HA1, the associated field-systems are not shown on the Toddington and Houghton Regis inclosure maps. Therefore, these pre-date 1796-1797 and represent pre-inclosure field systems. Their morphology is similar to those identified within HA1 and their association with the parish boundary suggests they may be broadly medieval or early post-medieval in date. Based on the evidence available, these remains are considered to be of **medium regional** value.
- 8.2.15 It is not clear whether the artefactual materials identified by fieldwalking (HA2.1) are associated with any of the sub-surface remains identified by geophysical survey (HA2.2). Trial trenching evaluation will be required to test the relationship between these two HAs.
- 8.2.16 **Heritage Asset 3** comprises HER15501, a site of suspected Roman occupation at Chalton Cross, identified from pottery, tile and ceramic building material during fieldwalking. HA3 lies partly within the DA, around 400m south of Chalton Cross Farm, with the remainder within the parish of Houghton Regis, outside the DA.
- 8.2.17 Fieldwalking and geophysical survey undertaken as part of this assessment were unable to confirm the presence of Roman remains within the DA. It is likely that any sub-surface remains associated with HA3 lie outside the DA, within the parish of Houghton Regis. Trial trenching evaluation will be required to confirm the presence or absence of Roman remains within the DA. However, as an indicator of potential sub-surface archaeology, HA3 is considered to be of **low regional** value.
- 8.2.18 Geophysical survey has revealed the presence of ridge and furrow cultivation in parts of the proposed DA (Appendix 8.2 - Linear feature, agricultural). The importance and significance of these remains lies with their presence and layout in plan; they are considered to have neutral importance and negligible significance. They are consequently considered to be of negligible cultural heritage value and have not been assigned a HA number.

Historic Landscapes

- 8.2.19 Within the context of this assessment, the term 'historic landscapes' refers to historically significant hedgerows, boundaries and footpaths within the DA and surrounding land.
- 8.2.20 For the purposes of this assessment, historic hedgerows are identified using the Hedgerows Regulations (1997) Guide to the Law and Good Practice (Defra 2002), which defines

significant hedgerows as being an integral part of field systems pre-dating 1845 or of inclosure field-systems pre-dating 1870.

- 8.2.21 **Heritage Asset 4.** Cartographic evidence indicates that a number of hedgerows within the DA are first recorded on the 1796 Houghton Regis and 1797 Toddington inclosure maps or the first edition Ordnance Survey maps of 1880 and 1882 (Figure 8.3). These hedged boundaries reflect the layout of the landscape following the eradication of the medieval field-systems through the process of inclosure, a process which began in the late 18th century and continued into the middle of the 19th century. They are considered to be of **medium regional** value.
- 8.2.22 **Heritage Asset 5.** A number of hedgerows within the DA are shown on the Houghton Regis estate map of 1762 (Figure 8.3). This map illustrates the landscape prior to the process of inclosure and is likely to represent the layout of medieval field-systems. Prominent among the few surviving elements of these pre-inclosure field-systems is the parish boundary which lies within the western part of the DA. The surviving elements of this medieval hedged boundary are of **medium regional** value.

Historic Buildings

- 8.2.23 The National Monuments Record (NMR) was consulted to search for listed buildings within a 500m radius of the DA. No listed buildings were identified within the DA or land immediately adjacent to it.

Setting of Historic Buildings

- 8.2.24 English Heritage requested (see Appendix 1 - EH letter of 27 April 2010) that the setting of the Grade II* listed Houghton Hall (HER5687) and gardens and listed buildings in the village of Chalton be considered in relation to the scheme. The 17th-century Houghton Hall (HER5687) and the area of its associated landscaped gardens (HER7024) do not fall directly within the DA. The grounds lie to the south-east of the southern extent of the scheme whilst the hall itself is located within these grounds, around 600m west of the southern extent of the DA. The setting of these assets is discussed in Section 8.3.

Other Historic Buildings

- 8.2.25 Several undesignated buildings exist within the DA. In order to assess their cultural heritage value and decide whether they should be defined as HAs, a rapid built heritage assessment has been undertaken.
- 8.2.26 **Heritage Asset 6 (Figure 8.3).** Chalton Cross Farm is located within the northern part of the DA first recorded on the 1st edition 6" Ordnance Survey map of 1880. However, it does not appear on the 1797 Toddington inclosure map. Its layout is similar to those of the 'model farms' built during the mid-19th century 'golden age' of farming as part of the process of agrarian industrialisation. This is likely to be of **medium regional** value, addressing specific

research themes for the eastern region (Gilman *et al* 2000, 42). Further characterisation of the significance will be required for inclusion in the Stage 3 DMRB report.

8.2.27 A small yard, located around 200m south of Chalton Cross Farm incorporates the derelict remains of buildings shown on the 1880 1st edition Ordnance Survey map (see Figure 8.3). They did not appear on the inclosure map of 1797 and are likely to be associated with Chalton Cross Farm. The only surviving elements of these buildings are parts of the southern and western walls. These remains, and the modern yard, are considered to have neutral importance and negligible significance and have **negligible** cultural heritage value.

8.3 Potential Effects

8.3.1 This section describes the magnitude of the potential effects of the proposed development, without mitigation and enhancement. For the purposes of this DMRB Stage 2 assessment, the impacts on heritage assets are assessed on the basis of a worst-case scenario within the scope of the entire DA. In practice the Chosen Road Corridor (CRC) would affect only part of the DA and would therefore have fewer impacts than set out in this document.

8.3.2 Impacts may affect assets materially, or affect their setting. For the purposes of this assessment and in line with DMRB Volume 11 Section 3 Part 2, impacts are assessed using the following scales:

- Magnitude - major, moderate, minor, negligible (positive or negative) or no change (see Table 8.3 below).
- Immediacy - direct, indirect or secondary.
- Permanence - temporary (short, medium or long term), permanent or cumulative (multiple or incremental effects on a single asset from the same scheme).

All impacts have been assessed using an element from each of these scales such that an impact may be described as (for example) permanent minor positive, medium term minor negative or secondary permanent major negative.

Table 8.3 ~ Definition of the Relative Magnitudes of Negative and Positive Impacts

Magnitude of Impact	Definition
Major Negative	<ul style="list-style-type: none"> Causes major change to archaeological assets, leading to their complete destruction or the complete loss of key components. Causes major and comprehensive change to the visible appearance of a heritage asset, either obscuring it from view or preventing any appreciation of its landscape context. Causes major change to key historic building elements, such that the asset is totally altered.
Moderate Negative	<ul style="list-style-type: none"> Causes moderate damage to archaeological assets, leading to their partial destruction involving the partial loss of two or more key components. Causes moderate change to the visible appearance of a heritage asset, partially obscuring it from view and preventing a full appreciation of its landscape context. Causes moderate change to many to key historic building elements, such that the asset is significantly modified.
Minor Negative	<ul style="list-style-type: none"> Causes moderate damage to archaeological assets, leading to their partial destruction without the complete loss of any key components. Causes a minor change to the visible appearance of a heritage asset, either slightly obscuring it from view or detracting from the appreciation of its landscape context. Causes minor change to key historic building elements, such that it is noticeably modified.
Negligible Negative	<ul style="list-style-type: none"> Causes negligible changes to damage to archaeological assets, amounting to partial damage without any loss of key components. Causes a negligible change to the visible appearance of an asset, such that it hardly changes the appreciation of its landscape context. Causes negligible changes to historic building elements, such that they hardly affect it.
No Change	<ul style="list-style-type: none"> No change to archaeological assets. No change to the visual appearance or setting of an asset. No change to historic building elements.
Negligible Positive	<ul style="list-style-type: none"> Ensures the continued survival of archaeological assets in a stable condition OR increases knowledge and understanding of it. Ensures that there will be no new detrimental impacts on the visible appearance of a heritage asset, with negligible improvement. Ensures the continued survival of historic building elements, with negligible improvement.
Minor Positive	<ul style="list-style-type: none"> Ensures the continued survival of archaeological assets in a stable condition OR considerably increases knowledge and understanding of it. Ensures that there will be no new detrimental impacts on the visible appearance of an archaeological feature, but without significant improvement OR increases knowledge and understanding of it. Ensures the continued survival of historic building elements, such that there is minor enhancement.
Moderate Positive	<ul style="list-style-type: none"> Actively improves the condition of archaeological assets by removing one or more low-level, chronic threats to their survival. Actively improves the visible appearance of a heritage asset by removing lesser elements that are overbearing or detract from an appreciation of its landscape context OR considerably increases knowledge and understanding of it. Ensures the continued survival of historic building elements, such that there is moderate enhancement and increased knowledge and understanding of it.
Major Positive	<ul style="list-style-type: none"> Actively improves the condition of archaeological assets by removing one or more acute threats to their survival. Actively improves the visible appearance of a heritage asset by removing elements that are very overbearing or a major obstacle to an appreciation of its landscape context. Ensures the continued survival of historic building elements, such that there is major enhancement and considerable increased knowledge and understanding of it.

8.3.3 Direct effects are those arising from straightforward consequences of the scheme (i.e. physical damage or improvements to an asset or increased noise/pollution). Indirect or secondary effects arise via a complex route, such that the impact is ‘complicated, unpredictable or remote’ (DMRB Volume 11 Section 3 Part 2, 4/3). This could (for example)

be changes to farming regimes arising from severance of land or changes to hydrology affecting the preservation of palaeoenvironmental remains.

- 8.3.4 Temporary impacts, whether short, medium or long term, are reversible. Permanent impacts are irreversible and cumulative impacts can arise from multiple and/or incremental effects of the same scheme on a single asset.
- 8.3.5 During construction the activities which would potentially impact upon sub-surface archaeological assets are broadly as follows:
- Groundworks for buildings, roads, utilities, contractors' compounds, temporary roads.
 - Landscaping and earthmoving.
 - Rutting of land caused by movement of contractors' plant.
- 8.3.6 The completed road could potentially impact upon HAs in the following ways:
- Direct damage or disturbance.
 - Severance/fragmentation of related assets or historic landscapes.
 - Noise and vibration.
 - Visual impacts on setting.
- 8.3.7 Sub-surface archaeological HAs are directly and indirectly vulnerable to all aspects of development involving removal or disturbance of topsoil and subsoil which can lead to the removal of sub-surface archaeological deposits. The construction of roads can also involve substantial landscaping which may also have a negative impact on sub-surface remains. Short term changes to the land, caused by contractors' compounds, material storage areas and temporary roads can also cause significant ground disturbance and affect sub-surface archaeological remains.
- 8.3.8 Above ground HAs (built heritage and landscape settings) are directly and indirectly vulnerable to all aspects of development. Buildings can be physically removed or damaged, or their settings can be obscured through the construction of roads and associated landscaping.
- 8.3.9 The DA covers a roughly 3km long corridor of land between Houghton Regis and the proposed Junction 11A of the M1, south east of the village of Chalton (Figure 8.1).
- 8.3.10 The construction of the scheme will have direct, permanent and short term impacts on sub-surface archaeology and built heritage assets and on the setting of built heritage assets and historic hedgerows.
- 8.3.11 Table 4.1 in section 4.3 above was used to assess the significance of the effects of development on each HA. The results of this process are discussed below and Figures 8.2 and 8.3 should be referred to in conjunction with this text.

8.3.12 The significance of effects is determined by the magnitude and permanence of the impact. The significance of the effects on a single HA is the same whether the impacts are direct, indirect or secondary.

8.3.13 **Heritage Asset 1.** The northernmost (minority) part of HA1 lies within the construction area, where the magnitude of development impact would be highest.

Table 8.4 ~ Summary of Cultural Heritage Value and Development Impact: HA1			
HA1	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on minority of asset	Medium	Major negative	Moderate / Large

8.3.14 **Heritage Asset 2.1.** HA2.1 is within the construction area, where the magnitude of development impact would be highest.

Table 8.5 ~ Summary of Cultural Heritage Value and Development Impact: HA2.1			
HA2.1	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on entirety of asset	Low	Major negative	Slight / Moderate

8.3.15 **Heritage Asset 2.2.** The majority of HA2.2 is within the construction area where the magnitude of development impact would be highest.

Table 8.6 ~ Summary of Cultural Heritage Value and Development Impact: HA2.2			
HA2.2	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on majority of asset	Medium	Major negative	Moderate / Large

8.3.16 **Heritage Asset 3.** The north-eastern part of HA 3 is within the construction area where the magnitude of development impact would be highest. The south western part, forming the minority of HA3, lies outside the construction area where the development would have no impact.

Table 8.7 ~ Summary of Cultural Heritage Value and Development Impact: HA3			
HA3	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on north east part (majority) of asset	Medium	Major negative	Moderate / Large

8.3.17 **Heritage Asset 4.** A number of historic, inclosure era (late 18th to late19th century) hedgerows fall within the construction area where the magnitude of development impact would be highest. Others fall outside the construction area and would not be directly affected by the proposed road. However, the construction of the road would directly impact on their wider landscape setting. There would also be a short-term impact on the setting of these hedgerows during the construction phase of the road as a consequence of construction traffic and noise.

Table 8.8 ~ Summary of Cultural Heritage Value and Development Impact: HA4			
HA4	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on those within DA	Medium	Major negative	Moderate/ Large
Direct permanent impact on setting of those outside DA	Medium	Minor negative	Slight
Direct short-term impact on setting of those outside DA	Medium	Negligible negative	Neutral Slight

8.3.18 **Heritage Asset 5.** A number of historic hedgerows, pre-inclosure (before 1762) hedgerows and boundaries, one of which represents the remains of the medieval parish boundary between Toddington and Houghton Regis, fall within the construction area where the magnitude of development impact would be highest. Others fall outside the construction area and would not be directly affected by the proposed road. However, the construction of the road would impact on their wider landscape setting. There would also be a short-term impact on the setting of hedgerows outside the DA during the construction phase of the road as a consequence of construction traffic and noise.

Table 8.9 ~ Summary of Cultural Heritage Value and Development Impact: HA5			
HA5	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on those within DA	Medium	Major negative	Moderate/ Large
Direct permanent impact on setting of those outside DA	Medium	Minor negative	Slight
Direct short-term impact on setting of those outside DA	Medium	Negligible negative	Neutral Slight

8.3.19 **Heritage Asset 6.** Chalton Cross Farm, a probable model farm of the early to middle 19th century falls entirely within the DA where the magnitude of development impact would be highest.

Table 8.10 ~ Summary of Cultural Heritage Value and Development Impact: HA6			
HA6	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on entirety of asset	Medium	Major negative	Moderate/ Large

Other Cultural Heritage Issues

8.3.20 The modern yard and derelict remains of a 19th-century farm building fall within the construction area where the magnitude of development impact would be highest.

Table 8.11 ~ Summary of Cultural Heritage Value and Development Impact on Modern Yard			
Modern Yard	Value	Impact Magnitude	Significance of Effects
Direct permanent impact on modern yard and derelict remains of C19th building	None	Negligible negative	Neutral

8.3.21 Houghton Hall (HER5687) and its gardens (HER7024) lie outside the construction area and would not be directly impacted by the proposed development. The gardens and hall lie around 600m to the west of the southern limit of the DA. They are screened from the proposed development by modern buildings at Houghton Hall business park and by an area of modern housing between Windsor Drive and Park Road North. Due to the screening afforded by these modern buildings, the proposed development is considered to result in no change to the visual setting of Houghton Hall and gardens.

Table 8.12 ~ Summary of Cultural Heritage Value and Development Impact on Houghton Hall & Gardens			
Houghton Hall & Gardens	Value	Impact Magnitude	Significance of Effects
Visual impact upon Houghton Hall & Gardens	Very High	No Change	Neutral

8.3.22 The historic village of Chalton lies around 500m north of the DA. It contains a number of post-medieval buildings from the 16th-19th centuries. The majority of the village will be screened from the proposed development by modern houses forming the southern limit of Chalton and intervening vegetation. The proposed development is likely to have a low impact upon the visual setting of Chalton village.

8.3.23 It is possible that as yet undiscovered sub-surface archaeological remains are present within the DA. All construction groundwork for the proposed road would have a major negative impact on any such remains within the road corridor. However, the significance of the effects of development on these areas is as yet **unknown**.

8.3.24 No additional impacts on sub-surface archaeological remains within the proposed road scheme are likely to arise during the operational period of the road.

Confidence Rating

8.3.25 The quantity and quality of archaeological information available is variable for different parts of the DA. It is possible that some impacts will be more or less significant than predicted above. The information currently available leaves some uncertainty with regard to the significance of the effects of the proposed road scheme on cultural heritage.

8.3.26 Additional archaeological evaluation will further clarify the value of known HAs within the CRC and identify as yet unknown sub-surface archaeological remains. It will also maximise the available information used to assess the magnitude of the development impacts on

known and as yet unknown heritage assets. The results of further evaluative work will be presented at Stage 3.

8.4 Proposed Mitigation Measures

8.4.1 Impacts with a neutral significance are not considered to require mitigation measures and have not been brought through to the following part of the assessment. A series of mitigation proposals covering HAs and setting issues have been generated using the following sources of data.

8.4.2 Phases 1 (walk-over survey), 2 (DBA) and 3 (fieldwalking and geophysical survey) were used to characterise the potential of the DA to contain HAs.

8.4.3 For above ground cultural heritage setting issues relevant English Heritage (EH) and Office of the Deputy Prime Minister (ODPM) guidance documents have been consulted (ODPM 2004, EH 2005, EH 2006, EH 2008).

Sub-Surface Archaeology

8.4.4 The results of the archaeological evaluation (Phases 1 to 3) will be used to decide (in consultation with the CBC CAO) which measures are needed to mitigate impacts on sub-surface archaeological remains. These Phase 4 mitigation measures (see Table 8.13) would be applied in order to ensure the proposed development would have positive, neutral or minor negative impacts on these remains.

Mitigation No.	Description of Mitigation Measure
Mitigation 1	No further action. Where evaluation works have shown the impact is negligible or minor and have provided sufficient information to mitigate the impact with no further recording work.
Mitigation 2	Where there are minor negative impacts on sub-surface remains: limited investigation and recording prior to or during development.
Mitigation 3	Where there are moderate negative impacts on remains: open area excavation and recording prior to or during development.
Mitigation 4	Where there are beneficial impacts on remains: design solutions to avoid or reduce the impact (preservation <i>in situ</i> through management plans and possible amenity enhancement strategies such as information boards).

8.4.5 The proposed development could have a major, negative impact on sub-surface archaeological remains without the employment of appropriate mitigation measures. In order to mitigate these impacts, a combination of preservation *in situ* (where possible) and large scale archaeological field investigation (leading to publication, dissemination and archiving) of any identified remains will be applied. The recording, publication and dissemination of information on any sub-surface remains would limit the negative impact of the proposed

development by increasing our understanding of the area's past, as it would provide new data on the archaeology and cultural heritage of the area.

Historic Landscapes

- 8.4.6 The results of archaeological evaluation will be used (in consultation with the CBC CAO) to develop strategies for the mitigation of impacts on historic landscapes (historic hedgerows and boundaries). Phase 4 mitigation measures (see Table 8.14) would be applied in order to ensure the proposed development would have either neutral or minor negative impacts on these remains.

Table 8.14 ~ Mitigation Options for Impacts on Historic Hedgerows and Boundaries	
Mitigation No.	Description of Mitigation Measure
Mitigation 5	No further action. Where evaluation works have shown the negative impact is negligible or minor and have provided sufficient information to mitigate the impact with no further recording work.
Mitigation 6	Where there are moderate or major negative impacts on asset: mapping of historic hedgerows and boundaries prior to development and appropriate dissemination/publication of results.
Mitigation 7	Where there are beneficial impacts on historic hedgerows and boundaries: design solutions to avoid or reduce the impact (preservation <i>in situ</i> where possible, provision of alternative routes for footpaths and enhancement of hedgerows/boundaries not directly impacted by development through information boards)

- 8.4.7 Removal of the historic hedgerows and boundaries within the CRC would have a major, negative impact, and a minor negative impact on the setting of those outside it.
- 8.4.8 In mitigation, several measures have been suggested to enhance the setting and accessibility of historic hedgerows and boundaries (enhancements of and improved access to hedgerows outside the DA, continuation of or alternative provision of removed footpaths). On balance, the changes which would be brought about by the proposed development would not detract from the '*significance of the place*' in its totality, the majority of which will remain located outside the CRC. The changes would moreover enhance visibility and accessibility of the historic hedgerows and boundaries surrounding the CRC and considerably increase our understanding of them. Proposed enhancement would limit the negative impact of the proposed development.

Historic Buildings

- 8.4.9 The results of archaeological evaluation will be used (in consultation with the CBC CAO) to develop strategies for the mitigation of impacts on historic building assets. Phase 4 mitigation measures (see Table 8.15) would be applied in order to ensure the proposed development would have either positive, neutral or minor negative impacts on these remains.
- 8.4.10 The following mitigation measures for historic building assets (Table 8.15) are such that photographic, drawn and written data are gathered in order to ensure that an adequate

record of fabric and character exists prior to any irrevocable change/s being made. Depending upon the relative significance of the asset and the extent of the proposed changes, the following Levels (RCHME 1996) of recording may be used as mitigation for the effects of development.

Table 8.15 - Mitigation options for Impacts on historic building assets				
Levels (RCHME 1996)				
Level	Record	Written	Drawings	Photographic
1	Visual	Simple record	Sketch (generally exteriors only)	General
2	Descriptive	Basic record	Scaled plans	General (external and internal)
3	Analytical	Full record	Scaled plans, sections, measured details	Comprehensive
4	Comprehensive	Full record	Scaled plans, sections, measured details, elevations, reconstructions	Comprehensive

8.4.11 Removal of the historic building assets within the CRC would have a major, negative impact. However, the recognition of Chalton Cross Farm as a Heritage Asset (HA6) through investigations occasioned by these development proposals and further Stage 3 recording will limit the negative impact of the proposed development.

8.5 Assessment of Residual Effects

8.5.1 Mitigation measures, undertaken in advance of or during the proposed development, would be sufficient to deal with all foreseeable negative impacts on heritage assets within and outside the CRC. This would include impacts of any normal maintenance works or permitted development that may take place subsequent to the initial completion of the scheme (e.g. planting trees). By recording sub-surface archaeological remains, built heritage assets, mapping and enhancing historic hedgerows/boundaries and disseminating information, the negative impact of the proposed development will be reduced through an increase in our understanding of the archaeological resource of the area.

8.6 Summary and Conclusions

8.6.1 There are two principal cultural heritage concerns arising from the proposed development:

- Direct and permanent damage to Heritage Assets within the CRC arising from construction of the road (sub-surface archaeological remains, extant historic hedgerows, boundaries and footpaths and non-statutory historic buildings).

-
- Direct and permanent or long term damage to the setting of Heritage Assets and historic landscape character (historic hedgerows, boundaries and footpaths and historic buildings).

Each of those concerns has been recognised and addressed with appropriate mitigation proposals (see Table 8.16 below).

- 8.6.2 The proposed development could potentially have a major, negative impact on sub-surface archaeological remains within the area of construction. However, by preserving significant archaeological remains *in situ* wherever possible, and investigating them in advance of construction where preservation is not possible, the development would, at worst, have a minor negative residual effect.
- 8.6.3 Removal of the historic hedgerows, boundaries and footpaths within the CRC would have a major negative impact. However, the proposed mapping of these assets prior to development followed by appropriate dissemination / publication of results would result in a minor negative residual effect.
- 8.6.4 Removal of one historic building within the area of the CRC would have a major negative impact. However, the proposed recording of this asset, followed by appropriate dissemination / publication of results would result in a minor negative residual effect.
- 8.6.5 The proposed development would have a minor, negative impact on the setting of historic landscape assets (historic hedgerows, boundaries and footpaths). However, increased access to and enhancement of remaining boundaries through information boards and the planting of trees in key positions would improve the wider setting of these assets and result in a neutral residual effect.
- 8.6.6 A summary of the residual effects is provided in Table 8.16 below.

Table 8.16 ~ Summary of Mitigation Measures and Residual Effects

Nature and Location of Impact	Unmitigated Impact Magnitude	Mitigation Measures	Summary Effects of Mitigation Measure/ Residual Effect		
			Permanence of mitigation measure	Magnitude of mitigation measure	Net residual effect after mitigation
Road construction resulting in destruction of known sub-surface archaeological remains within HA1 and HA2.2 (Figure 8.2).	Direct permanent major negative	Archaeological investigation, leading to the dissemination of new information on archaeological remains within the DA and to a considerable increase in archaeological knowledge.	Permanent record	Moderate positive	Permanent minor negative
		Identification of previously unknown archaeological remains through investigations occasioned by the development proposals.	Permanent record	Minor positive	
Road construction resulting in destruction of potential sub-surface archaeological remains within HA2.1 and N-E part of HA3 (Figure 8.2).	Direct permanent major negative	Archaeological investigation, leading to the dissemination of new information on archaeological remains within the DA and to a potentially significant increase in archaeological knowledge.	Permanent record	Moderate positive	Permanent minor negative
		Identification of previously unknown archaeological remains through investigations occasioned by the development proposals.	Permanent record	Minor positive	
Road construction resulting in destruction of parts of historic hedgerows and boundaries HA4 and HA5 (Figure 8.3).	Direct permanent major negative	Mapping of historic hedgerows and boundaries prior to development and appropriate dissemination/publication of results leading to a considerable increase in knowledge.	Permanent record	Moderate positive	Permanent minor negative
		Identification of previously unknown historic boundaries through investigations occasioned by development proposals.	Permanent record	Minor positive	

Table 8.16 ~ Summary of Mitigation Measures and Residual Effects

Nature and Location of Impact	Unmitigated Impact Magnitude	Mitigation Measures	Summary Effects of Mitigation Measure/ Residual Effect		
			Permanence of mitigation measure	Magnitude of mitigation measure	Net residual effect after mitigation
Road construction and severance of historic hedgerows and boundaries (HA4 and HA5) resulting in partially obscured views and reduction in the value of their wider setting (Figure 8.3).	Direct permanent minor negative	Improved access to and enhancement of remaining boundaries through information boards.	Long-term provision	Minor positive	Permanent neutral
		Tree planting along road to improve wider setting of historic hedgerows and boundaries.	Long-term provision	Minor positive	
Road construction resulting in the severance of historic footpaths (within HA4 and HA5) (Figure 8.3).	Direct permanent minor negative	Retain original route or provide alternative footpath maintaining and enhancing access to land.	Permanent provision	Minor positive	Permanent neutral
Road construction resulting in total destruction of Chalton Cross Farm (HA6) (Figure 8.3).	Direct permanent major negative	RHCME level 3 recording of building prior to demolition and publication of results leading to an increase in knowledge.	Permanent record	Moderate positive	Permanent minor negative
		Identification of Chalton Cross Farm as a heritage asset with cultural heritage significance through investigations occasioned by these development proposals.	Permanent record	Minor positive	
Road construction resulting in destruction of modern yard and derelict remains of 19th-century building.	Direct permanent major negative	RCHME Level 1 photographic record. Remains are of insufficient value to require further mitigation measures.	Permanent record	Negligible positive	Permanent neutral

Table 8.16 ~ Summary of Mitigation Measures and Residual Effects

Nature and Location of Impact	Unmitigated Impact Magnitude	Mitigation Measures	Summary Effects of Mitigation Measure/ Residual Effect		
			Permanence of mitigation measure	Magnitude of mitigation measure	Net residual effect after mitigation
Construction of road and ancillary structures (e.g. balancing ponds) resulting in destruction of as yet unknown sub-surface archaeological remains.	Direct permanent major negative	Where this is the case targeted evaluation (geophysical survey and trial trenching) prior to DMRB Stage 3 Assessment, followed by further archaeological field investigation, if appropriate, leading to the dissemination of new information on archaeological remains within the DA and to an increase in archaeological knowledge.	Permanent record	Moderate positive	Permanent minor negative
		Identification of previously unknown archaeological remains through investigations occasioned by development proposals.	Permanent record	Minor positive	
Road construction resulting in temporary negative impacts upon setting of historic landscapes and historic buildings (HA4, HA5, HA6) from construction traffic, compounds and noise (Figure 8.3).	Direct short term negligible negative	No mitigation measures are required because Impacts are short-term and negligible.	Short-term impact	Negligible negative	Short term negligible negative

Bibliography

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9 Nature Conservation

9.1 Introduction, Methodology and Study Area

Introduction

- 9.1.1 Some desk-based assessment was undertaken during Stage 1, and this was further developed during Stage 2 in 2009 and 2010. The area immediately around the route was also walked over in September 2009 to take advantage of the end of the summer season and to assess the current state of the habitats along the line of the route, and a further site check was undertaken in February 2010, to assess the state of the watercourses around the site in the winter, to check for the potential presence of badgers and generally to update the previous findings. Recommendations were also made at that time for further specialist surveys which were considered necessary in order to obtain information on the possible presence or protected or rare species, and to be able to determine the likely level of effects of the route options. The results of the appraisal as reviewed in April 2012 are set out in the Ecological Appraisal Report by CSA Environmental Planning; this is reproduced as Technical Appendix 9.1 in Volume 2 of the EAR.
- 9.1.2 Further surveys were then carried out in the spring and summer of 2010 for botany (including scarce arable flora), bats, badgers, water voles, breeding birds, reptiles and white-clawed crayfish. The results of these surveys are set out in the Ecological Phase 2 Survey Report by CSA Environmental Planning; this is reproduced as Technical Appendix 9.2 in Volume 2 of the EAR.
- 9.1.3 This chapter provides a brief summary of the above two documents and sets out the effects which it is anticipated would result from the three route options under consideration. This chapter should be read in conjunction with the above two Technical Appendices, as they contain the detailed evidence and assessment upon which it is based. The effects noted in this chapter are also provisional until such time as the route is confirmed and more detailed assessment of effects is undertaken.

The Study Area

- 9.1.4 The wider study area encompasses an area within 2km of the route - within this area a desktop search was made for designated sites and records of protected species as part of the Stage 1 assessment.

Methodology

- 9.1.5 The assessment was carried out in accordance with the methodology set out in the DMRB Volume 11 Section 3 Part 4, 'Ecology and Nature Conservation', and also other relevant, and more current guidance such as the 'Guidelines for Ecological Impact Assessment' (2006), produced by the Institute of Ecology and Environmental Management (IEEM). These

guidelines promote a scientifically rigorous and transparent approach to the ecological assessment process.

- 9.1.6 IAN 130/10, 'Ecology and Nature Conservation: Criteria for Impact Assessment' was published by the HA in September 2010, and brings the HA guidance into line with the IEEM guidance noted above. Much of the assessment had been completed by the time of publication of this IAN, but much of its content had already been allowed for in the assessment, and it will be followed in detail for the forthcoming Stage 3 assessment.
- 9.1.7 The geographic frame of reference used for assigning value to ecological features is based on that recommended in the IEEM guidelines, where ecological resources are assessed as having value at the following levels:
- International
 - UK
 - National
 - Regional
 - County
 - District (or Borough)
 - Local (or Parish), or
 - Within the zone of influence only.
- 9.1.8 Valuing ecological features can be complex. Other considerations include their potential value, social value to the local community, any important function they serve within a wider ecosystem and the level of legal protection they receive. Effects on ecological features based on the scale of values above were considered as part of the assessment.
- 9.1.9 The significance of an ecological effect, whether adverse or beneficial, was assessed in accordance with the IEEM guidelines. An effect is considered to be significant if it is likely to result in a change in the conservation status or degree of integrity of any ecological feature of Local value or above. Thus, any effect considered likely to change the value (up or down) of an ecological feature within the scale described above would be considered significant.
- 9.1.10 The guidance on environmental design in respect of nature conservation in general and also in respect of protected species, as set out in Volume 10 of the DMRB, has also been followed where relevant in terms of mitigation and habitat creation.
- 9.1.11 Reference has been made to the ecology chapter of the Environmental Statement for the proposed A5-M1 Link, produced by the Highways Agency, which sets out detailed information, including on the presence of protected or rare species, for the area just to the

north of the scheme, and overlapping to some extent with it.

- 9.1.12 The detailed methodologies followed for the individual surveys are described in the Ecological Appraisal Report and the Ecological Phase 2 Survey Report which form EAR Technical Appendices 9.1 and 9.2 respectively.

9.2 Baseline Conditions

- 9.2.1 The baseline situation in terms of statutory and non-statutory designated sites and the general planning background is set out in the Ecological Appraisal report, Technical Appendix 9.1, and is briefly summarised below, within the consideration of effects in section 9.4.
- 9.2.2 The baseline situation in terms of the results of the various specialist surveys and the presence or absence of protected species is set out in the Ecological Phase 2 Survey Report, Technical Appendix 9.2, and is briefly also summarised below in section 9.4.
- 9.2.3 Figure 9.2 shows the habitats and ecological features around the line of the route options.

9.3 Project Proposals, Including Mitigation Measures

- 9.3.1 The scheme proposals in terms of landscape and habitat creation are described in chapter 10, including the proposal to create a large area of Exchange Land in the central part of the scheme, to replace the informal open space lost to road construction at the southern end of the scheme. The residual areas of open space at the southern end of the scheme will also be managed for nature conservation and amenity benefit, and some of the new road features such as drainage ponds and new planted or grassed areas will be of some nature conservation value.
- 9.3.2 Specific mitigation measures for protected species are set out in the Ecological Phase 2 Survey Report (Technical Appendix 9.2) and are summarised at the end of this chapter.
- 9.3.3 A draft Landscape and Ecology Management Plan will be produced for the adopted route option as part of the Stage 3 assessment, and a detailed plan will then be produced prior to commencement of construction. This will aim to ensure that new and retained habitats are managed into the future to maximise their establishment and nature conservation value.

9.4 Assessment of Effects

Overview of Impact on Designated Sites

- 9.4.1 As outlined in the Ecological Assessment, no designated sites are located within or immediately adjacent to the proposed road corridor. Nine statutory sites designated as Sites of Special Scientific Interest (SSSIs) occur within 5km of the survey area (see Figure 9.1).
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The closest statutory site is Sundon Chalk Quarry SSSI and County Wildlife Site (CWS). It is around 0.7km north of the site and is separated from it by the M1, the mainline railway and Luton Road (the B579). No direct or indirect effects are anticipated on this statutory wildlife site.

- 9.4.2 Natural England expressed some concern about potential effects (as a result of possible groundwater connectivity) on the Houghton Regis Marl Lakes SSSI in their response to the Scoping Report (see Appendix 1). This has been considered, but the scheme drainage would be via a kerb and gulley system to lined grass swales and thence to pre-treatment and attenuation ponds, and then into the Houghton Brook - there would be no discharge to groundwater (see chapter 6), so there would be no connectivity with the SSSI and no effects upon it.
- 9.4.3 Seven CWSs occur within 2km of the survey area, one of the closest being the River Lea CWS, located around 0.7km to the east, starting at the source of the River Lea to the east of the M1 motorway and the railway line. Whilst there would not be any direct impact on the River Lea, there is some potential for an indirect impact on this CWS. This is due to the fact that the Houghton Brook runs through the survey area and joins the River Lea as a tributary, thus any contamination or pollution of the brook could result in off site impacts.
- 9.4.4 Conversely, the scheme could have a minor positive effect upon the River Lea, as the drainage proposals for the scheme could (in conjunction with the proposed EA Flood Storage Area) improve and stabilise the flow of Houghton Brook, which is currently seasonally variable. This could, in turn, benefit the flow and habitats of the River Lea, allowing increased connectivity for dispersal of a variety of species, such as water voles and aquatic invertebrates.
- 9.4.5 It is not anticipated that there would be any direct or indirect effects on other non-statutory sites as none are directly connected to the proposed road corridor, the majority being separated by road or rail networks.

Habitats and Species

Flora

- 9.4.6 In terms of effects on grassland flora, each of the three options would impact equally upon the semi-improved grassland habitats to the south of Parkside Drive. A proportion of these areas would be replaced or recreated in the form of grassland managed as hay meadows and permanent rough grassland in the area of Exchange Land (see chapter 10) and also in other areas alongside the road such as roundabouts and cutting and embankment slopes. Most of this grassland could be managed at low intensity and allow for local neutral and calcareous species to re-colonise.

9.4.7 The Blue Route would have less impact in the northern part of the study area than either the Green or Orange Routes, due to the fact it passes through arable fields and would not affect the herb rich flora at the base the main hedgerows running north to south, in particular H1, H2 and H3 (see Figure 9.2).

9.4.8 The survey area was found to have small populations of scarce arable species in F9a and F10. Whilst these species tend to be transient (appearing and disappearing in any one location according to agricultural practice, with the seeds remaining dormant in the soil) it is considered that the Blue Route would have the least impact upon these species already present. Mitigation possibilities include opportunities to recreate/ include areas of cultivated headlands adjacent to existing or realigned arable fields to provide suitable habitat conditions for these threatened species to continue to colonise the area. The Green and Orange Route options pass through a location where one of these assemblages was located, hence these routes would have a greater effect upon this group of plants.

Bats

9.4.9 A single bat roost was confirmed along the scheme corridor at Chalton Cross Farm. This was for a lone pipistrelle bat in a gap between the bricks in the northern apex of one of the farm outbuildings. It is recommended that further bat surveys are undertaken prior to the demolition of these buildings if they are to be removed. This would provide up-to-date information as to the status and level of bat activity in the older farm buildings. It may be that a Natural England European Species Licence will be required if a roost is found still to be present.

9.4.10 Whilst the overall level of bat activity in the wider survey area was found to be low, planting of trees and shrubs and replacement of linear features such as hedgerows has been proposed as part of the mitigation proposals along the line of the route, and this would compensate for the severance of flight lines and commuting routes. Where possible it is proposed that mature trees such as the poplar trees near to Houghton Brook and trees at the junction of H6 and H3a are retained in order to provide foraging and potential roost sites for bats. In addition, any lighting during the construction period and the design of the scheme lighting will need to be considered in terms of their potential effects on bats.

9.4.11 The Blue Route avoids the building which currently contains the single bat roost, and would have a lesser overall effect on the level of bat activity both in terms of the farm buildings and the effect on linear flight lines.

Badgers

9.4.12 There would be minimal disturbance to badgers within the proposed road corridor, as any badger activity observed was restricted to two outlier sets to the north west of the survey area, and occasional snuffle holes, latrines and mammal paths in the rest of the site. However the status of badger activity at the time will need to be established once the

adopted route is confirmed, and again immediately prior to construction. This is due to the fact that it is known that there are badger populations to the north and east of the survey area, which could extend their territory over time. Where possible, stream crossing points should be designed such that culverts afford a dry ledge/suitable terrestrial passageways for badgers and other terrestrial animals.

Water Voles

- 9.4.13 Through the surveys it has been established that there is a small water vole population present in Houghton Brook. All three proposed routes have the potential to impact upon this population, and various mitigation options have been considered. Since the Blue and Orange Routes cross the brook in three places and the Green Route only in one place, the Blue and Orange Routes would be likely to result in a larger impact upon the water vole population. However, as there would be some improvement to the local wetland habitat whichever route option is adopted, as part of the flood attenuation and drainage proposals, there could be a long term positive effect upon the water vole population.

Birds

- 9.4.14 The breeding bird survey revealed that there is a varied population of breeding birds in the area around and including the scheme. However it was not found to be notable or significant. Any effect of the route options would therefore arise largely from removal of nesting habitats. Whilst at the southern end of the scheme this would be equal between the three options, in area to the north of Parkside Drive the Blue Route would have the least impact on the bird communities and their habitats, as the main hedgerows and areas of mature trees would largely remain intact.
- 9.4.15 Where any vegetation likely to support nesting birds is to be removed as part of construction works it will need to be carried out outside the bird nesting season, to minimise disturbance to nesting birds. This applies to ground nesting birds in grassland as well as trees, shrubs and areas of woodland.
- 9.4.16 The scheme landscape proposals include significant areas of habitat creation, including tree and shrub planting, as well as the creation of rough grassland with some scrub for nesting birds, and new wetland areas.

Reptiles

- 9.4.17 The survey results indicated that a very low, isolated population of slow-worm is present in the area of the site just to the north of Parkside Drive adjacent to the housing area and amongst rough grassland and scrub. This area is not crossed by any of the route options. The scheme would therefore have negligible effects on the existing population of reptiles. However, due to the extensive nature of the site and the suitability of rough grassland and scrub for reptiles, some simple mitigation proposals have been presented.

White-clawed crayfish

- 9.4.18 No evidence of white-clawed crayfish was found during the survey of Houghton Brook, and the majority of the watercourse was not deemed to be suitable habitat for this species. There would therefore be no effects.

9.5 Summary

- 9.5.1 The value, significance of effects and possible mitigation for each of the interests or protected species noted above are summarised in the following table, together with a note as to where the three options would vary in terms of their effects for each interest.

Table 9.1 ~ Summary of Ecological Interests and Effects

Interest	Value	Nature of Potential Effect	Possible Mitigation	Significance of Effect	Comparative Assessment of Route Options
SSSIs	National	No effects.	None required.	None	No effects.
CWSs	County	Possible indirect effect on River Lea as a result of water quality effects in Houghton Brook.	Scheme drainage proposals should ensure no adverse effects in terms of water flow or quality, and in principle effects should be beneficial.	None	No difference between options.
Grassland Flora	Local	Loss of semi-improved grassland at the southern end of the scheme.	An area of Exchange Land will be provide to compensate for the loss of open space at the southern end of the scheme, and this would include species rich grassland. Other grassland areas alongside the new road would also provide some new grassland habitat.	Minor negative Level of existing interest is quite low.	No difference between options to the south of Parkside Drive. To the north of Parkside Drive Blue Route would have less overall effect.
Scarce Arable Plants	Local/District	Direct loss of plants in some areas, and also loss of soil seed bank and reduction in potential habitat.	Storage and re-use of soil. Depending on agricultural practice, new headland areas could be established around the fields realigned around the new road, replicating any lost habitat.	Minor negative Plants are not especially rare or numerous.	Blue Route avoids areas of known interest
Bats	Local	Loss of one roost site (Green and Orange Routes only), loss or severance of flight lines, loss of foraging areas.	Provision of alternative roosting opportunities. Scheme landscape proposals will provide alternative/enhance flight line and foraging opportunities. A licence may be required for the demolition of the farm building containing the roost.	Minor negative Roost is of one bat only, general usage of the site by bats is low.	Blue Route avoids the building containing the roost, and would also have less overall effect on flight lines.
Badgers	Local	Potential fatalities on new road, loss of foraging opportunities and dispersal routes.	No specific mitigation required, as no setts affected and level of use is low. The scheme landscape proposals would provide additional foraging opportunities.	Minor negative Usage of the site by badgers is low.	Blue Route avoids more valuable foraging areas and dispersal routes.

Table 9.1 ~ Summary of Ecological Interests and Effects (continued)

Interest	Value	Nature of Potential Effect	Possible Mitigation	Significance of Effect	Comparative Assessment of Route Options
Water Voles	Local	Loss of burrows, loss or fragmentation of habitat.	Search for water voles prior to construction to ensure no direct effects. Scheme drainage proposals should ensure no adverse effects in terms of water flow or quality, and habitat creation proposals will provide some enhancement. Longer term effects should in principle be beneficial.	Minor negative (temporary) Due to stream crossings and some loss of habitat.	Orange route preferred as it crosses the Houghton Brook only once, compared to three times for other options.
Birds	Local	Disturbance of breeding birds, loss of nesting opportunities or habitat.	Vegetation clearance to be timed to avoid the bird breeding season. Habitat creation proposals will provide some enhancement. Longer term effects should in principle be beneficial.	Minor negative (temporary) Due to some loss of habitat.	Blue Route avoids more valuable habitat in the area north of Parkside Drive.
Reptiles	Local	Killing of animals, loss of habitat.	Vegetation clearance in areas of suitable habitat to be phased to avoid harm. Habitat creation proposals will provide some enhancement. Longer term effects should in principle be beneficial.	Minor negative (temporary) Due to some loss of habitat. Population of slow worm is low and limited to one area.	Blue Route avoids more valuable habitat in the area north of Parkside Drive.
White-clawed Crayfish	Local	Destruction of burrows, loss of habitat.	Scheme drainage proposals should ensure no adverse effects in terms of water flow or quality. Habitat creation proposals will provide some enhancement. Longer term effects should in principle be beneficial.	None No evidence of presence on site, habitat not suitable.	No difference between options.

10 Landscape

10.1 Introduction, Methodology and Study Area

Introduction

10.1.1 This chapter assesses the likely effects of the scheme options on the character of the local landscape, and on visual receptors such as people in their homes or passing along public rights of way.

10.1.2 The landscape mitigation measures described in section 10.3 are an integral part of the scheme, and the assessment made in this section is of the scheme complete with those landscape mitigation measures. However, those measures are outline only at this stage, and represent broad intentions rather than detailed proposals. The mitigation measures, and the assessment of effects, will be developed in more detail as the project progresses.

Methodology

10.1.3 The assessment was carried out prior to the publication by the HA of IAN 135/10 ('Landscape and Visual Effects Assessment'), which replaced the methodology set out in the DMRB Volume 11 Section 3 Part 5, 'Landscape Effects'. However, the methodology used for the assessment (see Appendix 10.1 for details) was based on the former DMRB guidance, and also on the 'Guidelines for Landscape and Visual Impact Assessment', produced jointly by the Institute of Environmental Management and Assessment and the Landscape Institute ('the GLVIA', 1995, revised 2002).

10.1.4 The methodology used for the assessment has been reviewed against that set out in IAN 135/10, and is in general accordance with it, so it has not been considered necessary to repeat any of the work, though a general review and updating of this chapter as at April 2012 has been carried out.

10.1.5 In landscape and visual assessments, a distinction is normally drawn between landscape effects (i.e. effects on the character or quality of the landscape, irrespective of whether there are any views of the landscape, or viewers to see them) and visual effects (i.e. effects on people's views of the landscape, principally from residential properties, but also from public rights of way and other areas with public access). Thus, a development may have extensive landscape effects but few visual effects (if, for example, there are no properties or public viewpoints), or few landscape effects but significant visual effects (if, for example, the landscape is already degraded or the development is not out of character with it, but can clearly be seen from many residential properties).

10.1.6 The assessment carried out for this chapter would constitute a Detailed assessment in terms of the categories set out in IAN 135/10.

The Study Area

- 10.1.7 The study area for the assessment of landscape and visual effects comprises the area from within which views of the new road can be obtained (see Figure 10.9). In order to determine that area, checks were made as to potential visibility from the higher ground to the north and north east, and also the Dunstable Downs to the south, with particular reference to potential visibility from the Chilterns Area of Outstanding Natural Beauty (AONB - see Figure 10.1). While reference is made to the possibility of more distant views, the main study area for the assessment is limited to the land to the east and north of the existing urban edge, the west of the M1 and south of the village of Chalton.
- 10.1.8 This area is bounded by existing housing to the west and south, and the assessment includes potential visual effects on those properties. In the southern part of the route, where it is tightly enclosed by existing housing to both north and south, the assessment has focused on potential visual effects on the adjoining properties, and also on the potential for townscape, as opposed to landscape effects.

10.2 Baseline Conditions

General Landscape Context

- 10.2.1 The question of the appropriate baseline for the assessment is an important one - at the moment the northern part of the route is within the countryside, and crosses open, arable fields. However, it is likely that all of that area will be developed at some time in the future, as discussed in chapter 2 above. Until such time as the development is committed, it is appropriate to assess landscape and visual effects against a baseline of the existing landscape, and to develop landscape mitigation proposals on the basis that the road runs partly across an open, arable landscape as presently. However, if the surrounding development is committed, with a clear timescale for implementation, before the ES for the Woodside Connection has been completed, then the assessment would be revised to be against a baseline of that development being in place.
- 10.2.2 There are also several highway improvements which are either committed or planned in the area around the scheme. These include The M1 Junctions 10 to 13 and the A5-M1 Link, with its proposed construction of a new M1 Junction 11A. There are also outline plans for a Luton Northern Bypass, to the east of the motorway. Of these schemes, the only committed elements are the Hard Shoulder Running parts of the M1 Junctions 10 to 13 scheme. However, although the M1 Junction 11A is not yet committed, the Woodside Connection scheme relies on Junction 11A and could not proceed without it. The assessment therefore assumes that the Hard Shoulder Running parts of the M1 Junctions 10 to 13 scheme and the new Junction 11A will be in place as part of the baseline for the Woodside scheme, but does

not assume the other highways improvements will be present, as they are not yet approved or committed. However, as it is likely that these proposals will be implemented at some stage, the assessment refers to them where relevant.

10.2.3 There are also some other developments in the area around the scheme which will lead to changes in the baseline conditions. These include (see Figure 10.2):

- A new housing scheme, currently approaching completion on the north side of Kestrel Way and the east side of Pastures Way.
- The EA's proposed Houghton Brook Flood Storage Area scheme near the M1 (see also Figure 6.7).

10.2.4 The routes run from the existing double roundabout at the junction of Poynters Road with Porz Avenue, Park Road North, Sandringham Drive and Wheatfield Road, at the south western end of the scheme to the location of the proposed Junction 11A, to the north east of Chalton Cross Farm. The south western part of the scheme lies between Sandringham Drive (to the north) and Wheatfield Road (to the south). The routes then cross Houghton Brook and also Parkside Drive, a former bus only route now closed to vehicular traffic but used by pedestrians and cyclists and which also forms part of the National Cycle Network Route 6 (see Figures 2.1 to 2.6).

10.2.5 From Parkside Drive the routes turn to the north to run across open, agricultural land towards Chalton Cross Farm, between the urban edge of Houghton Regis around Conquest Road and Houghton Park Road (to the west) and the M1 motorway (to the east).

Topography and Drainage

10.2.6 The land along the line of the scheme falls gently from the south west to a low point in the central section of the routes, and then rises gently to the north towards Chalton Cross Farm and the location of the proposed Junction 11A. Levels are around 130m AOD (Above Ordnance Datum, or mean sea level) at the south western end of the route, falling to around 122m as the central section of the route crosses the Houghton Brook, and rising again to around 135m near the site of Junction 11A.

10.2.7 Further afield, the land continues to rise to the north east of the M1 motorway, reaching levels of more than 160m in the Sundon Hills, which are within the north eastern outlier of the Chilterns AONB (separated from the main part of the AONB, which extends to the south west of Dunstable - see below and also see Figure 10.1). Levels also rise gradually to the south, through the urban area, and then rise sharply up the Chilterns escarpment south of the A505, reaching over 210m around 2km to the south of the southern end of the scheme - this area is within the main part of the Chilterns AONB.

10.2.8 There are two watercourses within the study area; the Ouzel Brook rises at a spring to the south west of Chalton Cross Farm and runs initially to the north west to cross Sundon Road, and then runs to the west and south west to join the River Ouzel. The Houghton Brook runs from near Houghton Hall to the west of the route, turns to run to the north east and then again to the east (through the broad, shallow valley which occupies the central part of the route), to pass under the motorway and flow into the River Lea to the east. The brook passes under the M1 in a culvert, at the lowest point of the land to the west of the motorway. At this point a flood storage area (the Houghton Brook Flood Storage Area) is proposed as part of the Luton Flood Risk Management Strategy (see chapter 6). A tributary of the Houghton Brook runs to the south from south west of Chalton Cross Farm, joining the brook close the line of pylons in the central part of the route.

Land Use

10.2.9 Land use to the south of Parkside Drive is a mixture of urban fringe uses, with a variety of vegetation cover, including (from south west to north east) a linear belt of mixed woodland to the north east of the roundabout, a large area of rough grass and developing hawthorn scrub as far as the footpath linking Wheatfield Road to the south and the southern part of the Houghton Park housing estate (around Conway Close) to the north, a small area of dense, scrubby woodland to the south of the Houghton Brook and a broad area of mixed amenity grassland to the north of the watercourse, close mown to the west, towards the houses on Conway Close, and infrequently mown to the east. There is a small electricity substation just to the south of the brook at this point, with a small, triangular copse to its south west. As noted in section 2.4, the land to the south of Houghton Brook is considered within this assessment to be informal Public Open Space, on account of its use for informal recreation and designation as a proposed open space in the South Bedfordshire Local Plan Review.

10.2.10 To the north of Parkside Drive there is a strip of uncultivated rough grass along the urban edge, stretching to the north and with some developing scrub at its southern and northern ends, though much of this scrub had recently been cleared and grubbed up as at April 2012. The remainder of the land crossed by the routes is under arable cultivation, other than a narrow strip alongside the brook and a small triangular area between the brook and its tributary watercourse running to the south from Chalton Cross Farm. The farm complex comprises a lodge adjacent to Sundon Road in the north, a track leading to the main farm yard which includes a range of storage buildings to the east of the track, and the farmhouse to the west. The track continues to the south, to a small yard which appears to be used for haulage and plant storage.

10.2.11 The route corridor broadly follows the line of a series of overhead electricity transmission lines - one line runs from north to south along the west side of the motorway, and another

(EDF 132kV) line follows it just to the west, before turning to run south west to cross Parkside Drive and follow the route corridor south west towards the roundabout. A third line of pylons (EDF 33kV) runs from the substation noted above northwards to the village of Chalton, north of Sundon Road, and a fourth line (National Grid Transco 400kV) runs from the west of Chalton, across Sundon Road, and south along the urban edge of Houghton Regis before turning to the south west to run along the route corridor, parallel to the second line noted above.

- 10.2.12 It seems likely that the long term presence of the two lines of pylons running into the urban area has (together with the presence of the brook) effectively protected the zone alongside and beneath them from development, such that the south western end of the route corridor now forms a green, undeveloped wedge extending into the urban area. This area is also (excluding that which falls within the area of LBC) designated as a proposed open space in the South Bedfordshire Local Plan Review.

Existing Vegetation

- 10.2.13 Visually significant existing vegetation along the route corridor, from south to north, comprises the following (see chapter 9 for a description of vegetation in terms of its nature conservation interest):
- The strip of woodland near the roundabout - this consists of two lines of trees (principally sycamore up to around 15m in height, with some native cherry) around the edge of the area, with a scrubby area of hawthorn, hazel, rose and elder with some open glades in the centre. The two overhead electricity transmission lines cross this area at an angle, and the trees have been severely pruned in the past where they are close to the power lines, significantly reducing their amenity value (see photographs 1, 2 and 3). In the area of close mown grass to the south of the woodland there are some semi-mature walnut trees, and three London plane trees to the north of the main woodland area.
 - Rough grassland with hawthorn scrub - this area is not mown, and much of the hawthorn scrub is of uniform age, suggesting that it may have been mown at some time, up to perhaps 7 to 10 years ago (see photographs 7, 9, 10 and 12). Within this area there are also some (mostly pruned) clumps of ornamental shrubs (including *Cotoneaster*, *Symphoricarpos* and *Mahonia* spp.) around the service road for numbers 134 to 170 Wheatfield Road, and some further clumps of bramble to the east, together with occasional young ash trees closer to the houses and some scattered, self-sown goat willow (see photographs 5, 6 and 8).

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- The scrubby woodland to the south of the Houghton Brook - this is mostly dense scrub, with hawthorn and elder, and a groundcover of ivy, with some more open glades to the south, with blackthorn thickets (see photographs 13, 14 and 38). There is also a rectangular open area within the woodland, just to the south of the brook, which acts as a flood attenuation area for the Houghton Brook - it is artificial in appearance and is set down below the surrounding land (see photograph 15).
 - Trees within the area of grass to the north of the brook - there is a line of young weeping willow and beech within the close mown grass to the west, closest to the existing houses (see photographs 16 and 17). The larger area of grass to the east is not regularly mown, but appears to have been mown in the past as it is free from scrub incursion.
 - Woodland and trees around the electricity substation - here there are some taller trees, mostly beech with some sycamore in the triangle to the south of the watercourse, and a large crack willow and a black poplar on opposite sides of the brook just to the west of the substation. Alongside the brook to the north of the substation there is a line of goat willow with some sycamore.
 - Scrub and rough grass along the eastern edge of the urban area - this comprises a dense area of hawthorn and sycamore scrub just to the north of Parkside Drive, with a broad strip of tussocky grass and hawthorn scrub extending to the north, adjacent to the urban edge. Some of the scrub in this area had been grubbed up and left in piles, as at April 2012. To the east of this strip is a further broad area of rough grass without much scrub, and the entire area between the urban edge and the arable fields appears to be used by local people for dog walking and informal recreation (see photographs 19, 20, 25, 27 and 28). Remnants of two hedgerows run across this area - the hedge to the south is low and gappy with two small cherry trees, and that to the north is gappy to the east but denser to the west, where it is up to 3m in height and comprises mostly hawthorn with some goat willow. At the north end of this area a tall, dense hawthorn hedge with some sycamore and ash up to 12m in height forms the southern boundary to the playing fields of the Kings Houghton Middle School. To the north of the playing fields is a further dense hawthorn hedge around 4m in height, and another tall hedge running parallel to this, on the north side of a small rectangular area which appears to be in use as a haulage/light industrial yard.
 - Vegetation alongside the Houghton Brook - to the north of Parkside Drive, there is a strip of uncultivated land alongside the watercourse, which is used for informal public access, especially along the east and south side of the brook (see photographs 21, 22 and 24). A line of small trees, mainly shrubby willows, follows the line of the brook to the north from Parkside Drive, with a small group of tall poplars at the point

where the small tributary from the north joins the watercourse. As the brook continues to the east there are no trees, and its course is marked by intermittent shrubs and rough grass only.

- Hedgerows are not a significant landscape feature - the arable fields are large, and hedges are mainly low and trimmed, with some gaps. There are occasional trees in the hedges to the south of Chalton Cross Farm, mainly ash but also some taller sycamore in the corners of fields, at the hedgerow junctions (see photographs 29 and 30).
- Planting alongside the motorway - This is a narrow but fairly dense and continuous band of planting, comprising hawthorn with some ash, field maple and oak, between 4 and 7m in height. The motorway is on embankment to the south, and the traffic is therefore intermittently visible above the vegetation, but to the north the motorway is at grade (passing into cutting as it approaches the Sundon Road overbridge), and the vegetation therefore provides a more effective screen to the traffic on the motorway. Some of the vegetation on the motorway embankment had recently been cleared as part of the M1 Junctions 10 to 13 works, as at April 2012.
- Trees around Chalton Cross Farm - there are some mature trees including horse chestnut around the farmhouse and also some ash trees around an old orchard with some remaining fruit trees to the west of the house (see photographs 32 and 35). There is a 2m high hedge around the garden area just to the west of the farmhouse.

Landscape Character

National Landscape Character

10.2.14 In terms of wider landscape character, the site lies just within an area identified as 'The Chilterns' in the Countryside Agency's (now Natural England) 'Countryside Character Volume 7: South East and London' (this is a national assessment of landscape character, published as a series of regional volumes). This is an extensive area, strongly related to the underlying geology, running from Reading in the south west to Hitchin in the north east. Key characteristics are noted as including the scarp/dip slope topography, chalk hills and plateau and the '*enclosed and intimate landscapes of the valleys contrasting with the more open plateau top*'.

10.2.15 However, although the site lies within this area, it has more of the characteristics of the adjoining area to the north, the 'Bedfordshire and Cambridgeshire Claylands'. This is a large area extending to Peterborough in the north and Cambridge in the east, and is described as '*an empty gently undulating lowland landscape with expansive views of large scale arable farmland, contained either by sparse trimmed hedgerows, open ditches or streamside*

vegetation’.

County Landscape Character

10.2.16 The former Bedfordshire County Council (BCC) published a landscape character assessment (‘Bedfordshire County Landscape Character Assessment’, 2003) for the county. This assessment identifies 12 generic Landscape Character Types, with the site being within an area described as ‘Rolling Chalk Farmland’, extending in a narrow strip to the north of Houghton Regis and in a broader strip to the north of Luton, east of the M1. The county assessment is not currently available following the reorganisation of local government within Bedfordshire in April 2009, and has been largely superseded by the more detailed assessments noted below.

District Landscape Character

10.2.17 The former South Bedfordshire District Council (SBDC) published the ‘South Bedfordshire District Landscape Character Assessment’, jointly with BCC, in 2009. This assessment adds detail to the BCC assessment and again places the site in the ‘Rolling Chalk Farmland’ landscape character type, within Landscape Character Area 10B, the ‘Houghton Regis - North Luton Rolling Chalk Farmland’. This area includes the route corridor to the north of Parkside Drive (but not to the south - that area is shown as being within the urban area), and also a larger area to the east of the M1, extending from the edge of Luton towards the villages of Sundon and Streatley. The description of this area includes the following:

- *‘Dominated by arable cropping within large geometric parliamentary enclosure fields - inconsistent, varied margins define the field boundaries (removed/ gappy/ overgrown hedges).*
- *Strongly influenced by the urban edges of Luton and Houghton Regis - clear and intermittent views gained from primary and secondary roads as well as the settlements of Upper Sundon and Streatley.*
- *The skyline is frequently characterised by communication masts and pylons.*
- *Busy transport corridors interrupt the landscape - the M1, Midland Mainline Railway and A6.’*

10.2.18 Under the heading of ‘Landscape Strategy’, the assessment states:

‘The overall strategy for the Houghton Regis - North Luton Rolling Chalk Farmland character area is to enhance, and reinforce the landscape of the chalk dip slope and its role as the setting to the chalk scarp and the adjacent urban area. Landscape enhancement will include conserving, restoring and improving positive features and renewing/creating elements to strengthen landscape pattern, visual integrity and sense of place. In this respect there are particular opportunities for strengthening tree and hedgerow planting in relation to the transport corridors and larger scale woodland creation to provide a framework for the urban edge.’

10.2.19 Under the heading of 'Development Considerations', the assessment makes a number of recommendations for this area, of which the following are relevant:

- *'Consider opportunities to improve the condition of approaches and entrances to villages to enhance the sense of arrival and sense of place.*
- *Conserve and enhance small scale features such as watercourses (tributaries of the Leagrave) - and consider opportunities to retain as green space linkages in association with any future development.*
- *Conserve and enhance access and connections from the urban area into the landscape and to the chalk escarpment, e.g. links to Sundon Country Park and the John Bunyan trail. Avoid severance of existing routes.*
- *Consider opportunities for creating further facilities for recreational enjoyment and access public access e.g. land purchase/management agreements for land adjacent to existing sites and creation of linkages between sites.*
- *Consider opportunities for large scale woodland planting in association with development - strengthening hedges and tree cover. Hazel, hawthorn, field maple and ash form a suitable species palette within this character area.*
- *Seek to create a sympathetic interface of any new urban edge with the adjacent rural area - avoid stark transition with farmland e.g. urban fences, strong lighting.*
- *Consider and mitigate wider effects such as light pollution on the surrounding rural area, and in particular consider impact of light spill over the ridgeline of the escarpment.*
- *Ensure that development does not lead to further fragmentation/isolation of land parcels which may become marginal for agricultural and degraded.'*

10.2.20 Finally, it also recommends:

'In the event of large scale development it is recommended that a strategic countryside management initiative is put in place to implement these guidelines and, for example, take on long term management of greenspace and other environmental assets.'

The Chalk Arc

10.2.21 The Chalk Arc Initiative (CAI) is a government funded programme set up to secure greenspace within and around the large scale growth areas envisaged for Luton, Dunstable, Houghton Regis and Leighton Linlade over the next 10 to 15 years. It has promoted various studies and initiatives, including the Chalk Arc Landscape Character Assessment (2007). This detailed assessment builds upon the South Bedfordshire District Landscape Character Assessment to provide a finer grain landscape character assessment of those areas falling within the Chalk Arc, and concentrates on the urban fringe.

10.2.22 Within the district landscape character area noted above ('Houghton Regis - North Luton Rolling Chalk Farmland'), this study identifies a series of smaller character areas, with the area of the routes (north of Parkside Drive) lying within Area 26, 'Houghton Park Low-lying Farmland'. This is described as '*a level, open area of arable farmland located between the edge of Houghton Regis and the M1.*' Further description includes:

'The landscape pattern comprises medium and large-scale irregular fields divided by low trimmed, intermittent hedgerows with some post and wire fencing. Drainage channels follow field boundaries. The area is dissected by three lines of pylons, which run southwards from Sundon Substation into the urban area. Large-scale farm buildings associated with Chalton Cross are also prominent and detracting features.'

10.2.23 This area is assessed as being '*fragmented and marginalised with a strong urban fringe character and many detracting built features.*' It is noted as being of medium to low sensitivity (see below). Opportunities are noted as including '*Maintain links between urban green space and adjacent countryside through integrating green infrastructure*' and '*Enhance woodland planting along the urban edge and M1 corridor to reduce abrupt interface*'.

10.2.24 The remainder of the area around the routes, to the south of Parkside Drive, lies along the southern edge of a further character area, the 'Parkside Post War Estate'. The description of the urban edge to this area includes the following:

'Views from the urban edge are across marginalised arable fields, to transmission lines, the M1 and large industrial units to the east.

The rural-urban interface has a fragmented, marginalised character with detracting features, rough scrub edges, fly tipping and infrastructure.

Traffic noise from the M1 motorway, the crackle of electricity transmission, and views of large industrial units beyond the motorway reduce tranquillity.'

10.2.25 Opportunities for this area are noted as including:

'Enhance management and connectivity of green spaces.

Enhance built rural interface with Houghton Park, through sensitive planting and unifying boundary treatments.'

10.2.26 In parallel with the above assessment a report entitled 'Historic Environment Characterisation' was produced by Albion Archaeology for the (then) County Council and the CAI in December 2007. This defines a series of Historic Environment Character Areas which are determined by the amalgamation of the four main strands of the historic environment, namely Historic Landscape Character Areas, Archaeological Character Areas, Historic Urban Character Areas and Rural Built Environment Character. The study places the area around the route options in Historic Environment Character Area 10.

10.2.27 Historic Environment Character Area 10 is referred to as the 'Chalk downland to north of Luton', and the scheme is in the western part of the character area, to the west of the M1. The assessment notes:

'To the west are a number of small settlements of at least medieval origin, which have undergone relatively little 20th-century expansion. With the exception of early enclosures and earthworks around the villages, fewer historic landscape features survive in this part of the area.'

To the west of the M1 around Chalton and Chalgrave few historic landscape features have survived 20th-century boundary changes.

Further to the west, north of Houghton Regis, there is a denser pattern of settlement comprising nucleated villages and hamlets, which generally have experienced little growth in the 20th century.

The predominant building material is red brick with some timber framing. Roofs are generally old and new tile, slate, and thatch. The M1 bisects the area, passing close to the extensive modern sewage works and electrical substations to the north of Chalton.

10.2.28 In summary, the area around the scheme has two distinct characters; the area to the north of Parkside Drive is gently undulating, open arable farmland with little vegetation or enclosure and is strongly affected by the motorway and its traffic, the lines of pylons, large scale buildings to the east of the motorway and the existing urban edge. As part of the baseline for the assessment, it will also be affected by the new Junction 11A on the M1 - this will be a large scale dumb-bell junction arrangement, with roundabouts to each side of the motorway. The western roundabout will be located on relatively high ground just to the north of Chalton Cross Farm. The area to the south of Parkside Drive is much more enclosed, and is generally unmanaged with an urban fringe character, and is also strongly affected by the overhead electricity transmission lines.

10.2.29 In order to add more detail for the area around the scheme to the above assessments, a further subdivision of the various landscape character areas was made as part of the Stage 2 assessment. Six local landscape character zones were identified (see Figure 10.2), as follows:

1. **Urban** This is the urban area of Houghton Regis (to the west), Dunstable (to the south) and Luton (to the east).
2. **Dunstable Downs** This is the high ground of the AONB to the south (see photograph 36).
3. **M1 Corridor** This, together with the proposed A5-M1 Link and Junction 11A forms a major transport corridor to the east of the routes which is visually prominent across the open landscape as a result of the constantly flowing traffic passing along it.

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4. **Open Undulating Farmland** This is the countryside to the north of Sundon Road, which has a more pleasant, rural character than the urban fringe landscape of character zone 5.
 5. **Disturbed Arable Farmland** This is the area crossed by the route options to the north of Parkside Drive, and is gently undulating, open, arable farmland subject to a range of intrusive and detracting urban fringe features.
 6. **Urban Scrubland** This is the area crossed by the route options to the south of Parkside Drive, and comprises developing scrub, rough grassland and patches of woodland. It is dominated in terms of its character by the twin overhead electricity transmission lines, and is surrounded by urban land uses.

Landscape Quality, Value and Sensitivity

- 10.2.30 The landscape around the route options does not carry any designations for landscape quality, and the southern part of the route corridor is regarded by the South Bedfordshire District Landscape Character Assessment as being within the urban area of Houghton Regis rather than in the countryside. However, landscapes of lower quality can still have significant value, and the narrow triangle of land to the south of Parkside Drive stretching into Houghton Regis is likely to have some significant local landscape/townscape value as a green corridor and link to the countryside to the north east. Much of it is also designated as a proposed open space in the South Bedfordshire Local Plan Review. Its landscape quality is **low**, however, as it is crossed by two overhead electricity transmission lines, has existing areas of housing overlooking it from both north and south, and has a generally disturbed, urban fringe character. The sensitivity of the area to the south of Parkside Drive is **medium**, as it has some value for informal recreation and as a green break in the adjoining development, and a new road passing through it would be visible at relatively short distances from the houses to the north and south.
- 10.2.31 To the north of Parkside Drive the character of the area traversed by the route options is different, being an open, expansive arable landscape strongly affected by neighbouring detractors. These include the motorway and its traffic, which is widely visible and often audible, the large scale industrial buildings on the east side of the motorway, the electricity transmission lines and pylons, the radio mast and blocks of flats on the skyline to the south, and the somewhat raw and unscreened urban edge to the west and south. They also include the proposed Junction 11A as part of the baseline - this would be locally prominent in views from the south and south west. The quality of this area is again **low**, but it does have some value for recreation along the rights of way and also informally along the field margins. Its sensitivity is therefore **low to medium**. This is also the assessment made by the Chalk Arc Landscape Character Assessment, which describes the area as being '*fragmented and*

marginalised with a strong urban fringe character (see section 10.2.23 above).

10.2.32 Another factor to be considered is that all of the land which the route options run across is within the Green Belt (see Figure 10.1). This is a planning designation rather than an indicator of landscape quality, but government policy as set out in the NPPF does state that the openness and permanence of Green Belts are essential characteristics (see section 10.2.38 below). While the land around the scheme is at the moment within the Green Belt and the assessment has been undertaken on that basis, the boundary will need to be redrawn to allow the development to the north and east of Houghton Regis to take place.

10.2.33 There is one high level, national designation for landscape quality in the wider area around the scheme - the Chilterns Area of Outstanding Natural Beauty (AONB) lies within 2km of the scheme to the south, with a small outlier area to the north east between Upper Sundon and Hitchin, with the nearest point roughly 2km from the northern end of the scheme (see Figure 10.1). The AONB designation was made because of the general landscape quality of the area and also (as set out in the AONB Management Plan 2008 - 2013) on account of its:

'special qualities which include the steep chalk escarpment with areas of flower-rich downland, woodlands, commons, tranquil valleys, the network of ancient routes, villages with their brick and flint houses, chalk streams and a rich historic environment of hill forts and chalk figures.'

10.2.34 The AONB is separated from the scheme by the urban areas of Dunstable and Houghton Regis to the south, and the M1 to the north east, but potential effects on the special qualities and character of the AONB have been considered in the assessment.

Existing Light Sources

10.2.35 Although there are few light sources directly along the line of the route options, the surrounding area is generally well lit, and contains the following existing light sources (see photograph 40):

- The M1 motorway is lit with pairs of high pressure sodium lanterns on tall lighting columns in the central reserve. Even where the motorway and its traffic cannot be seen (for example where it passes beneath Sundon Road in a deep cutting) the lights are still visible from the surrounding area.
- There is also street lighting along the roads within the urban area to the south and west; Sundon Road is lit as far east as the edge of the urban area, just to the north of Kings Houghton Middle School, Wheatfield Road and Kestrel Way to the south are lit, and Parkside Drive is lit with low pressure sodium lanterns on lighting columns around 6m high as it crosses the line of the routes. Roads outside the urban area are not generally lit, other than the motorway, though there are some lights at the junction of Sundon Road and the B579 Luton Road, immediately to the east of the motorway.

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- In the future, the new Junction 11A, with its large roundabout just to the north of Chalton Cross Farm, would be lit with 18m high lighting columns - these new lights would be prominent due to their location on relatively high ground.
 - Vehicle lights on the surrounding road network are also visible.
 - There are also lights within and around the houses to the south and west, Kings Houghton Middle School to the west (the school site includes a floodlit all weather sports pitch), and the large scale industrial buildings to the east of the motorway.

Existing Views

10.2.36 The visibility of the area traversed by the route options is limited by the rising ground to the north, the motorway and large scale industrial buildings to the east and the urban edge to the south and west. As a result the main areas and points from which the area around the routes can be seen are:

- From the north there are some views to the area around Chalton Cross Farm from the local ridge of higher ground just to the north of Sundon Road, and also some limited and distant views from properties on the south edge of Chalton and from higher ground to the north west, near Chalgrave Manor (see photographs 33, 34 and 35).
- From the east there are views for traffic passing along the M1, mostly for northbound traffic to the south of Chalton Cross Farm, where the motorway is on embankment.
- From the south there are views from houses on the urban edge, along Kestrel Way, though these views are partially screened by the boundary hedgerow along the north side of the road. There will be clear views from the first floor of some of the new houses currently under construction along Kestrel Way and Pastures Way. There are also some more distant views from the tower blocks of flats to the east of the motorway in Luton (see photograph 23).
- From the west there are further views from houses on the urban edge, around Conquest Road and Houghton Park Road, and these views are also screened and filtered to some extent by intervening vegetation either close to the houses or in the form of hedgerows between the arable fields (see photographs 25 to 28).
- To the south of Parkside Drive there are short distance views to the line of the routes from houses to the north (along Sandringham Drive and also in the new housing area around Holyrood Drive) and the south (along Wheatfield Road) - see photographs 1 to 11.

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- There are also views from the public rights of way which run across the fields to the north of Parkside Drive, and from Parkside Drive itself, which is not open to vehicles but is well used by pedestrians and cyclists (see photographs 17, 21, 22 and 24).

10.2.37 From further afield, there are some distant views to the site from the Chilterns escarpment to the south of Dunstable (see photograph 36). Though the site may be present in such views, it is a small component only of a wide, expansive view in which there are many large scale urban or detracting elements, including the urban areas of Dunstable, Luton and Houghton Regis, and the M1 motorway.

Landscape Planning and Policy

National Planning Policy

10.2.38 The government's national planning policy and guidance on various aspects of planning are set out in the recently published National Planning Policy Framework (NPPF), which supersedes previous Planning Policy Statements (PPSs). The broad thrust of government planning policy is concerned with the achievement of sustainable development principles, with the planning system seen as combining economic, social and environmental roles.

10.2.39 Section 9 of the NPPF sets out the government's position in respect of Green Belts. Paragraph 79 states that:

'The fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and their permanence.'

10.2.40 Paragraph 81 of the NPPF states that:

'Once Green Belts have been defined, local planning authorities should plan positively to enhance the beneficial use of the Green Belt, such as looking for opportunities to provide access; to provide opportunities for outdoor sport and recreation; to retain and enhance landscapes, visual amenity and biodiversity; or to improve damaged and derelict land.'

Regional Planning Policy

10.2.41 The East of England Plan (May 2008), formerly providing the Regional Spatial Strategy (RSS) for the East of England, was revoked in July 2010 but was then reinstated following a legal challenge, and therefore remains as part of the Development Plan for the time being, though it seems likely to again be revoked in the near future.

Local Planning Policy

10.2.42 Most of the policies in the Natural Environment chapter of the South Bedfordshire Local Plan have been deleted as they are covered by national planning policy. Relevant saved policies include Policy R3, which relates to the southern end of the scheme (see also section 2.4

above), and states:

'THE FOLLOWING AREAS OF LAND IN HOUGHTON REGIS ARE PROPOSED AS NEW URBAN OPEN SPACES TO MAKE GOOD EXISTING DEFICIENCIES AND PROVIDE RECREATIONAL OPPORTUNITIES FOR THE RESIDENTS OF NEW HOUSING AREAS.'

10.2.43 The policy then refers to an area of 7.43ha, as *'Land between Houghton Brook, Sandringham Drive and Wheatfield Road, Houghton Regis'* (i.e. the area crossed by the route options to the south of Houghton Brook), and describes the proposal as:

'ENHANCEMENT AND APPROPRIATE MANAGEMENT OF EXISTING OPEN AREA FOR A MIX OF FORMAL AND INFORMAL RECREATION IN ACCORDANCE WITH DETAILED PROPOSALS TO BE DRAWN UP BY THE DISTRICT PLANNING AUTHORITY'.

10.2.44 Policy R14 of the Local Plan states:

'THE DISTRICT COUNCIL, IN CO-OPERATION WITH BEDFORDSHIRE COUNTY COUNCIL, TOWN AND PARISH COUNCILS, LANDOWNERS AND OTHERS, WILL SEEK TO IMPROVE AND PROTECT EXISTING FACILITIES SO AS TO ENSURE ACCESS TO INFORMAL RECREATION IN THE COUNTRYSIDE BY:

- (i) MAKING PROVISION FOR ADDITIONAL INFORMAL COUNTRYSIDE RECREATIONAL FACILITIES AND SPACES.*
- (ii) IMPROVING ACCESS FOR WALKERS, HORSE RIDERS AND CYCLISTS TO THE WIDER COUNTRYSIDE FOR RECREATIONAL PURPOSES.*
- (iii) ENHANCING THE LANDSCAPE, IMPROVING HABITAT MANAGEMENT, RESOLVING PROBLEMS OF PUBLIC ACCESS AND INCREASING THE INFORMAL RECREATIONAL AND AMENITY VALUE OF THE COUNTRYSIDE - PARTICULARLY CLOSE TO URBAN AREAS.'*

10.2.45 Saved policies in the Luton Local Plan include the following:

- Policy ENV4, 'Access to the countryside', which states:

'Subject to their scale, purpose and location, development proposals may be required to provide, where feasible, pedestrian, cycle, equestrian, disabled and limited mobility access into:

[A] the footpath and bridleway network; and/or

[B] the countryside.'

- Policy ENV10, 'Landscaping':

'Development proposals will not be approved unless they make adequate provision for landscaping, and any landscaping scheme is:

[A] appropriate in that it takes account of the setting or intended use of the development; and

[B] effective in that it:

- (i) retains trees of merit and other important landscape features; and*
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(ii) establishes new planting and trees which will not be problematic in the long term.'

10.2.46 Relevant policy options were set out in the Luton and South Bedfordshire Local Development Framework Core Strategy Preferred Options Summary Document. Although this document was withdrawn in September 2011 it has been endorsed by Central Bedfordshire Council for development management purposes until a new Development Strategy is adopted. The relevant preferred options include::

'Preferred Option CS14 - Green Infrastructure and Green Space

The Joint Committee's preferred option is to:

Maintain, enhance and deliver new green infrastructure, including green open space at appropriate scales throughout the Growth Area by:

- Seeking a net gain in Green Infrastructure and Green Space through the protection and enhancement of existing and the provision of new green infrastructure assets as set out in the GI Plans and Green Space Strategy across the Growth Area in particular Dunstable, Leighton Linlade and in the preferred emerging sustainable urban extensions;*
- Taking forward the priority areas identified in the Bedfordshire and Luton Strategic GI Plan for the enhancement and provision of green infrastructure in the Ouzel River Corridor, Chalk Arc Corridor, Leighton Linlade to Dunstable Corridor and Upper Lea River Valley Corridor; and*
- Requiring new development, in particular the preferred emerging sustainable urban extensions, to contribute towards the delivery of new green infrastructure and the management of a connected network of new and enhanced open spaces and corridors in accordance with the Green Space Strategy standards.'*

'Preferred Option CS15 Country and Landscape

The Joint Committee's preferred option is to:

- Protect, conserve and enhance the quality and character of the countryside and landscape of Luton and southern Bedfordshire in accordance with the findings of the South Bedfordshire Landscape Assessment 2007 and Environmental Sensitivity Assessment 2008;*
- ensure that development includes appropriate mitigation measures to reduce its impact on the countryside in accordance with the findings of the South Bedfordshire Landscape Character Assessment 2007 and the Environmental Sensitivity Assessment 2008; and*
- Protect, conserve and enhance the Chilterns Area of Outstanding Natural Beauty.'*

10.2.47 There are also a number of relevant supporting planning documents, including:

- The Bedfordshire and Luton Strategic Green Infrastructure Plan (2007), produced by the Bedfordshire and Luton Green Infrastructure Consortium. This is intended to provide the context and evidence base for guiding the location and pattern of development and Green Infrastructure policy within the emerging LDF. This plan*

assesses the extent of 'Strategic Accessible Greenspace' and regards the area around the scheme as being deficient in this respect, and in need of new provision of Accessible Greenspace and general improvement in Green Infrastructure provision. The 'Chalk Arc Corridor' is one of the main corridors for provision of new or enhanced Green Infrastructure identified in the plan.

- The Luton and South Bedfordshire Green Space Strategy (February 2008) - this is a draft Supplementary Planning Document for the LDF, and sets out the future vision for the planning and management of green spaces both within and around the urban areas. The plan accompanying the strategy shows the area of the scheme to the south of Parkside Drive as 'Natural and semi-natural Greenspace', and indicates a 'Potential Major Green Corridor Linkage' leading roughly along the line of the scheme and then to the north west, to what the strategy identifies as an 'Opportunity Area' for strategic green space provision.
- An Environmental Sensitivity Assessment covering southern Bedfordshire was prepared by Bedfordshire County Council's Heritage and Environment Service and was completed in April 2008. This considered areas identified for possible development within the emerging Core Strategy, and also other areas adjacent to them which could be affected by development. In terms of landscape, the assessment graded areas from high to low sensitivity, on a four point scale, and the area around the route options for the scheme (to the north of Parkside Drive only) was graded as grade 3 (the second lowest grade) or grade 2 in a strip alongside the existing urban edge. By combining consideration of landscape, biodiversity, archaeology and historic landscape, the assessment identified a series of areas for potential development, including the area of the scheme north of Parkside Drive.
- A more detailed 'spatial vision' for a Green Infrastructure network in South Bedfordshire and Luton is set out in the 'Luton and southern Bedfordshire Green Infrastructure Plan' (2009). This is intended to be a technical document providing detailed background information to support the policies and proposals in the emerging LDF. In the area around the scheme, it identifies a strip along the urban edge to the south and west of the line of the routes as having potential for 'urban fringe enhancements', and also shows a broad corridor alongside the Houghton Brook (including the section to the south of Parkside Drive) as a 'priority opportunity area'.
- A Scoping Report produced in December 2009, as part of the Chalk Arc Initiative, for 'Multi-functional Greenspace in Luton and Southern Bedfordshire'. This was intended to begin the process of identifying options for the delivery of new strategic, multi-functional green space. The study identified the 'Chalton Cross Farm flood plain, north of Dunstable' (around the southern end of the scheme, along the Houghton Brook) as a potential area for strategic provision. This appears to be based on the

assumption that the area of flood plain alongside the Houghton Brook (see chapter 6) is not suitable for development and will therefore need to be kept open, possibly forming the basis for a new area of accessible open space, which the report describes as:

'probably a new urban park, possibly making a significant feature of any strategic flood storage, with green corridors to Houghton Regis and south into Luton and also north to the wider countryside and/or urban extension to the north of Houghton Regis'.

10.3 Project Proposals, Including Mitigation Measures

Engineering Proposals

10.3.1 The road and associated engineering proposals are described in chapter 2 of the EAR. The options currently under consideration have been developed together with the environmental assessment as part of an iterative process, and the alignments themselves therefore include elements which aim to minimise environmental effects, by avoiding sensitive areas or features, and by keeping the vertical alignment as low as possible (subject to other constraints such as flooding and wildlife access). These elements include:

- Maintaining a distance between the scheme and residential properties - it is difficult to achieve this at the southern end of the scheme, but the routes pass generally through the middle of the wedge shaped area of informal open space, maximising the distance between the new road and the adjoining housing as far as possible.
- Achieving a balance in the vertical alignment of the scheme. There is a requirement to keep the road above flood levels, but also a desire to set it as far down into the landscape as possible to minimise importation of fill and also to reduce landscape and visual effects. The proposals seek to achieve a reasonable compromise between these two potentially conflicting needs.
- The use of open structures (as opposed to culverts) for watercourse crossings wherever possible - this also has benefits in terms of nature conservation and pedestrian access.

Landscape Proposals

10.3.2 Outline landscape proposals for each of the route options are shown on Figures 10.3 to 10.8. As there are currently three options under consideration, and only one of them will be taken forward, no detailed landscape design work has been undertaken. However, some design development is needed in order to make initial judgements about likely landtake and to

inform the landscape and visual assessment. The proposals shown on Figures 10.3 to 10.8 are illustrative only at this stage, and show the types of provision and the approximate areas of land which would be required to mitigate the effects of the new road. More detailed landscape proposals will be developed at Stage 3, for the preferred route.

- 10.3.3 There are two main strands to the landscape proposals for the scheme. The first relates to mitigation of potential landscape and visual effects, in the same way as would be considered for any highways scheme, with the intention of reducing potential adverse effects to a level at which they may be acceptable, and also to provide some benefit or enhancement where possible. The second strand is to do with the policy objective, at all levels from national to local, of establishing and enhancing Green Infrastructure, and the proposals seek to assist with this where possible within the land available.
- 10.3.4 All of the proposals fall within the first strand, as they are all intended to mitigate the potential adverse effects. These include the provision of Exchange Land, the planting along the line of the road, the use and design of the acoustic barriers at the southern end of the scheme and the landscape treatment of the proposed scheme drainage features. Some of the proposals also serve to assist with the second strand - these include the proposals for the treatment and management of the residual areas alongside the road as it passes through the green corridor to the south of Parkside Drive, the provision for continued access across the line of the road, the provision where possible for connections into other existing or proposed Green Infrastructure areas, and the general creation of a green, planted corridor along the line of the road.

Residual Areas

- 10.3.5 In the area to the south of Parkside Drive the routes run through a corridor of undeveloped land associated with the overhead power lines, and would (to varying degrees) truncate or sever the areas of informal open space alongside them. Exchange Land is proposed to compensate for the areas of open space which would actually be lost to the scheme (see section 2.4), but there is also the question of the areas of open space which would remain to either side of the new road. Each of the proposed route options allows, in principle, for the design and management of the residual areas alongside them, for amenity and nature conservation benefit. This is on the basis that the new road would introduce a significant change into this green corridor, and that appropriate mitigation for that change should include a comprehensive design and management approach to the entire corridor to the south of Parkside Drive, combining landscape, ecology and access considerations.
- 10.3.6 Initial discussions have been held with CBC landscape officers about the design and management of these areas, with the aim of developing designs which will not only mitigate the effects of the road, but would also assist with the delivery of the Local Plan policy of developing this area as a new urban open space for formal and informal recreation.

10.3.7 More detailed proposals will be developed in discussion with CBC at Stage 3, but the intention would be for the residual areas to provide for a mixture of informal and formal recreation. The informal recreation would be in terms of retaining areas of grassland, woodland and scrub for walking and informal children's play, and also for nature conservation benefit. The more formal recreation would be in terms of 'natural play areas' - these would be areas with some simple, fixed timber play equipment, perhaps large section posts for balancing on, or other timber features with a part sculptural, part play function, and with grass mounds and some robust timber seats, but these would not be formal play areas with traditional play equipment. There would also be some areas of close mown amenity grassland for informal ball games, though no marked out sports pitches would be provided.

10.3.8 The residual areas would therefore be treated as set out below:

- Some areas of existing hawthorn scrub would be retained, with some additional planting of feathered trees at around 4 to 10m centres, with the long term intention of developing into open woodland. This treatment would help to screen and integrate the new road.
- Other areas would be treated as grassy glades, some large enough for informal ball games and with grass mown short, others would be smaller with wildflower grassland. In these glades the existing scrub would be removed and the grass would need to be cut (either frequently or once or twice per year only) to prevent re-encroachment. This would result in some loss of scrub vegetation, but would increase the usability of the wider residual areas as open space.
- Some areas of developing scrub would simply be left alone and not maintained, other than for general operations such as litter removal.
- Possible use of mounding alongside the new road in some areas, where needed for noise and/or visual mitigation. This would help to separate the road from the new areas of open space, and the mounds could be planted with a woodland edge mix where screening is important.
- Noise barriers are likely to be required to each side of the road between Chainages 400 and 1000 (see chapter 13). The requirements and design for these barriers will be finalised at Stage 3, but in principle they are likely to be either vegetated barriers or simple timber barriers, in which case planting on the side away from the road will help to integrate them.
- There would need to be a secure boundary to the new road where there are no noise barriers, in order to prevent people wandering across the carriageway - this would be a timber post and rail fence, with gaps to direct people to the at grade

crossing points. In some areas the fence would be augmented by a new hedge - hedges would in general be of native species, but in areas of more formal, managed open space the planted boundary could comprise tall shrubs such as laurel, with intermittent trees.

- Some areas (perhaps smaller areas closer to houses, where more active use may be appropriate) could be laid out as natural play areas, with some provision of simple fixed play equipment.
- Access through the residual areas would be by hard surfaced paths for the main pedestrian and cycle routes to the road crossing points. Sealed gravel or a similar surface could be considered to give an informal appearance with low maintenance. Paths elsewhere would be simple mown grass, winding through the retained scrub areas or connecting the grassy glades.
- All of the above areas would need appropriate management into the future, and some of the desired features would be achieved over time by management rather than by design intervention. The landscape proposals at Stage 3 would therefore be accompanied by an outline Landscape and Ecology Management Plan to set out how all of the various components of the residual areas should be managed over time in order to produce the desired results. A fully detailed long term management plan would then be provided as part of the detailed design of the scheme, prior to implementation.

Landscape Proposals in General

10.3.9 The landscape proposals for the scheme in general aim to:

- Screen the road, its structures and the traffic using it, in general to avoid adverse effects and in particular in sensitive or visually prominent locations, or where the element of the scheme concerned is potentially intrusive or discordant.
- To integrate the new road into the surrounding landscape.
- Where the above two aims are not paramount, some areas alongside the road may be left unplanted, for variety and to allow some views out from the road, and also because completely enclosing a new road or other development with dense planting can in itself appear discordant within a generally open landscape. As shown on the drawings, the eastern side of the new road closest to the M1 (in the case of the Blue Route) would not be planted, and views to the east from the new road would be possible.

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- To provide visual interest for road users and people passing through the surrounding landscape. Where screening is not a requirement, the planting alongside the road may consist of a boundary hedgerow only, perhaps with intermittent hedgerow trees, or simply groups of trees set at intervals on the earthworks slopes.
 - To provide some local nature conservation benefit in terms of new areas of native planting and species rich grassland. All planting would be of locally appropriate native species, with some ornamental species possibly used to highlight areas at the southern end of the scheme, such as the Park Road North/Poynters Road roundabout. Where available, planting would also be of local provenance (i.e. propagated from seeds and/or cuttings gathered or taken in the appropriate UK region).
 - To minimise future maintenance commitments - in line with HA advice, planting of large trees would not be undertaken close to the carriageway, with progressively smaller plants being used at shorter distances from the carriageway, to minimise the need for future thinning and cutting back. The detailed proposals at Stage 3 would include an outline management plan setting out how the various planting types would be managed into the future.
 - To provide a variety of grass types alongside the road - the intention would again be to minimise maintenance commitments, and grass types would range from those cut frequently and kept short (grass paths through the residual and Exchange Land areas and limited areas of short grass within the residual areas as described above), those cut regularly but not frequently to limit sward height (verges and visibility splays) and those cut once or twice per year only, to promote a species rich sward.

10.3.10 The landscape proposals would be developed in more detail at Stage 3, and would at that stage be categorised in line with the DMRB terminology of Environmental Functions (EFs, such as EFA - Visual Screening, and EFB - Landscape Integration) and Landscape Elements. The main Landscape Elements (LEs) which would be provided as part of the landscape proposals would be:

- LE1.1 Amenity Grass Areas
- LE1.3 Species Rich Grassland
- LE2.1 Woodland
- LE2.2 Woodland Edge
- LE2.4 Linear Belts of Shrubs and Trees
- LE2.5 Shrubs with Intermittent Trees

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- LE2.7 Scattered Trees
 - LE2.8 Scrub
 - LE4.1 Ornamental Species Hedges
 - LE4.3 Native Species Hedgerows
 - LE4.4 Native Hedgerows with Trees
 - LE6.1 Water Bodies and Associated Plants

Exchange Land

10.3.11 As set out in section 2.4, an area of roughly 5.0ha of Exchange Land would be provided as part of the scheme. The landscape proposals drawings show approximate locations and areas where this could be provided. No attempt has been made at this stage to accurately calculate the areas required, or to show exactly where this land would be provided - that exercise would form part of the Stage 3 work. However, the landscape drawings do show that it would be possible in principle to provide the appropriate area of land, and also show how that land could be laid out to integrate with the scheme landscape proposals and also with wider aspirations for Green Infrastructure provision in the area surrounding the scheme.

10.3.12 The Exchange Land provision would vary to some extent in terms of location and layout with each of the route options, but would in principle need to replicate the nature of the land which would be lost to the scheme, and would therefore comprise the following:

- Woodland planting, with the aim of forming small areas of native woodland in the medium to long term, linked with the roadside planting and existing hedgerows and green corridors.
- Species rich grassland - some removal of existing topsoil may be necessary to provide more impoverished soils suitable for the establishment of chalk grassland flora. This would be maintained by mowing once or twice per year, with cuttings collected and removed, possibly as a hay crop.
- Wetland - areas of natural wetland would be provided to complement the existing ditch and watercourse habitats, and also the new wetland habitats to be provided as part of the scheme drainage proposals. Permanent water bodies in the form of large ponds would be provided, together with seasonally wet areas for marginal and wetland plants. The detailed design would need to control public access and provide for public safety.
- Links with existing landscape features - the Exchange Land would probably be alongside the Houghton Brook, and would provide links with the watercourse, with

the existing scrubland habitats to the south and with the existing green corridors along the hedges and ditches in the agricultural land to the north.

- Informal public access - the areas would be open to the public and would have mown grass paths across them, linking with existing public footpaths and informal routes.

Scheme Drainage Proposals

- 10.3.13 The scheme drainage proposals are not yet designed in detail, but would in principle consist of drainage off the edge of the carriageway into grass swales around 2m in width, leading to attenuation ponds which would control the flow of the eventual outfalls into the Houghton Brook. Exceptions to this would be in short sections around the junctions, where the drainage would be means of kerbs and gullies, with no swales. The swales would have a shallow depression only, and would have the appearance of wide grass verges - they would need to be mown at regular intervals.
- 10.3.14 The attenuation ponds would have upstream pollution control measures as described in chapter 6, and the ponds themselves would be designed as permanently wet, natural water bodies with some native marginal planting and shallow side slopes. However, there would be no attempt to specifically encourage wildlife, as the presence of protected species could hamper future maintenance.

Wider Green Infrastructure

- 10.3.15 There are a number of proposals or strategies for the provision of Green Infrastructure in the area around the scheme (see section 10.2 above). While the Woodside Connection scheme can only contribute to such proposals and strategies for the area within its limits, the proposals to date have sought to fit in with wider strategies and to make contributions to those strategies where possible.
- 10.3.16 This would be in terms of the provision of elements of Green Infrastructure (planting, green corridors, wetland features and formal and informal access routes) within the scheme limits, and also provision for existing or future links to Green Infrastructure outside the scheme limits.

10.4 Assessment of Effects

Landscape Change

- 10.4.1 Compared with the baseline situation described in section 10.2.1, the change to the north of Parkside Drive would be **minor to moderate**. This is because the area of agricultural land is already disturbed and strongly affected by the M1 and its traffic and by the overhead

electricity transmission lines, and will also be further affected in due course by the new Junction 11A, which will occupy an elevated position and add further intrusive elements to the existing landscape. The new road would be visible across the flat, open landscape, but would not be especially discordant or intrusive, given the existing landscape character.

10.4.2 Compared with a potential future baseline situation in which the proposed large scale development to the north and east of Houghton Regis was in place, the change resulting from the new road would be significantly reduced, and would be no more than minor.

10.4.3 To the south of Parkside Drive the landscape change would be **moderate**. This is because the change would take place within a relatively narrow, enclosed corridor, would involve some loss of developing scrub vegetation, would lead to some loss and severance of the existing informal open space and because existing traffic levels around this area are quite low. However, the degree of change would be limited due to the disturbed, urban fringe nature of the existing landscape and its ability, as a result of the existing vegetation within it, to accommodate some change.

Visual Envelope and Views

10.4.4 The most visible, and therefore the most potentially intrusive, elements of the proposals would be (from south to north):

- The new road as it passes through the narrowest part of the wedge of informal open space, between Windsor Drive and Wheatfield Road. There would be a retaining wall on the west side of the road, facing the end of Windsor Drive, and there would be little existing vegetation to screen the new road and its traffic. Just to the north of this point the road and the traffic passing along it would also be visible from the houses to the west and east, though the existing scrub vegetation would provide some screening. Effects at this point would be essentially the same for all three route options.
- The noise barriers which are likely to be required along the southern part of the new road would screen traffic using it to some extent, though high sided vehicles would still be visible above the barriers (which would probably be between 2 and 3m in height). The barriers themselves could also be somewhat intrusive, though they would be designed to avoid this as far as possible, and planting could also be located alongside them, where space permits - these issues would be addressed as part of the Stage 3 design and assessment process.
- Further to the north, the new road would rise up to cross the Houghton Brook at around Chainage 830, and would at this point be around 4m above existing levels. The visibility of the road and its traffic would be limited by the existing scrubby

woodland on the south side of the brook, and by the trees within the open space on the north side, but the road embankments would still be locally prominent. The road would remain on embankment as it continues northwards to cross the Houghton Brook again (for the Blue and Green Routes) at Chainage 1100. The Orange Route does not cross the brook again, but would remain on embankment as it crosses this area.

- The new road would remain on embankment as it crosses the open agricultural land to the north of Parkside Drive as far as Chainage 1800 to 1900 (for the Blue and Green Routes). To the north of this the route would be largely in cutting, which would diminish its presence in the landscape, with the roundabout at Chainage 2300 (for the Blue and Green routes) set around 2m below surrounding levels. The roundabout for the Orange Route would be roughly at grade, and therefore more visible.
- The new road would emerge from the shallow cutting and rise up to connect with the proposed Junction 11A - while this part of the new road would be clearly visible, it would be seen as a relatively small scale feature in association with the new Junction 11A and the A5-M1 Link.
- As described in chapter 2, the section of the new road to the south of Parkside Drive would be lit, as would the junctions in the northern section of the scheme. The lighting columns would be 10m high, and would be prominent in the small scale landscape to the south of Parkside Drive, highlighting the presence of the road. However, any adverse effects would be limited by the existing presence of lighting to the roads to either side of the scheme, and also the electricity pylons running parallel with the scheme. The lighting in the northern part of the scheme would also be visible on the higher ground around Chalton Cross Farm, but would only be seen in the context of the existing M1 lighting and the proposed lighting for the new Junction 11A.
- The landscape and visual effects of a new road scheme are determined not just by the presence of the road itself, together with its structures and lighting columns, but also by the presence of traffic passing along the road, which can be intrusive if the surrounding landscape is otherwise largely static. In this case the area around the scheme is already affected by existing traffic flows, particularly those along the M1, and effects in this respect would therefore be felt less strongly.

10.4.5 The visual envelope for the route options has been assessed, and this is illustrated on Figure 10.9 in Volume 1A. There would be no significant variations between visibility of the route options, so for the purposes of this Stage 2 assessment, the same visual envelope has been assumed for each option. The main features of the visual envelope are:

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- Views are largely limited to a relatively small area around the scheme, bounded by the urban edge of Houghton Regis and Luton to the west and south (with the visual envelope drawn very tightly around the scheme, along the edges of the wedge of open land in the area to the south of Parkside Drive) and Luton Road (just to the east of the motorway) to the east.
 - The visual envelope is less well defined to the north, and extends to the southern edge of the village of Chalton.
 - There are also some more limited, longer distance views from beyond this area, with partial views from land around Chalgrave to the north west, tall blocks of flats in Luton to the south east and from the high ground of Dunstable Downs to the south. In these views (see photograph 36 for views from Dunstable Downs), the area around the scheme can be seen, and the new road would therefore be visible, but it would form a small part only of a wide, expansive view which already contains a number of large scale and intrusive urban elements.

10.4.6 It can therefore be seen that the main views of the route options, and also of the traffic using them, would be:

- From the north there would be clear views from Sundon Road and more limited, filtered views from some properties on the edge of Chalton. These views would also include the new Junction 11A and the A5 - M1 Link.
- From the east there would be some views for traffic passing along the M1, and very limited views from a small area on the eastern side of the motorway.
- From the south there would be some views from the upper floors of properties along Kestrel Way, above the hedge along the north side of the road.
- Around the wedge of open land to the south of Parkside Drive there would be views from Sandringham Drive and the properties alongside it to the north west, the new housing area around Holyrood Drive, and also from Wheatfield Road and the properties alongside it to the south east of the scheme.
- From the west there would be views from properties on the edge of Houghton Regis, and also from the playing fields of King's Houghton Middle School. There are three isolated properties along the south side of Sundon Road which would have some limited views from first floor windows, but these are in general well screened by garden vegetation.
- From within the visual envelope there would be views from the public rights of way which pass through the area, and also the informal access routes, especially to the south of Parkside Drive.

Physical Losses of Landscape Features

10.4.7 One of the main potential adverse effects of any form of development is in the removal of existing positive landscape features. In this case, the following would be affected:

- Some of the woodland at the southern end of the scheme would be lost, though many of the trees in this area have already been affected by past pruning to prevent conflict with the adjacent overhead power lines.
- The route options pass through an area of scrubby woodland to the south of the Houghton Brook. This would involve some loss of the developing woodland vegetation, and also a degree of severance, but also means that the route would be well screened from the surrounding area as it passes through the woodland. The Blue and Green Routes pass through the western side of this area, and would affect a length of around 120m, while the Orange Route passes through the centre of the woodland, and would result in the loss of around 200m length. In addition, all three options would result in some further loss of woodland in order to provide the proposed drainage ponds and other features as shown on the drawings - possible alternative locations for these features would be explored at Stage 3, with the aim of minimising the loss of woodland at this point.
- There would be some loss of hedgerows as the route passes across the fields to the north of Parkside Drive. The Orange Route would have the least effects in this respect, as it stays to the west of the main north-south field boundary, but it would still cross two hedge lines. Effects for all of the routes would be limited in significance because the hedges are in general not tall or continuous, and contain few hedgerow trees.

Green Belt

10.4.8 Although the scheme would not result in any built development, it would still involve significant areas of hard surfacing, embankments and other structures, and the introduction of traffic and features such as lighting columns into an area which (while disturbed already) is largely undeveloped. There would therefore be some in-principle adverse effects on the openness and visual amenity of the Green Belt. However, these effects would be limited as a result of the presently low level of visual amenity in this area and the fact that the openness would be reduced but not totally removed - views across the line of the road would still be possible in most cases, and the new road would run across the open landscape, rather than completely blocking views. It should also be noted that the status of this area may be reviewed in the near future - the Green Belt boundary will need to be redrawn to

exclude this area to enable the proposed large scale development to the north and east of Houghton Regis to go ahead.

Landscape Effects

- 10.4.9 As the nature of the landscape to the south and north of Parkside Drive is quite different (and lies within different landscape character zones), the effects on the landscape are considered separately in turn.
- 10.4.10 To the south of Parkside Drive (in landscape character zone 6, see Figure 10.2) the effects would be greater, as the new road would be visible at short distance, and would tend to dominate some of the relatively small scale spaces, and the loss of vegetation would be locally significant. The combination of medium sensitivity and a moderate degree of change would lead to **slight to moderate adverse** landscape effects in the first winter after completion of the scheme (year 1). At this time, while the proposed planting would have little effect in terms of screening, the provision of Exchange Land (to the north of Parkside Drive) would still represent a positive addition to the local landscape in terms of access and usability, and would therefore already be offsetting some of the adverse effects.
- 10.4.11 By the summer of year 15 the effects would reduce to **slight adverse only**, as the proposed planting matures and the road becomes progressively better screened and integrated with the surrounding landscape.
- 10.4.12 The above assessment would apply equally for all three route options.
- 10.4.13 To the north of Parkside Drive (in landscape character zone 5, see Figure 10.2) the existing landscape is disturbed and of low to medium sensitivity. In combination with the predicted minor to moderate degree of change this would lead to **slight adverse** landscape effects in year 1. By the summer of year 15 these effects would have reduced as a result of the maturing scheme landscape proposals, but would still be within the slight adverse category.
- 10.4.14 This assessment of slight adverse effects would apply for all three route options - there is some variation between them, with the Orange Route taking the shortest line across the open agricultural landscape and crossing fewer hedgerows and therefore being marginally preferable in landscape terms, but these differences would not be sufficient for the different routes to fall within different assessment categories.
- 10.4.15 If the wider development to the north and east of Houghton Regis were to go ahead, then any adverse effects for the area to the north of Parkside Drive would be largely eliminated, as the area which could potentially be affected by the scheme would itself have been substantially developed. Effects to the south of Parkside Drive would remain largely as before.

Visual Effects

10.4.16 Landscape effects are those affecting the landscape as a resource, while visual effects are those affecting a specific visual receptor. As there are no detailed design or mitigation proposals at this stage, visual effects are considered in general terms for groups of receptors where appropriate, rather than in detail for every receptor potentially affected, and the following represents an estimate of likely effects, rather than a detailed assessment of effects for each receptor, as would be undertaken at Stage 3. Receptors or groups of receptors are considered in turn below:

- Properties to the north of the road around Sandringham Drive:
 - Properties at the western end of Sandringham Drive would be largely screened by the retained woodland close to Park Road North. Further to the north east, just to the west of Windsor Drive, around 10 properties would have close range views of the new road, in some cases from first floor windows only above garden walls, and in all cases across Sandringham Drive. For some of these properties their existing middle ground view of the trees between Sandringham Drive and Wheatfield Road would be replaced by views of the new road and its traffic, with houses on Wheatfield Road visible in the background. Effects would be **moderate to large adverse for around 6 properties** with the clearest views, and **slight to moderate adverse for those with partial or filtered views**. The noise barriers which are likely to be required along this stretch of the new road would screen traffic on the road to some extent, but views would still be possible from the first floor of adjacent properties, and the barriers themselves may also be somewhat intrusive. The Stage 3 assessment will consider the effects of the barriers in more detail, once their location and design are finalised.
 - A further 18 properties to the east of Windsor Drive would experience similar views of the new road, though the loss of existing vegetation would not be so significant in this case, as there are no existing mature trees at this point. There would be moderate adverse effects **for around 8 properties** with the clearest views (where the houses front onto Sandringham Drive, and where there are therefore no rear garden walls), and **slight adverse for those with partial or filtered views**. The comments in respect of noise barriers as noted above would also apply here.
 - Around 20 properties in the area of new housing around Holyrood Drive, to the east of Sandringham Drive, would also have views of the new road, and in this case there is no existing road in the views and the change resulting from the scheme would therefore be greater. Effects would be **moderate adverse** for

these properties. The comments in respect of noise barriers would again apply here.

- Further to the north east there are around 12 properties along the northern edge of the area of open land just to the south of Parkside Drive. These properties would have views of the new road as it runs across the open space on embankment, just to the north of the Houghton Brook crossing. There are some semi-mature trees within the open space which would provide some filtering of these views in the summer, but the existing view is relatively green and unspoilt, with no roads or traffic, and the change would therefore be relatively high. Effects for these properties would be **moderate or moderate to large adverse**, depending on the openness of the view in each case.
- Properties to the south of the road around Wheatfield Road:
 - There are 22 properties at the western end of Wheatfield Road, set back from the road and slightly elevated above it. These properties would have clear and short range views to the new road as it runs roughly parallel to Wheatfield Road, and there would be some loss of existing mature trees in these views. However, the existing views include the overhead electricity transmission lines and the existing road, so effects would be no more than **moderate adverse**. The comments in respect of noise barriers as noted above would also apply here, and the elevated location of these properties means that views above the barriers would show slightly more of the new road and its traffic.
 - Further to the north east there are around 65 properties on the north side of Wheatfield Road, including those in Wheatfield Court. These properties are at a higher level than the scheme, and would have views across the new road. However, some of the properties are partially screened, at least at ground level, by rear garden fences and/or garden vegetation and semi-mature trees within the informal open space to the north, and the new road would be progressively further from the houses towards the north east, as it diverges from the line of Wheatfield Road. There would therefore be **moderate adverse effects** for around 15 properties with the clearest views, **slight to moderate adverse effects** for around 30 properties and **slight adverse effects** only for around 20 properties with more substantial existing screening. The comments in respect of noise barriers as noted above would also apply here.
 - Properties further to the north east, on Thresher Close and just to the west on Wheatfield Road, would be largely screened by garden vegetation, the area of scrubby woodland to the south of Houghton Brook and by the mature trees close to the electricity substation. However, there would still be some views from upper floor windows only, and there would be **slight adverse effects** for

around 5 properties at this point.

- Around 12 properties at the north end of Paddock Close and Gelding Close would have views of the Blue or Green Routes as they cross Parkside Drive and run to the north across the open fields, and these properties would have more distant, oblique views of the Orange Route, which follows a more westerly course. Views would in all cases be from first floor windows only, and effects would be **slight to moderate adverse**.
- Properties to the west of the road on the edge of Houghton Regis - there are around 100 properties here, along Burford Walk, Conquest Road and Houghton Park Road. Some of the houses are separated from the open land to the east, across which the routes run, by local access roads or rear gardens and/or garage blocks, depending on their local arrangement, whereas others have more open views towards the line of the scheme. In general, most of the views are from upper floor windows only, and views tend to be clearer and shorter distance towards the south. There would be **slight to moderate adverse effects** for around 20 properties with the clearest views towards the south of this area, **slight adverse effects** for around 60 properties and **neutral effects** for remaining 20 properties which are better screened or have very limited views. These effects would be for the Orange Route, which runs closer to the urban edge at this point - effects for the other two route options would be at a slightly lower level.
- Properties along Sundon Road - there are three properties here (Mekoda, Woodlands and Osborne House) on the south side of the road beyond the main urban edge. The two properties to the west are well screened by boundary vegetation, a small patch of scrubby woodland and also vegetation around the yard to the rear of the third property (Osborne House), and would therefore experience no visual effects. Osborne House itself is screened by a tall hedge along its north eastern boundary (see photograph 34), but the link from the new road to Sundon Road would pass within 100m or so of the house and the new Sundon Road roundabout would also be around 100m away. Views from this property would be limited and filtered, but there would still be **slight adverse visual effects**, mainly in winter.
- Chalton Cross Farm - the farmhouse is on the western side of the group of farm buildings, and is screened to the east by the remaining buildings and also to some extent to the north and south by mature trees (see photograph 32). There would be some views to the south of the new link to Sundon Road, at a distance of around 250m, and the main line of the new road would pass within 100m of the farmhouse to the east, but would be largely screened by the intervening buildings (though some of the easternmost buildings would need to be removed as part of the scheme).

There would be **moderate adverse effects** for the farmhouse. Chalton Cross Lodge (on Sundon Road) and four cottages on Luton Road (on the eastern side of the M1) would be demolished as part of the A5-M1 Link scheme, and would not therefore be affected.

- Properties in Chalton - there would be some views towards the northern part of the scheme, around Chalton Cross Farm, from properties on the southern edge of Chalton, at a distance of around 800m. However, these views would be largely screened by the proposed realignment of Sundon Road over the new A5-M1 Link, and the scheme would therefore not be visible from these properties and there would be **neutral effects** upon them.
- Properties along Kestrel Way are slightly elevated relative to the land around the central parts of the scheme, and there will be some views to the north across the open fields from the first floor windows of some of the properties which are currently under construction on the north side of the road, and also along Pastures Way. However, these new properties will largely screen views towards the scheme from the older houses on the south side of the road. The new road would be visible as it passes across the fields, at a distance of around 0.7 to 1.5km, but the views would also include traffic on the M1 and the overhead electricity transmission lines. There would be **slight adverse effects** for around 20 properties with the clearest views, and neutral effects for the remainder.
- Properties in Luton - in general there are no views to the area around the scheme from houses on the eastern side of the M1, but there are two tall blocks of flats on the western side of Luton which have views over the motorway towards the scheme. While the new road would be visible in views from some properties within these blocks at a distance of more than 1km, it would only be visible in the context of wide, expansive views which would also include the motorway, large parts of Luton and Houghton Regis and also the A5-M1 Link. There would therefore be **neutral effects**.
- Users of public rights of way:
 - Users of National Cycle Network Route 6 and also Footpaths 6, 7, 8 and 17 would be affected directly in terms of having to cross the new road in the course of their journeys (either at grade or in some cases passing beneath the new road), and also indirectly in terms of visual effects and the general loss of tranquillity resulting from the presence of the new road and the traffic passing along it. However, the area around the scheme is not especially tranquil at the moment, and is affected by the motorway and its traffic, by traffic using Sundon Road and also by the adjacent urban areas and the overhead electricity

transmission lines. There would therefore be in general **moderate adverse effects** for users of the routes.

- Users of the network of routes to the north of Sundon Road would be largely screened by the realigned Sundon Road and the A5 - M1 Link, and there would be **neutral effects**.
- Further afield, there are footpaths along the crest of the Chilterns escarpment to the south, and the area around Blow's Downs is open to public access; this area is also within the AONB, and parts of it are an SSSI. The area around the site can be seen from this vantage point, at a distance of more than 2km, and the new road would be visible (see photograph 36). However, it would only be visible in the context of very wide, expansive views which would also include much of Houghton Regis in the foreground and also the M1, parts of Luton and the A5 - M1 Link. The scheme would be a minor, incremental addition to these views, and there would therefore be **neutral effects**.
- There would also be some effects for people using the footways alongside some of the roads around the scheme, including Sandringham Drive (where Footpath 39 runs alongside the road for a short distance - see photographs 4 and 11). People passing along footways alongside existing roads would in general be less sensitive than people using footpaths through the countryside, and effects would in this case be no more than **slight adverse**.
- People using the area for informal recreation - The wedge of informal open space at the southern end of the scheme is well used for dog walking and other informal recreation, and is also crossed by a number of undesignated pedestrian and cycle routes. This area is not especially attractive or unspoilt at the moment, but the introduction of a new road passing through the middle of it would significantly alter the experience of using the area, and effects would be **moderate adverse**.
- Road users are in general of lower sensitivity than people walking or cycling, and they also tend to experience any change in their views for a relatively short time only. There would be views of the new road for people passing along Sandringham Drive, Windsor Drive and Wheatfield Road at the southern end of the scheme, and Houghton Park Road, Sundon Road and the M1 for the central and northern parts. Effects would be no more than **slight adverse for the local roads**, and **neutral for the motorway**, from which views would be partially screened and fleeting.

10.4.17 There would be some detailed variation in the above effects between the different route options, with the Orange Route having greater effects on properties on the eastern side of Houghton Regis, as it would pass closer to these properties. However, this means that it would also be further away from properties in Paddock Close and Gelding Close, and also those along Kestrel Way. The overall visual effects of the routes are therefore expected to

be similar, and it would not be possible to identify one route option which is significantly better or worse in terms of overall visual effects.

- 10.4.18 All of the above effects are for the worst case scenario of year 1 in the winter, and would be expected to reduce significantly for the summer year 15 situation. The Stage 3 landscape design would seek to address potential visual effects on individual receptors, with the aim of minimising them as far as possible, and a detailed assessment of likely effects at year 15 would therefore only be possible at that stage, but Table 10.1 below gives an initial indication of how effects may be expected to reduce over time.
- 10.4.19 If the wider development to the east of Houghton Regis were to go ahead, then any adverse effects for receptors in the area to the north of Parkside Drive would be largely eliminated, as the new development would largely enclose and screen the new road. Effects for receptors to the south of Parkside Drive would remain largely as before.

Night Time Effects

- 10.4.20 Night time effects arising from scheme lighting and also from the presence of vehicle lights along the scheme would in principle be less than effects during the day, as not all of the scheme would be lit, and vehicle lights would be largely hidden from the surrounding area for the sections in cutting. The areas to be lit would be seen in the context of existing lighting in the surrounding area - for the southern section there is already lighting along Sandringham Drive, Wheatfield Road and the other local roads, and for the northern section there is already lighting along the M1, and the lighting around the new Junction 11A would also be in place.
- 10.4.21 In general, both landscape and visual effects would therefore be at a lower level at night than those described above for the daytime. However, there may be some instances in which views for a given receptor are screened to a certain height, meaning that there would be no effects during the day, but where the lighting columns would be visible at a higher level - in such a case the night time effects could be greater, and the assessment will be reviewed in more detail at Stage 3 once the detailed design (including lighting design) is available, to check whether there are such cases.

Effects During Construction

- 10.4.22 There would, in general, be some additional landscape and visual effects while the works for the scheme are being carried out, due to the presence of construction plant and vehicles and the exposure of bare soil, and also because the planting and other mitigation would not yet be in place. However, these additional effects would be balanced to some extent because there would be no traffic using the scheme, and would in any case be temporary only.

10.5 Summary

10.5.1 The landscape and visual effects described above are summarised in Table 10.1 below:

Table 10.1 ~ Summary of Landscape and Visual Effects

Receptor	Effect		Night Time Effects	Notes
	Winter Year 1	Summer Year 15		
Landscape Effects				
Landscape to the south of Parkside Drive.	Slight to moderate adverse	Slight adverse	Slight to moderate adverse	No significant difference between route options.
Landscape to the north of Parkside Drive.	Slight adverse	Slight adverse	Slight adverse	Slight preference for Orange Route as it takes a shorter route, closer to the urban edge.
Visual Effects				
Properties on Sandringham Drive, west of Windsor Drive.	6 Moderate to Large adverse 4 Slight to Moderate adverse	2 Slight to Moderate adverse 5 Slight adverse 3 Neutral	Effects at a slightly lower level than daytime, as area is already lit.	No significant difference between route options.
Properties on Sandringham Drive, east of Windsor Drive.	8 Moderate adverse 10 Slight adverse	5 Slight to Moderate adverse 13 Slight adverse	Effects at a slightly lower level than daytime, as area is already lit.	No significant difference between route options.
New properties around Holyrood Drive, east of Sandringham Drive.	20 Moderate adverse	5 Slight to Moderate adverse 10 Slight adverse 5 Neutral	Effects as daytime, as few existing light sources in the view.	No significant difference between route options.
Properties to north of open space near Parkside Drive.	6 Moderate to Large adverse 6 Moderate adverse	12 Slight to Moderate adverse	Effects as daytime, as few existing light sources in the view.	No significant difference between route options.
Properties at western end of Wheatfield Road, south side.	22 Moderate adverse	22 Slight to Moderate adverse	Effects at a slightly lower level than daytime, as area is already lit.	No significant difference between route options.
Properties on north side of Wheatfield Road.	15 Moderate adverse 30 Slight to Moderate adverse 20 Slight adverse	5 Slight to Moderate adverse 35 Slight adverse 25 Neutral	Effects at a slightly lower level than daytime, as area is already lit.	No significant difference between route options.
Properties on Thresher Close and Wheatfield Road.	5 Slight adverse	5 Neutral	Effects likely to be greater as new lighting more visible than the road itself.	No significant difference between route options.
Properties on Paddock Close and Gelding Close.	12 Slight to Moderate adverse	6 Slight adverse 6 Neutral	Effects as daytime, as few existing light sources in the view.	No significant difference between route options, though Orange Route slightly further away.

Table 10.1 ~ Summary of Landscape and Visual Effects (continued)

Receptor	Effect		Night Time Effects	Notes
	Winter Year 1	Summer Year 15		
Properties on the edge of Houghton Regis.	20 Slight to Moderate adverse 60 Slight adverse 20 Neutral	40 Slight adverse 60 Neutral	Effects as daytime, as few existing light sources in the view.	Orange Route runs closer to these properties and would tend to have greater effects.
Properties on Sundon Road.	1 Slight adverse	1 Neutral	Effects likely to be greater due to visibility of lighting around Sundon Road roundabout.	No significant difference between route options.
Chalton Cross Farm.	1 Moderate adverse	1 Slight to Moderate adverse	Effects likely to be greater as new lighting more visible than the road itself.	No significant difference between route options.
Properties in Chalton.	Neutral	Neutral	Neutral	Properties largely screened by realigned Sundon Road and A5 - M1 Link.
Properties on Kestrel Way.	20 Slight adverse	6 Slight adverse 6 Neutral	Effects at a slightly lower level than daytime, as area is already lit.	No significant difference between route options, though Orange Route slightly further away.
Properties in tower blocks in Luton.	Neutral	Neutral	Neutral	Views are distant and scheme would be a small component only of an expansive view. No significant difference between route options.
Users of public rights of way crossed by the scheme	Moderate adverse	Slight to Moderate adverse	Effects as daytime, as few existing light sources in the view.	Some views at very short range. No significant difference between route options.
Users of public rights of way and access land on Chilterns escarpment.	Neutral	Neutral	Neutral	Views are distant and scheme would be a small component only of an expansive view. No significant difference between route options.
Users of footways alongside local roads.	Slight adverse	Neutral	Effects at a slightly lower level than daytime, as area is already lit.	No significant difference between route options.

Table 10.1 ~ Summary of Landscape and Visual Effects (continued)

Receptor	Effect		Night Time Effects	Notes
	Winter Year 1	Summer Year 15		
Users of informal open space to south of Parkside Drive.	Moderate adverse	Slight to Moderate adverse	Effects as daytime, as few existing light sources close to or within the area.	Some views at very short range, route options pass through this area. No significant difference between route options.
Road users.	Slight adverse	Neutral	Neutral	No significant difference between route options.

Notes:

1. The above assumes that the wider development to the north and east of Houghton Regis is not in place. If this development were to go ahead then most of the above effects would be significantly reduced.
2. Above assessment is based on Stage 2 highways and landscape design and will need to be refined in detail at Stage 3, in particular in relation to the extent and design of any noise barriers at the southern end of the scheme. Visual effects for year 15 are estimated only at this stage.
3. Night time effects are for year 1.

Chapter 10 Landscape ~ Appendices

Appendix 10.1 ~ Detailed Methodology for Assessment of Landscape and Visual Effects

1. Landscape and visual effects were assessed in terms of the magnitude of the change brought about by the development and also the sensitivity of the resource affected. The magnitude of change will generally decrease with distance from its source, until a point is reached where there is no discernible change. Residential properties were taken to be of high sensitivity in general, although this can vary with the degree of openness of their view (see Table 1 below). Landscapes which carry a landscape quality designation and which are otherwise attractive or unspoilt will in general be more sensitive, while those which are less attractive or already affected by significant visual detractors and disturbance will be generally less sensitive (see Table 3 below).
2. For the purpose of the assessment visual change was categorised as follows, where each level (other than neutral) can be either beneficial or adverse:
 - No change no discernible change
 - Negligible the scheme would be discernible but of no real significance
 - Minor the scheme would cause a perceptible deterioration (or improvement) in existing views
 - Moderate the scheme would cause an obvious deterioration (or improvement) in existing views
 - Major the scheme would cause a dominant deterioration (or improvement) in existing views.
3. Sensitivity was taken into account in the assessment, such that a lesser magnitude of change would be needed to create a large visual effect on a sensitive receptor than on one of lesser sensitivity (see Table 10A.1 below).

Table 10A.1 ~ Criteria for Determining Visual Sensitivity	
Sensitivity	Typical Criteria
High	<p>Residential properties with predominantly open views from windows, garden or curtilage. Views will normally be from ground and first floors and from two or more windows of rooms in use during the day.</p> <p>Users of Public Rights of Way with predominantly open views in sensitive or unspoilt areas.</p> <p>Non-motorised users of minor or unclassified roads in the countryside.</p> <p>Visitors to recognised viewpoints or beauty spots.</p> <p>Users of outdoor recreational facilities with predominantly open views where the purpose of that recreation is enjoyment of the countryside - e.g. Country Parks, National Trust or other access land etc.</p>
Medium	<p>Residential properties with views from windows, garden or curtilage. Views will normally be from first floor windows only, or an oblique view from one ground floor window, or may be partially obscured by garden or other intervening vegetation.</p> <p>Users of Public Rights of Way with restricted views, in less sensitive areas or where there are significant existing intrusive features.</p> <p>Users of outdoor recreational facilities with restricted views or where the purpose of that recreation is incidental to the view.</p> <p>Schools and other institutional buildings, and their outdoor areas.</p> <p>Users of minor or unclassified roads in the countryside, whether motorised or not.</p>
Low	<p>People in their place of work.</p> <p>Users of main roads or passengers in public transport on main routes.</p> <p>Users of outdoor recreational facilities with restricted views and where the purpose of that recreation is incidental to the view.</p>

4. Visual effects were then determined according to the interaction between change and sensitivity (see Table 10A.2 below), where effects can be either beneficial or adverse.

Table 10A.2 ~ Significance Criteria for Visual Effects	
Significance	Typical Criteria
Neutral	No change in the view.
Insignificant	The proposals would not significantly change the view but would still be discernible.
Slight	The proposals would cause limited damage (or improvement) to a view from a receptor of medium sensitivity, but would still be a noticeable element within the view, or greater damage (or improvement) to a view from a receptor of low sensitivity.
Moderate	The proposals would cause some damage (or improvement) to a view from a sensitive receptor, or less damage (or improvement) to a view from a more sensitive receptor, and would be a readily discernible element in the view.
Large	The proposals would cause significant damage (or improvement) to a view from a sensitive receptor, or less damage (or improvement) to a view from a more sensitive receptor, and would be an obvious element in the view.
Very Large	The proposals would cause a high degree of change in a view from a highly sensitive receptor, and would constitute a dominant element in the view.

5. Landscape change was categorised as follows, where each level (other than neutral) can be either beneficial or adverse:

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- No change no loss or alteration of key landscape characteristics, features or elements
 - Negligible very minor loss or alteration to one or more key landscape characteristics, features or elements
 - Minor minor loss of or alteration to one or more key landscape characteristics, features or elements
 - Moderate partial loss of or damage to key characteristics, features or elements
 - Major total loss of or severe damage to key characteristics, features or elements

6. Landscape quality was judged using the following definitions:

- Very high quality National Park or Area of Outstanding Natural Beauty standard
- High quality attractive landscape, usually with varied topography or historic features, and few visual detractors
- Medium quality pleasant landscape with few detractors but with no distinctive qualities
- Low quality unattractive or degraded landscape, affected by visual detractors.

7. The concept of landscape value was also considered. The GLVIA considers landscape value as a measure to be assessed in association with landscape character, in order to avoid consideration only of how scenically attractive an area may be, and thus to avoid undervaluing areas of strong character but little scenic beauty. It is defined in the glossary of the GLVIA as:

‘The relative value or importance attached to a landscape (often as a basis for designation or recognition), which expresses national or local consensus, because of its quality, special qualities including perceptual aspects such as scenic beauty, tranquillity or wildness, cultural associations or other conservation issues.’

8. Landscape sensitivity relates to the ability of the landscape to accommodate change of the type and scale proposed without adverse effects on its character. This is defined in the glossary of the GLVIA as:

‘The extent to which a landscape can accept change of a particular type and scale without unacceptable adverse effects on its character.’

9. It is noted in the GLVIA that this varies with:

- (i) *existing land use;*
- (ii) *the pattern and scale of the landscape;*
- (iii) *visual enclosure/openness of views, and distribution of visual receptors;*
- (iv) *the scope for mitigation, which would be in character with the existing landscape; and*
- (v) *the value placed on the landscape.*

10. A landscape of high sensitivity will be one with a low ability to accommodate change, and vice versa. Landscape sensitivity was judged according to the criteria set out in Table 10A.3 below, taking into account factors such as the presence or absence of designations for quality and the nature of the proposed change.

Table 10A.3 ~ Criteria for Determining Landscape Sensitivity	
Sensitivity	Typical Criteria
Very High	<p>A landscape with a very low ability to accommodate change because such change would lead to a significant loss of valuable features or elements, resulting in a significant loss of character and quality.</p> <p>Development of the type proposed would be discordant and prominent.</p> <p>Will normally occur in a landscape of very high or high quality or value.</p>
High	<p>A landscape with limited ability to accommodate change because such change would lead to some loss of valuable features or elements, resulting in a significant loss of character and quality.</p> <p>Development of the type proposed would be discordant and visible.</p> <p>Will normally occur in a landscape of high quality or value.</p>
Medium	<p>A landscape with reasonable ability to accommodate change. Change would lead to a limited loss of some features or elements, resulting in some loss of character and quality.</p> <p>Development of the type proposed would be visible but would not be especially discordant.</p> <p>Will normally occur in a landscape of medium quality or value, a low quality/value landscape which is particularly sensitive to the type of change proposed, or a high quality/value landscape which is well suited to accommodate change of the type proposed.</p>
Low	<p>A landscape with good ability to accommodate change. Change would not lead to a significant loss of features or elements, and there would be no significant loss of character or quality.</p> <p>Development of the type proposed would not be readily be visible or would not be discordant.</p> <p>Will normally occur in a landscape of low quality or value.</p>

11. Landscape effects were then determined according to the interaction between change and sensitivity, as summarised in Table 10A.4 below, where effects can be either beneficial or adverse, though the examples given are for adverse effects.

Table 10A.4 ~ Significance Criteria for Landscape Effects

Significance	Typical Criteria
Neutral	<p>The proposals:</p> <ul style="list-style-type: none"> • complement the scale, landform and pattern of the landscape. • incorporate measures for mitigation to ensure that the scheme will blend in well with the surrounding landscape • avoid being visually intrusive and adverse effects on the current level of tranquillity of the landscape • maintain existing landscape character in an area which is not a designated landscape nor vulnerable to change • avoid conflict with policy towards protection of the countryside.
Insignificant	<p>The proposals:</p> <ul style="list-style-type: none"> • generally fit the landform and scale of the landscape • have limited effects on views • can be mitigated to a reasonable extent • avoid effects on designated landscapes • generally avoid conflict with policy towards protection of the countryside.
Slight	<p>The proposals:</p> <ul style="list-style-type: none"> • do not quite fit the landform and scale of the landscape • will impact on certain views into and across the area • cannot be completely mitigated for because of the nature of the proposal or the character of the landscape • affect an area of recognised landscape quality • conflict with local authority policies for protecting the local character of the countryside.
Moderate	<p>The proposals are:</p> <ul style="list-style-type: none"> • out of scale or at odds with the landscape • are visually intrusive and will adversely impact on the landscape • not possible to fully mitigate • will have an adverse impact on a landscape of recognised quality or on vulnerable and important characteristic features or elements • in conflict with policies to protect open land and nationally recognised countryside.
Large	<p>The proposals are damaging to the landscape in that they:</p> <ul style="list-style-type: none"> • are at variance with the landform, scale and pattern of the landscape • are visually intrusive and would disrupt important views • are likely to degrade or diminish the integrity of a range of characteristic features and elements and their setting • will be damaging to a high quality or highly vulnerable landscape • cannot be adequately mitigated • are in conflict with government policy for the protection of nationally recognised countryside.
Very Large	<p>The proposals are very damaging to the landscape in that they:</p> <ul style="list-style-type: none"> • are at considerable variance with the landform, scale and pattern of the landscape • are visually intrusive and would disrupt fine and valued views • are likely to degrade, diminish or even destroy the integrity of a range of characteristic features and elements and their setting • will be substantially damaging to a high quality or highly vulnerable landscape • cannot be adequately mitigated • are in serious conflict with government policy for the protection of nationally recognised countryside.

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12. Photographs were taken with a digital camera with a lens that approximates to 50mm. This is similar to a normal human field of view, though this field of view is extended where a number of separate images are joined together as a panorama.
 13. A useful concept in considering the potential visual effects of a development is that of the visual envelope (or zone of visual influence, ZVI). This is the area from within which the development would be visible. Any visual effects must therefore be contained within this area, and land falling outside it need not be considered in terms of visual effects. The area from within which the various elements of the scheme (including traffic using it) would be visible has therefore been estimated, but it is possible that in practice some limited views of those elements may be obtained from more distant properties or from elevated, distant vantage points, above or through intervening vegetation.
 14. Landscape and visual effects were assessed at two future points, in accordance with IAN 135/10:
 - Winter Year 1, which represents a worst case situation, when all of the works are complete and the scheme is open to traffic, but where the proposed planting has little or no effects in terms of screening and mitigation.
 - Summer Year 15, to make allowance for the proposed planting to have begun to take effect (though the planting, especially of trees, would continue to grow and become more effective after 15 years) and to allow for the (mainly deciduous) vegetation to be in full leaf.
 15. For the purposes of the assessment the assumption has been made that the proposed planting would have grown to a height of around 6 to 8m by year 15. This represents a reasonably conservative assumption about growth rates, based on experience of highway planting in a variety of locations, and assuming that the planting consists primarily of transplants planted at initial heights of 40-60cm (smaller plants such as these tend to establish more quickly and can overtake planting carried out at larger initial sizes).

11 Community and Private Assets

11.1 Introduction, Methodology and Study Area

11.1.1 The current DMRB guidance is that effects should be grouped under the above heading, but the extant topic guidance is still under the separate headings (dating from 1993) of 'Land Use' and 'Pedestrians, Cyclists, Equestrians and Community Effects'. IAN 125/09 states that assessments should be reported under the new heading but that the assessment should be based on relevant extracts from the existing topic guidance.

Methodology

11.1.2 This chapter therefore covers the following topic areas, and uses the methodologies set out in the existing DMRB guidance, as appropriate:

- Demolition of private property.
- Effects on agricultural land - this includes land take from productive agricultural land, with an assessment of the quality of the land taken, and also any effects on the operation of farm businesses. The DMRB advises that, where significant areas of best and most versatile land (i.e. land for which the Agricultural Land Classification (ALC) is Grade 1, 2 or 3a) are likely to be affected, a detailed survey of agricultural land quality may be required. Published ALC maps are quite general and not always accurate for scheme specific assessments, and a specialist assessment of local agricultural land quality has therefore been undertaken, to determine the ALC grade of all of the land which may be affected by the scheme. This is appropriate because the scheme seems likely to lead to the loss of significant areas of Grade 2 or Grade 3 land, and also because the Grade 3 land may (at least in part) actually comprise Grade 3b land, which is not considered as best and most versatile, and the detailed assessment is required to allocate the Grade 3 land to either Subgrade 3a or 3b. The detailed methodology for the assessment of agricultural land quality is set out in the Agricultural Land Assessment report (see Technical Appendix 11.1 in Volume 2).
- Effects on development land - the DMRB states that this should include an assessment of the effects of the scheme on any land which is allocated or permitted for development.
- Direct effects on community facilities - this would include any land take from built community facilities or from land used by the community, whether formally (in the form of Public Open Space or other facilities) or informally. Where there is land take from areas such as common land, village greens or Public Open Space there may be a requirement for the provision of Exchange Land, as replacement for any land to be taken by the scheme (see section 2.4).

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- Indirect effects on community facilities - this is principally in terms of access to facilities, and in particular whether the new road would hinder such access to the extent that people could be severed from their community facilities. 'Community severance' is defined in the DMRB (Volume 11 section 3, Part 8, paragraph 5.2) as:

'the separation of residents from facilities and services they use within their community caused by new or improved roads'.

The DMRB also notes (in paragraph 5.4 of the above section) that:

'aged people, the disabled and children are particularly vulnerable to disruption of their travel patterns.'

- Indirect effects on community facilities are also possible in terms of air quality and noise; these aspects are considered in chapters 12 and 13.

The Study Area

- 11.1.3 The nominal study area for this topic was a corridor 500m to either side of each route, together with any land beyond that corridor which is within the same ownership, and also any community facilities beyond that distance which may be affected by the scheme.

11.2 Baseline Conditions

Land Use

- 11.2.1 As described above in section 10.2, the land use along the routes is markedly different to the south and north of Parkside Drive. To the south it is urban fringe land with no defined or formal use, with a cover of rough grass, developing scrub or scrubby woodland. It is traversed by two overhead electricity transmission lines, which have affected its use in terms of preventing built development beneath the lines and also necessitating the periodic pruning of trees alongside or beneath the lines, to leave some of them in a poor and unattractive state. Much of this area is designated as a proposed open space in the South Bedfordshire Local Plan Review.
- 11.2.2 Around the open, urban fringe land there are established residential areas to the north (along Sandringham Drive) and south (along Wheatfield Road), together with a recently constructed area of housing around Holyrood Drive, between Sandringham Drive and the Houghton Brook. Just to the south of the line of the routes there is a small electricity substation, close to the north end of Thresher Close. There are also four overhead electricity transmission lines in the area traversed by the routes, as described in section 10.2 above. One line runs from the substation noted above northwards to the village of Chalton.

11.2.3 To the north of Parkside Drive the dominant land use is arable farming, with a few uncultivated strips along the urban edge of Houghton Regis or alongside the watercourses and along field margins.

11.2.4 The Agricultural Land Assessment report notes that all of the agricultural land within the study area is part of a single agricultural holding known as Chalton Cross Farm, which comprises approximately 234 ha (578 acres) of agricultural land. The agricultural land at Chalton Cross Farm is mainly in arable production and used predominantly for growing cereal crops, with rotations of wheat, barley, oil seed rape and field beans. Chalton Cross Farm is let on an agricultural tenancy to a contract farm business, Sentry Farms Ltd, whose registered address is Chalton Cross Farm, Houghton Road, Luton, Beds. LU4 9TX. The Chalton Cross Farm holding forms part of a larger agricultural business extending to approximately 1,446 ha (3,573 acres), most of which is within an 13km radius of Chalton Cross Farm.

Community Assets

11.2.5 'Community Assets' is the term used in the current version of the DMRB guidance, and covers formal or built community facilities and also land which may be used in an informal manner by local people. Community Assets in the area around the scheme therefore include:

- Schools - there are three junior schools and a middle school in the eastern part of Houghton Regis, to the north of the scheme, and four primary or junior schools in the area of Luton to the south, as shown in Figure 11.2. None of the schools adjoins the line of the scheme, and the closest are Southfields Infants and Junior School and also Chantry Primary School, which are around 400m to the south of the routes.
- Doctors and dentists - Figure 11.2 shows that there is one doctors' surgery close to the line of the scheme, on Wheatfield Road, and also one dental surgery just to the south, in the Lewsey Farm local centre.
- Shops and libraries - there is a wide range of facilities, including shops (a newsagent, convenience store, two takeaway food outlets and a number of other local shops), a post office, a library, a community centre and a church in the Lewsey Farm local centre, around 300m to the south of the scheme.
- Public Open Space - there is a variety of formal open space provision in the area around the scheme, including:
 - Houghton Hall Park to the west of the scheme.
 - The playing fields on the eastern side of Windsor Drive to the north.
 - The area of amenity grassland close to the library, on the south side of Wheatfield Road.

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- Small areas of amenity grassland within the housing areas to the north and south of the scheme, including that to the south of Parkside Drive, between it and the Houghton Brook.
 - An area of amenity grassland around the tall radio mast on the south side of Kestrel Way to the south east.
 - Formal parks and play areas further away from the scheme, including that to the north of the scheme, in the Parkside area of Houghton Regis.
- The area of urban fringe land to the south of Houghton Brook, through which the route options run, should also be regarded as a community asset as parts of it are used for informal recreation, and it provides a green corridor extending out into the countryside. However, it is also unmanaged, untidy in parts and presently subject to a range of abuse including flytipping and dumping of garden waste (see photograph 37). This land is the subject of an Open Space Proposal (Policy R3) under the South Bedfordshire Local Plan Review (see sections 2.4 and 10.2 above). The Policy proposes to improve the area for a mix of formal and informal recreation, and the assessment therefore considers effects on the existing use and also the potential use of this land in the light of the Local Plan policy.
 - There is no land formally designated as common land, Public Open Space or a village green directly along the lines of the routes, and there would therefore be no land take in these categories.

11.2.6 No detailed assessment of catchment areas or journeys in respect of the above facilities has been undertaken at this stage, as the purpose of the Stage 2 assessment is principally to determine differences between route options, and in this case all of the options are essentially the same in the area to the south of Parkside Drive, where any community effects would be most likely. However, in order to gain an initial appreciation of potential effects in this respect, two simple counts were undertaken at the point shown on Figure 11.2, in the morning on 7 October and again on 3 November 2010. This location is at the southern end of a surfaced footpath running across the line of the routes from north to south, linking the Parkside area of Houghton Regis with Wheatfield Road. The counts were undertaken to give some idea of the nature and number of pedestrian and cyclist movements across the line of the routes and therefore the potential for severance effects.

11.2.7 The results of the counts are shown in Table 11.1 below:

Table 11.1 ~ Pedestrian Counts			
8.10am to 9.10am, 7 October 2010			
Category of User	Northbound	Southbound	Total Movements
Adults	8 3(D) 1(C)	16 1(D) 1(C)	24 4(D) 2(C)
Accompanied children (age 4 to18)	0	9	9
Accompanied children (under 4)	1	3	4
Unaccompanied children	2	9 5(C)	11 5(C)
TOTAL	15	44	59
8.10am to 9.10am, 3 November 2010			
Category of User	Northbound	Southbound	Total Movements
Adults	9 1(D)	13	22 1(D)
Accompanied children (age 4 to18)	0	7	7
Accompanied children (under 4)	0	4	4
Unaccompanied children	5	4 3(C)	9 3(C)
TOTAL	15	31	46

(C) = cyclist
(D) = dog walker

11.2.8 It can therefore be seen that there is significant use of this route by pedestrians and cyclists, and that on each occasion there are more southbound journeys than northbound. This is likely to reflect a net movement south to schools in Luton, and a check in the afternoon will be made at Stage 3 to see if there is a net northbound movement in the afternoon. The detailed design of the scheme at Stage 3 will need to make appropriate provision for these movements, and the Stage 2 design does allow for an at grade crossing along the line of this route.

Development Land

11.2.9 There is no land along the line of the scheme which is currently allocated for development, though as noted above a broad area to the north and east of Houghton Regis has been designated as a preferred option for growth in the emerging LDF.

11.2.10 There is also the new housing development along the north side of Kestrel Way - this has been included in the assessment as a potential receptor of effects from the new road, even though at the time of writing the new houses were not occupied.

11.3 Project Proposals, Including Mitigation Measures

11.3.1 The lines of the route options have been chosen to follow largely undeveloped or open land, and therefore involve no demolition of residential properties or community facilities.

11.3.2 The proposals also include a range of measures designed to reduce the potential for community severance - these include:

- Crossings - the route options provide for crossings as follow:
 - For the Blue Route at grade crossings would be provided at Chainage 240, at the south end of Windsor Drive, at Chainage 700, on the line of the existing footpath noted above for the pedestrian counts and at the roundabout near Chainage 2350. Depending on the detailed design and the available headroom, it may also be possible for the underbridge required for the Houghton Brook at Chainage 1100 to provide for pedestrians and cyclists, enabling them to cross beneath the carriageway.
 - For the Green Route the same crossing points would be provided, with the additional provision of at grade crossings around the roundabout at Chainage 1200 to 1250.
 - For the Orange Route there would be at grade crossings at Chainage 240 and Chainage 700, and also at the roundabout near Chainage 2100, in a similar manner to the Blue Route. There would also be an additional at grade crossing at Chainage 1020, to cater for movements along Parkside Drive.
- Public rights of way - existing public rights of way would be retained wherever possible and diverted where necessary, as shown on Figures 2.1 to 2.6. See chapter 14 for further details in respect of public rights of way.
- The presence of the scheme itself would assist in improving access to the Woodside area and also to Houghton Regis in general.

11.3.3 The scheme has also been developed in order to avoid as far as possible any effects on the overhead electricity transmission lines or the existing electricity substation. A site meeting was held on 26 April 2010 with EDF Energy to identify cable clearance restrictions from their two overhead power lines (132kV and 33kV). Three locations were identified where overhead line clearances may have prevented the scheme from passing beneath the lines without diversionary works being required. EDF subsequently undertook a line survey which confirmed that safe clearance margins could be achieved.

11.3.4 However, one diversion would be required in terms of the relocation of one of the 132kV pylons located around 150m north of the new roundabout at Poynters Road. The horizontal alignment of each of the routes has been designed to minimise their impact on the existing overhead power lines present between Sandringham Drive and Wheatfield Road. At this point, the requirement to keep both Sandringham Drive and Wheatfield Road in operation whilst providing a new link through an already narrow corridor means that conflict with this pylon would be unavoidable, and it will need to be relocated. This diversion would be necessary for all three route options.

- 11.3.5 National Grid has provided Amey with swing profile curves for their 400kV overhead line. A review of these profiles against the proposed alignment options confirmed that no diversions of National Grid plant would be necessary.
- 11.3.6 It is understood that one of the north-south overhead electricity transmission lines may be undergrounded as part of the wider development proposals for the area to the east of Houghton Regis. However, this Stage 2 assessment has been undertaken on the basis that the wider development is not in place, so the overhead power lines have been assumed for the purposes of the assessment to all still be in place.
- 11.3.7 The main concentrations of underground services are in the existing road at the Poynters Road and Park Road North roundabouts and along Wheatfield Road and Sandringham Drive. There is also an existing water main and telephone and electricity cables routed adjacent to the Pastures Way/Parkside Drive bus corridor. At this stage no significant diversions of these services would be envisaged as a result of any of the proposed route options. If any diversions were to be required, these would be agreed in detail with the relevant statutory undertakers, and there would therefore be no effects in terms of harm to these private assets.
- 11.3.8 The proposals allow for the provision of Exchange Land, as a replacement for the loss of the informal open space to the south of the Houghton Brook (see section 2.4 and also chapter 10).

11.4 Assessment of Effects

Land Use

- 11.4.1 The effects of the route options in terms of agricultural land take are shown in Table 11.2 below (see Technical Appendix 11.1 in Volume 2 for details).

Table 11.2 ~ Land take by ALC Grade			
ALC Grade	Blue Route (approx. ha)	Green Route (approx. ha)	Orange Route (approx. ha)
Grade 1	0	0	0
Grade 2	2.08	2.86	3.13
Subgrade 3a	3.40	1.91	1.03
Subtotal of BMV land	5.48	4.77	4.16
Subgrade 3b	0	0	0
Grade 4	0	0	0
Grade 5	0	0	0
Other land/ non-agricultural (including farm buildings, tracks, woodland, amenity grassland, etc)	2.45	2.58	2.29
TOTAL (approx.)	7.93	7.35	6.45

Notes:

1. Above areas are for basic engineering alignments only and do not include land required for drainage or landscape purposes, or for Exchange Land.

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- 11.4.2 It can be seen from the above that all of the proposed route options would involve the loss of some 'best and most versatile' (BMV) agricultural land; in this case a combination of Grade 2 (very good quality) and Subgrade 3a (good quality) land. All of the options also include a proportion of 'other land/non-agricultural land', consisting of the farm buildings at Chalton Cross Farm in the north of the study area, and the rough grassland/amenity land in the south western part.
- 11.4.3 The alignment options were found to vary in the proportion of Grade 2 and Subgrade 3a agricultural land that would be directly lost; the Orange Route would affect the largest area of Grade 2 land, but the smallest overall area of best and most versatile land, while the Blue Route would affect the smallest area of Grade 2 land, but the largest overall area of best and most versatile land.
- 11.4.4 The Blue Route would also involve the greatest total landtake, with the Orange Route requiring the smallest overall area of land. It should be noted that the northern part of the farm holding would already have been affected by landtake for the new Junction 11A.
- 11.4.5 In terms of effects on the operation of the farm, all three options would result in the loss of some of the farm buildings, which are necessary for the storage of harvested grain and large agricultural machinery. All the options would also lead to some severance of agricultural land from the remainder of the holding, though this could be minimised by provision of revised access to the severed fields. The Blue Route would have the greatest effects in terms of severance, as it runs through the two large fields adjacent to the motorway, and the Orange Route would have the least effects, as it would leave these fields intact.
- 11.4.6 While the above assessment has been of the effects of the scheme relative to the baseline situation, it should be noted that the entire farm would cease to operate if the wider development to the east and north of Houghton Regis goes ahead, so in that event there would be no effects as a result of the scheme.

Community Assets

- 11.4.7 As there would be some land take from the area to the south of Houghton Brook which is currently used for informal recreation, an equal area of land would be provided as Exchange Land to the north of Parkside Drive (see Figures 10.7 to 10.12). The areas indicated are illustrative only at the moment, and a detailed calculation of the area required would be made as part of the Stage 3 assessment.
- 11.4.8 However, there would still be some effects on the existing area of informal open space in terms of severance, though any increased difficulty of access across the line of the road would be balanced by better general provision for access, with surfaced paths and safe crossing points, and also by the proposed improvements to the planting and management of the area to the south of Parkside Drive, as set out in chapter 10.
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11.4.9 Given the provision of at grade crossings, most existing movements to and from Community Assets across the line of the route would be catered for, but there would still be some hindrance to movement in terms of having to cross the road and potentially (depending on the type of crossing used) having to wait for a signal in order to do so. In accordance with the DMRB methodology (Volume 11 Part 3 Section 8) such effects would be **slight adverse**.

Development Land

11.4.10 No land which is allocated for development would be lost to the scheme. There would be some land take from the area to the north of Parkside Drive which is proposed for large scale development, but the scheme would in fact facilitate that development by providing access to it, so there would be no adverse effects.

11.5 Summary

11.5.1 Land use along the line of the scheme differs to the south and north of Parkside Drive. To the south it is urban fringe open space with no formal usage, and to the north it is open arable farmland, managed as part of the Chalton Cross Farm holding.

11.5.2 There are a number of community assets, including schools, within the urban areas to either side of the scheme, but none which would be directly affected by the scheme other than the area of informal open space to the south of Houghton Brook. A pedestrian count for one route across this open space has shown significant movement of pedestrians and cyclists in the morning peak.

11.5.3 The proposals make provision for at grade crossings to continue existing routes on their current alignments wherever possible, though some minor diversions of public rights of way may be required. The proposals have been designed to minimise conflicts with existing underground services or overhead power lines, though again some minor diversions are likely to be required.

11.5.4 All of the proposed route options would involve the loss of some best and most versatile agricultural land; the Orange Route would affect the largest area of Grade 2 land, but the smallest overall area of best and most versatile land, while the Blue Route would affect the smallest area of Grade 2 land, but the largest overall area of best and most versatile land. The Blue Route would also involve the greatest total landtake, with the Orange Route requiring the smallest overall area of land. All three route options would involve the loss of some farm buildings, and the Blue Route would have the greatest effects in terms of severing the remaining farmland. In the context of effects on the farm, it should be noted that all of its land would be taken, and the farm would cease to operate, if the wider development to the east and north of Houghton Regis proceeds.

11.5.5 Effects on the area of informal open space to the south of Houghton Brook would be mitigated by the provision of an area of Exchange Land, but there would still be slight adverse effects overall on this community asset.

12 Air Quality

12.1 Introduction, Methodology, and Study Area

Introduction

12.1.1 Emissions from traffic on the proposed road and changes to traffic flows and/or speeds on affected roads can potentially have a significant impact on air quality. Air quality is of concern as pollutants can build to levels where they are harmful to human health and ecosystems.

12.1.2 The air quality assessment will assess the changes in emissions and the resultant changes in pollutant concentrations using the methodology as set out in the DMRB, Volume 11 Section 3 Part 1(HA207/07).

Methodology

12.1.3 The local air quality assessment following the HA207/07 methodology involves identifying properties and designated sites within 200m of roads affected by the project. Affected roads are defined as those for which:

- Road alignment will change by 5m or more.
- Daily traffic flows will change by 1,000 annual average daily traffic (AADT) or more.
- Heavy duty vehicle flows will change by 200 AADT or more.
- Daily average speed will change by 10km/h or more.
- Peak hour speed will change by 20km/h or more.

12.1.4 HA207/07 requires either a Simple or Detailed assessment of air quality effects following the Scoping assessment. The Scoping assessment (see section 4.2 of this EAR) identified that a Simple assessment should enable an understanding to be reached as to the effect of the project, and whether the likely effect is significant enough to require a further Detailed assessment. A Simple assessment is considered sufficient if it confidently establishes that the environmental effects would not be a fundamental issue in the decision making process. In contrast, a Detailed assessment is conducted where the scheme has the potential to cause significant effects, or where the scheme cannot be assessed using Simple methods.

12.1.5 Screening calculations have indicated that, despite increases in emissions along the route, exceedances of air quality objectives are not forecast and therefore the Simple assessment will be sufficient for Stage 2. If the Simple assessment does not confidently establish that the environmental effects would not be a fundamental issue in the decision making process then there would be an automatic requirement to proceed to the Detailed assessment for Stage 3.

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- 12.1.6 The steps that have been undertaken for this Stage 2 air quality assessment, as identified by HA207/07 for a Simple assessment, are as follow:
1. Update the number of properties in the required distance bands, taking account of any recently constructed properties.
 2. Use the DMRB 'Local' Screening Method to calculate pollutant concentrations at a wide range of properties that are likely to be affected by the proposals, including those adjacent to the route as well as those along affected roads.
 3. Compare the base year model results with any available measured concentrations and adjust results as necessary.
 4. If any air quality objectives are predicted to be exceeded, proceed to a Detailed assessment.
 5. Consider emissions during the construction phase and likely mitigation requirements.
 6. Prepare an air quality report setting out the results of the above, in accordance with the DMRB.

12.1.7 It is important to note that not all the affected roads have been identified, as speed data is not included in the traffic model produced at Stage 2. The traffic model also does not cover the roads in the Dunstable Air Quality Management Area (AQMA), so the full extent of affected roads is not known at this stage. As a result of this an expanded traffic model will be used to identify affected roads to be assessed at Stage 3.

Study Area

- 12.1.8 The study area for this topic was a zone 200m to either side of the centre line of the proposed route options, and also any affected roads known at this stage. The proposed scheme is almost entirely within the authority of Central Bedford Council (CBC) though a small area of it is within the authority of Luton Borough Council (LBC).
- 12.1.9 Based on the AADT the affected roads are identified as Park Road North, Sundon Road, Porz Avenue and the M1. This identification is based on AADT only, and identification of further affected roads may occur once speed data is available for the Do-Minimum and Do-Something scenarios.
- 12.1.10 The assessment of affected roads will take place at Stage 3 once an expanded traffic study area with speed data and details of congestion is available.

12.2 Regulatory and Policy Framework

12.2.1 **EU Air Quality Directive (Directive 2008/50/EC).** This came into force in June 2008, and was transposed into legislation in the UK on 19 July 2010. The directive consolidates existing air quality legislation (apart from the 4th Daughter Directive) and provides a new regulatory framework for PM_{2.5}. It also makes provision for Member States to postpone attainment deadlines. The obligation to meet the requirements of the directive falls primarily upon the Secretary of State for the Environment in England, and appropriate Ministers in the Devolved Administrations, who are designated as the appropriate 'competent authority'.

12.2.2 **National Air Quality Strategy for England, Scotland, Wales and Northern Ireland.** The first National Air Quality Strategy was published in 1997. The Strategy was last updated in 2010 and continues to provide the framework for local government to assess ambient air quality in their locality against specific health-based standards for nine pollutants (NO₂, PM₁₀, sulphur dioxide, benzene, lead, 1,3-butadiene, carbon monoxide, PAH and ozone). Seven of these (excluding ozone and PAH) are regulated through the Air Quality Regulations 1997 (HM Government 1998), 2000 (HM Government 2000), Air Quality (England) (Amendment) Regulations 2002 (HM Government 2002) and 2007 (OPSI 2007). The National Objectives are shown in Table 12.1 below.

Pollutant	Time Period	Objective	To be achieved by
Benzene	Annual mean	5 µgm ⁻³	2010
1,3 – Butadiene	Running annual mean	2.25 µgm ⁻³	2003
Carbon Monoxide	Maximum daily running 8-hour mean	10 µgm ⁻³	2003
Lead	Annual Mean	0.25 µgm ⁻³	2008
Nitrogen Dioxide	1- hour mean	200 µgm ⁻³ not to be exceeded more than 18 times a year	2005
	Annual mean	40 µgm ⁻³	2005
Sulphur dioxide	1- hour	350 µgm ⁻³ not to be exceeded more than 24 times a year.	2004
	24-hour mean	125 µgm ⁻³ not to be exceeded more than 3 times a year	2004
	15-minute mean	266 µgm ⁻³ not to be exceeded more than 3 times a year	2005
PM ₁₀	24-hour mean	50 µgm ⁻³ not to be exceeded more than 3 times a year	2005
	Annual mean	40 µgm ⁻³	2004
PM _{2.5}	Annual mean	25 µgm ⁻³ (target)	2020
	Annual mean	15% cut in urban background exposure	2010 - 2020

Notes:

1. Pollutants of concern highlighted in yellow.

12.2.3 The **National Planning Policy Framework (NPPF, 2012)** came into force in March 2012, and states that:

'Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.'

12.2.4 **DMRB HA207/07.** The DMRB guidance HA207/07 states that an air quality assessment should be undertaken if a proposed scheme meets screening criteria. Where the DMRB screening model assessment indicates that exceedances of the objectives are likely, a more detailed study may then be required. This may include the use of more complex dispersion models, and/or the use of local monitoring. However, where a good agreement between the DMRB model results and monitoring (at relevant locations) is demonstrated, then the results of the DMRB model should, in many instances, be sufficient to determine the area of exceedance of the objective. In circumstances where complex road layouts, such as large junctions or complex street canyons are being assessed, then more detailed modelling is recommended.

12.2.5 **Local Air Quality Management: Technical Guidance 09 (LAQM.TG09).** This is designed to support local authorities in carrying out their duties under the Environment Act 1995. These duties require local authorities to review and assess air quality in their area. These reviews and assessments form the cornerstone of the system of Local Air Quality Management (LAQM). LAQM itself forms a key part in the UK Government's strategies to achieve the air quality objectives and gives extensive guidance on monitoring, modelling and reporting air pollution.

12.2.6 **Development Control: Planning for Air Quality EPUK 2010.** This guidance defines a number of criteria that can trigger the requirement for an air quality assessment:

- Proposals that will generate or increase traffic congestion, where 'congestion' manifests itself as an increase in periods with stop/start driving.
- Proposals that will give rise to a significant change in either traffic volumes, typically a change in AADT or peak traffic flows of greater than $\pm 5\%$ or $\pm 10\%$, depending on local circumstances (a change of $\pm 5\%$ will be appropriate for traffic flows within an AQMA), or in vehicle speed (typically of more than ± 10 kph), or both, usually on a road with more than 10,000 AADT (5,000 if '*narrow and congested*'). Professional judgement will be required when deciding whether an air quality assessment is necessary, as it is not possible to apply an exact and precise set of criteria to cover all development proposals. It will be important to take into

account current air quality conditions and the location of relevant exposure, as well as the potential impacts when requesting an air quality assessment.

12.2.7 **Dunstable Air Quality Action Plan.** The Dunstable Air Quality Action Plan (AQAP) is currently being developed by CBC in order to identify options to work towards reducing concentrations of NO₂ to meet the Government's objective level (see <http://www.centralbedfordshire.gov.uk/environment/pollution/pollution-air-quality.aspx>).

12.2.8 **Local Transport Plan for Central Bedfordshire (LTP3).** This plan was published in 2011 and will run until 2026. The LTP provides the strategic framework within which the environmental impacts of transport can be tackled. Of greatest potential is reducing the demand for travel, and to encourage the use of non-car modes of transport through investment in infrastructure and promoting these travel choices.

12.2.9 **Local Transport Plan for Luton (LTP3).** This plan also runs from 2011 to 2016, and has a number of Air Quality Strategy Tools:

- a) With relevant partners, review existing air quality monitoring data and agree an appropriate extended monitoring regime to establish baseline air pollution levels.
- b) Set up an enhanced monitoring and reporting regime to determine progress against the baseline levels.
- c) Use the monitoring data to inform the development of future transport schemes and initiatives and monitor their performance in air quality terms.
- d) Use the monitoring data in conjunction with planning powers to properly assess proposed housing developments in infill areas adjacent to large sources of air pollution (such as the M1), to eliminate the potential requirement for declaration of further AQMAs.
- e) Use the monitoring data to support the AQAP to influence decisions made by the HA, with the aim of removing the AQMA centred on M1 Junction 11.

Consultation

12.2.10 Consultation with Environmental Health Officers (EHOs) from CBC has advanced the requirement for NO₂ diffusion tube monitoring conforming to TG09 (see section 12.2.5 above), with preferably at least 6 months of monitoring data. This will be undertaken as part of the Stage 3 assessment.

12.3 Baseline Conditions

12.3.1 The proposed scheme may potentially have local air quality impacts in both the CBC and LBC areas. Both these local authorities identify nitrogen dioxide (NO₂) and particulate

matter less than 10 microns (PM₁₀) as the pollutants of concern in the Updating and Screening Assessment (USA) and Progress Reports for Local Air Quality Management (LAQM) for their areas. Local authority monitoring data shows ongoing exceedances of the NO₂ annual mean objective of 40µgm⁻³ (microgrammes per cubic metre) at a number of diffusion tube sites in the Central Bedfordshire area. Sites at Dunstable and Chalton are calculated to exceed the NO₂ annual mean objective at residential receptors. Central Dunstable has been declared an AQMA for NO₂.

- 12.3.2 The Dunstable AQMA incorporates Dunstable Town Centre, the A505 (from the town centre to the junction of Poynters Road/Dunstable Road), the A5 (from Union Street to Borough Road), and the B489 West Street from the town centre to St Mary's Gate.
- 12.3.3 NO₂ is the main pollutant of concern and it continues to exceed the annual mean air quality objective in Dunstable. An AQAP for the Dunstable AQMA has been produced, in compliance with the Environment Act 1990, and PG03 (Policy Guidance 03, produced by Defra to help local authorities with their local air quality management duties under Part IV of the Environment Act 1995).
- 12.3.4 Following exceedances at NO₂ diffusion tube site SB41 (Chalton Cross Lodge), and a Detailed Assessment for Chalton Cross (west of the proposed bypass near to the M1), an AQMA has been recommended to be declared around Chalton Cross Cottages and Long Meadow Farm. The NO₂ annual mean monitored in 2010 was 46.58µgm⁻³ at a site representing a residential receptor (SB41 Chalton Cross Lodge). The M1 Junction 11A scheme and the proposed scheme for Luton Northern Bypass are both within the area of exceedance of the annual mean NO₂ objective but the relevant residential receptors at Chalton Cross Cottages will be removed as they are within the footprint of both these schemes. The residential receptor at Long Meadow Farm is not within the footprint of these schemes and the changes in concentrations of air pollutants will be assessed as part of the Luton Northern Bypass scheme. Long Meadow Farm is further than 200m from the footprint of the Woodside Connection scheme and any identified affected roads, and is not therefore considered further as part of the Stage 2 air quality assessment.
- 12.3.5 The proposed scheme runs partly within the area of LBC at the roundabout junction with Poynters Road. LBC has two AQMAs, declared for annual mean NO₂, both located towards the northwest of Luton, adjacent to the M1 motorway. Luton AQMA No.1 comprises 24 dwellings in the vicinity of the M1 motorway. Luton AQMA No.2 covers an area encompassing 431 premises in the vicinity of the M1 motorway either side of Junction 11. The closest diffusion tube to the scheme in LBC is tube M14 at Copperfield which had an annual mean NO₂ of 34.42µgm⁻³ in 2010. No AQMA is located within 200m of the scheme.

12.3.6 Background levels of the pollutants of concern NO₂ and PM₁₀ required for assessment are shown in Table 12.2 with the grid squares from which the concentrations were sourced shown in Figure 12.1. The background pollution concentrations were obtained from the 1km x 1km grids available on the Defra LAQM website (see <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>).

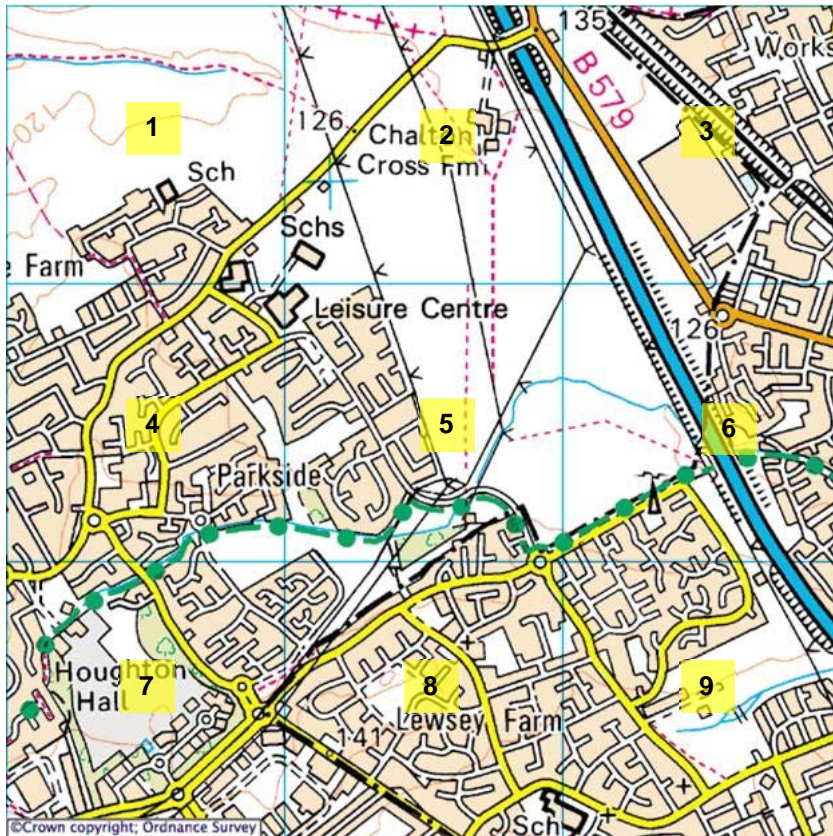


Figure 12.1 Location of 1x1km grid squares used for background air quality data.

Table 12.2 ~ Background Air Quality Data from 1x1km Grid Estimates Produced by Defra							
Grid Square	Grid Square reference	2010 background pollutant concentrations (µgm ⁻³)			2016 background pollutant concentrations (µgm ⁻³)		
		NO ₂	NO _x	PM ₁₀	NO ₂	NO _x	PM ₁₀
1	502500, 225500	14.56	22.18	16.86	9.31	13.14	16.50
2	503500, 225500	21.84	35.68	19.64	13.00	18.90	18.92
3	504500, 225500	25.54	45.97	19.90	16.45	21.25	18.64
4	502500, 224500	16.78	26.19	15.94	11.22	16.15	15.54
5	503500, 224500	17.31	27.14	16.50	11.38	16.37	16.04
6	504500, 224500	28.46	49.74	20.46	17.21	25.94	19.18
7	502500, 223500	21.30	35.28	17.22	13.81	20.42	16.16
8	503500, 223500	19.60	31.56	16.46	12.83	18.75	15.76
9	504500, 223500	22.40	36.94	18.05	14.29	21.11	17.30
Average		20.87	34.52	17.89	13.27	19.11	17.16

12.3.7 This background data will be supplemented by the results of the NO₂ diffusion tube survey of both roadside and background sites prior to the Stage 3 assessment (see below).

12.3.8 Levels of nitrogen oxides (NO_x), NO₂ and PM₁₀ have been calculated for the Base Year 2010 using the DMRB Screening Method for Air Quality from HA 207/07 and the Department of Environment and Rural Affairs (Defra) spreadsheet which calculates the nitrogen dioxide concentration from the modelled oxides of nitrogen concentrations (available from <http://www.airquality.co.uk/archive/laqm/tools.php>). Modelled and monitored data (see Table 12.3 below) were compared in order to provide some validation to the DMRB screening results. It is noted that the DMRB model predicts exceedance of the NO₂ Air Quality Objectives which is confirmed by the diffusion tube monitoring data at Chalton Cross Lodge. The M14 diffusion tube site to the west of the M1 in the Copperfield area of Luton is located more than 200m from any of the affected roads and therefore outside the range of the DMRB screening model. In this instance the DMRB screening model and Defra calculator over-predicted the measured concentrations of NO₂.

Table 12.3 ~ DMRB Screening Calculation Predicted Concentrations for 2010						
2010 Base Year	Receptor Name	Year	NO _x	NO ₂	PM ₁₀	
			Annual mean µg/m ³	Annual mean µg/m ³	Annual mean µg/m ³	Days >50µg/m ³
SB41	Chalton Cross Lodge	2010	67.51	81.83	30.67	30.04
1	208 Wheatfield	2010	35.36	21.70	18.17	1.54
2	92 Milton Way	2010	35.35	21.70	18.15	1.52
3	7 St James Close	2010	34.89	21.19	18.02	1.42
4	26 Kensington Close	2010	34.52	20.87	17.56	1.09
5	460 Poynters Road	2010	35.97	22.45	18.24	1.59
6	209 Wheatfield	2010	35.53	21.90	18.12	1.50
7	2 Milton Walk	2010	36.72	23.44	18.50	1.81
8	85 Conway Close	2010	34.52	20.87	17.29	0.91
9	61 Fareham Way	2010	34.52	20.87	17.89	1.00
10	285 Pastures Way	2010	34.52	20.87	17.89	1.00
11	Osbourne House	2010	37.03	23.87	18.56	1.87
12	Chalton Cross Farmhouse	2010	34.52	20.87	17.55	1.09

12.3.9 PM₁₀ is also a pollutant of concern as there is considered no 'safe' level. The EU is proposing a PM_{2.5} exposure reduction target and PM_{2.5} limit value. The Defra Air Quality Strategy for 2010 aims for a target of 15% reductions in concentrations at urban background between 2010 and 2020 and an objective of 25µgm⁻³ to be achieved by 2020. No method for assessing the PM_{2.5} of road schemes has yet been developed.

12.3.10 HA207/07 requires the local air quality assessment to:

'identify any nature conservation sites (Designated Sites) and their characteristics. The Designated Sites that should be considered for this assessment are those for which the designated features are sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by the effect of local air quality on vegetation within the following nature conservation sites: SACs (SCIs or cSACs), SPAs, pSPAs, SSSIs and Ramsar sites. Sites designated for geological purposes need not be assessed. Only properties and Designated Sites within 200m of roads affected by the project need be considered.'

12.3.11 A search was conducted for internationally or nationally designated nature conservation sites within 200m of the proposed scheme using MAGIC. No designated sites were found within 200m of the scheme (see also chapter 9).

Property Counts

12.3.12 The number of properties in 50m bands up to 200m from the centre line of the proposed routes has been estimated, and is very similar for all three routes, as they all pass through a narrow band of land between Houghton Regis and the Lewsey Farm area of Dunstable, as shown in Table 12.4 (see Figures 12.2 to 12.4 for property bands for each route option).

Table 12.4 ~ Property Counts Within Distance Bands of the Proposed Routes			
Distance band from centre line of road	Blue Route	Green Route	Orange Route
0-50m	101	102	108
50-100m	299	304	288
100-150m	400	407	356
150-200m	413	397	484

12.3.13 Affected roads and the effect of diverting traffic from the AQMAs will be identified in the Stage 3 traffic report. The property counts for affected roads will be conducted at Stage 3.

12.4 Value of Environmental Resources and Receptors

12.4.1 Sensitive receptors are defined as locations where members of the public are regularly present and are likely to be exposed over the averaging period of the objective (which varies depending on the pollutant assessed). Typically for long-term AQS objectives (NO₂ and PM₁₀ annual mean), this includes residential properties, schools, hospitals and care homes, where people are likely to be present for long periods. For short-term objectives (such as

the hourly mean for NO₂), this includes high streets and shopping streets. It is generally appropriate to consider the building façade to represent relevant exposure.

- 12.4.2 The residential properties noted above are sensitive receptors and are considered as such in this assessment of potential air quality effects. There are no community sensitive receptors such as schools, hospitals or old people's homes within 200m of the scheme. This may change later in the assessment process upon identification of affected roads.
- 12.4.3 Chronic exposure to PM₁₀ and PM_{2.5} contributes to the risk of developing cardiovascular and respiratory diseases, as well as lung cancer. In the EU, average life expectancy is 8.6 months lower due to exposure to anthropogenic PM_{2.5}. Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long term exposure to NO₂. Reduced lung function growth is also linked to NO₂ at concentrations currently measured in the U.K.
- 12.4.4 The Air Quality Strategy has objectives for protection of vegetation and ecosystems. The NO₂ objective is an annual mean not exceeding 30µg^m⁻³. Above this level there can be damage to foliage, reduction of plant growth and reduced crop yields. NO₂ is also involved in the chemical reactions forming ozone and particulates.
- 12.4.5 Airborne dust generated from construction activities can be deposited through gravitational settling, and by a process known as 'wash-out' during rainfall. Deposition of construction dust has the potential to cause nuisance and inconvenience through the soiling of sensitive surfaces such as windows, painted surfaces and cars. Dust deposition can also potentially damage vegetation by affecting photosynthesis, respiration and transpiration thereby reducing the overall productivity of plants.

Existing Air Quality Monitoring in the Area Around the Scheme

- 12.4.6 CBC and LBC conduct diffusion tube monitoring in the area around the scheme and the data from this monitoring for 2010 is available from <http://www.hertsbedsair.net/>. However, none of the diffusion tube sites are located within 200m of the proposed routes or affected roads, with the exception of Chalton Cross, where CBC diffusion tube site SB41 is within 200m of the scheme's junction with the proposed Junction 11A. The dwellings at this site would be the subject of compulsory purchase and demolition should the Junction 11A scheme proceed, as they are within the footprint of the junction. The Woodside Connection scheme is dependent on the Junction 11A scheme in order to provide access from the M1 and so these properties within an area of exceedance do not need to be considered as part of this assessment, as they will be removed as part of another road scheme.

12.5 Project Proposals Including Mitigation Measures

12.5.1 The proposed scheme is designed to relieve congestion on the surrounding road network and avoid HGVs using routes through residential areas, thereby lowering levels of traffic pollution at sensitive receptors along the existing road network. The scheme itself can therefore be considered as mitigation of the existing air quality problems alongside the road network in this area. The route alignments have been designed to maintain substantial distances between properties and the road, where possible. The speed will also be limited to 30mph from Chainage 0 to 300, 40mph from Chainage 300 to 1100, and 60mph for the remainder of the route.

12.6 Construction Air Quality Impacts and Mitigation

12.6.1 The assessment of construction dust impact cannot be undertaken in detail at Stage 2 as there is no detailed construction methodology or information on types of plant to be used. The assessment of construction dust impact will be conducted at Stage 3, when more information will be available, though detailed mitigation measures cannot be set out until a contractor has been appointed, which would be after Stage 3.

12.6.2 There is the potential for air quality to be affected during construction, due to dust created by earthworks and emissions caused by plant or vehicle movements and disruption to the existing road network.

12.6.3 Dust and emissions generated during construction should be mitigated as a matter of good practice, and construction dust will be controlled through following the mitigation measures in the GLA and London Councils Best Practice Guidance 'The control of dust and emissions from construction and demolition'. These measures can include use of low emission plant, dust suppression and designated construction traffic routes which avoid residential areas.

12.6.4 A Construction Environmental Management Plan (CEMP) will be produced prior to the commencement of work on site. It will incorporate measures from the best practice guidance into the management of the site. Daily visual inspections of dust will be made and dust gauges can be used to measure the levels of dust deposited at nearby receptors.

12.7 Assessment of Effects

12.7.1 The pollutants of concern for this assessment are NO₂ and PM₁₀. The criterion used to assess the magnitude of impact is that of the Institute of Air Quality Management

assessment of significance.

- 12.7.2 The impact on the Dunstable and Luton AQMAs cannot be fully determined for this Stage 2 assessment as the affected roads and links have not yet been fully identified. The scheme is unlikely to adversely affect air quality within the AQMAs as it would divert traffic, especially HGVs, away from the Dunstable AQMA to the new route and so it is in principle likely to improve air quality in the AQMA. In order for this benefit to be quantifiable roads within the AQMA (A5 High Street and A505 Luton Road, Church Street and West Street) need to be identified as affected roads.
- 12.7.3 The impact on designated sites does not need to be considered at Stage 2 as there are no designated sites within 200m of the proposed route or identified affected routes. This may change with an expanded traffic model and the identification of further affected roads at Stage 3.

Estimation of Pollution Concentrations

- 12.7.4 An estimation of pollution concentrations at a wide range of properties around the proposed scheme has been made using the DMRB screening method and HA207/07 methodology. The pollution concentrations for the opening year (2016) with the Do-Minimum (without scheme) and Do-Something (with scheme) scenarios have been calculated using the available traffic data. The estimates for the Do-Minimum scenario are shown below in Table 12.5 and the estimates for the Do-Something scenario are shown in Table 12.6. The estimated difference between the two scenarios is shown in Table 12.7.
- 12.7.5 The model will be revised at Stage 3 when more detailed traffic data is available, including predicted speeds.

Table 12.5 ~ DMRB Screening Calculation Predicted Concentrations for 2016 Do-Minimum

2016 Opening Year	Receptor Name	Year	NO _x	NO ₂	PM ₁₀	
			Annual mean µg/m ³	Annual mean µg/m ³	Annual mean µg/m ³	Days >50µg/m ³
1	208 Wheatfield Road	2016	20.81	14.20	18.17	1.54
2	92 Milton Way	2016	20.71	14.14	18.14	1.51
3	7 St James Close	2016	19.86	13.68	18.03	1.43
4	26 Kensington Close	2016	19.11	13.27	17.66	1.15
5	460 Poynters Road	2016	21.60	14.62	18.16	1.53
6	209 Wheatfield Road	2016	20.75	14.16	18.07	1.46
7	2 Milton Walk	2016	23.15	15.46	18.36	1.69
8	85 Conway Close	2016	19.11	13.27	17.43	0.99
9	61 Fareham Way	2016	19.11	13.27	17.89	1.50
10	285 Pastures Way	2016	19.11	13.27	17.89	1.60
11	Osbourne House	2016	25.14	16.52	18.47	1.79
12	Chalton Cross Farmhouse	2016	19.11	13.27	17.63	1.13

Table 12.6 ~ DMRB Screening Calculation Predicted Concentrations for 2016 Do-Something

2016 Opening Year	Receptor Name	Year	NO _x	NO ₂	PM ₁₀	
			Annual mean µg/m ³	Annual mean µg/m ³	Annual mean µg/m ³	Days >50µg/m ³
1	208 Wheatfield Road	2016	23.72	15.77	18.45	1.77
2	92 Milton Way	2016	23.53	15.66	18.41	1.74
3	7 St James Close	2016	21.53	14.59	18.19	1.55
4	26 Kensington Close	2016	19.11	13.27	17.72	1.19
5	460 Poynters Road	2016	22.73	15.23	18.27	1.62
6	209 Wheatfield Road	2016	22.89	15.32	18.28	1.62
7	2 Milton Walk	2016	23.46	15.63	18.39	1.72
8	85 Conway Close	2016	19.11	13.27	17.44	1.00
9	61 Fareham Way	2016	19.33	13.39	17.91	1.33
10	285 Pastures Way	2016	19.67	13.58	17.94	1.36
11	Osbourne House	2016	24.24	16.04	18.44	1.76
12	Chalton Cross Farmhouse	2016	20.98	14.29	18.08	1.46

Table 12.7 ~ Estimated 2016 Differences in Pollution Concentrations With and Without the Scheme					
Receptor Ref.	Receptor Name	NO ₂ difference µg/m ³	PM10 difference µg/m ³	NO ₂ % difference	PM10% difference
1	208 Wheatfield Road	1.57	0.28	9.96	1.52
2	92 Milton Way	1.52	0.27	9.71	1.47
3	7 St James Close	0.91	0.16	6.24	0.88
4	26 Kensington Close	0.00	0.06	0.00	0.34
5	460 Poynters Road	0.61	0.11	4.01	0.60
6	209 Wheatfield	1.16	0.21	7.57	1.15
7	2 Milton Walk	0.17	0.03	1.09	0.16
8	85 Conway Close	0.00	0.01	0.00	0.06
9	61 Fareham Way	0.12	0.02	0.90	0.11
10	285 Pastures	0.31	0.05	2.28	0.28
11	Osborne House	-0.48	-0.03	-2.99	-0.16
12	Chalton Cross Farm	1.02	0.45	7.14	2.49

12.7.6 All predicted pollution concentrations are below (i.e. better than) the relevant Air Quality Objectives. Using the IAQM assessment guidelines for the magnitude of change shown in Table 12.8 the magnitude of change ranges from Imperceptible up to the upper end of the Medium category. Applying the criteria for the description of impact from the IAQM shown in Table 12.9 indicates the impact of the change in pollution concentrations in the year of opening (2016) in some localities is Slight Adverse, but that for most areas it is Negligible.

Table 12.8 ~ IAQM Magnitude of Change Guidelines	
Magnitude of Change	Annual Mean
Large	Increase/Decrease >10%
Medium	Increase/Decrease 5 -10%
Small	Increase/Decrease 1 -5%
Imperceptible	Increase/Decrease <1%

Table 12.9 ~ Criteria for the Description of Impacts (Source IAQM)			
Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Increase With Scheme			
Above Objective/Limit Value With Scheme (>40µgm ⁻³)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36-40µgm ⁻³)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30-36µgm ⁻³)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30µgm ⁻³)	Negligible	Negligible	Slight Adverse
Decrease With Scheme			
Above Objective/Limit Value With Scheme (>40µgm ⁻³)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36-40µgm ⁻³)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30-36µgm ⁻³)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30µgm ⁻³)	Negligible	Negligible	Slight Beneficial

Significant Effects

- 12.7.7 Once the magnitude of change is known and the impact is described at relevant receptors, the assessment of significance is made. At this stage the significance of the impact cannot be categorically determined as the traffic model does not contain speed data and not all the affected road links may have been identified. The determination of significance will be based on the magnitude of change, description of impacts and the factors shown in Table 12.10. In the absence of background monitoring data at this stage for the scheme, and therefore uncertainty about background levels of pollutants, the magnitude of change cannot be given with confidence. The impacts are likely to be most significant near the roundabout junction with Park Road North, Poynters Road and Porz Avenue. The development of the traffic model at Stage 3 will provide more robust traffic data for the air quality assessment and may lead to the identification of further affected roads to assess.
- 12.7.8 Monitoring within 200m of the scheme at Chalton Cross shows exceedance of the annual mean NO₂ objective and nearby Dunstable and Luton both have an AQMA for exceedances of the annual mean near to the study area.
- 12.7.9 It is therefore considered that the DMRB screening model may not be suitable for assessing possible exceedances in the study area for the scheme, and that a Detailed Assessment using dispersion modelling may need to be conducted. This will be considered following Scoping and Simple assessment at Stage 3 using the background data and model

verification from the NO₂ diffusion tube monitoring.

Table 12.10 ~ Factors to Consider When Assessing Significance of Impact on Air Quality (Source: IAQM)

The magnitude of the changes and the descriptions of the impacts at the receptors i.e. Table of Magnitude of Change and Changes in relation to objectives.
Number of people affected by increases and/or decreases in concentrations and the judgement of overall balance.
Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced.
Uncertainty, including the extent to which worst-case assumptions have been made.
The extent to which an objective or limit value is exceeded e.g. an annual mean NO ₂ of 41µgm ⁻³ should attract less significance than an annual mean of 51µgm ⁻³ .

- 12.7.10 DMRB screening model calculations show there are **no predicted exceedances** of the relevant air quality objectives (NO₂ annual mean, PM₁₀ annual mean and PM₁₀ daily mean) within the study area for the proposed year of opening, 2016.
- 12.7.11 The receptors near the proposed routes are likely to be subject to increases in pollution concentrations, but those receptors near Park Road North are likely to benefit from a reduction in pollution concentrations from a diversion of traffic, in particular HGVs, away from this road to the Woodside Connection. The magnitude of change ranges up to the upper end of the Medium category but the predicted levels with the scheme will still be well below EU limit values and it is considered likely that impact will **either be Negligible or Slight Adverse** for the receptors modelled. The identification of affected roads at Stage 3 may identify receptors that have a beneficial impact from the scheme.
- 12.7.12 There is no clear preferred route in terms of air quality impact as the constraint of the narrow parcel of land which all of the alignments pass through to the south of Parkside Drive means that the routes are very similar.

12.8 Indication of Any Difficulties Encountered

- 12.8.1 The traffic information used in this Stage 2 air quality assessment do not at this stage contain details of vehicle speeds, peak hour queuing or congestion (though a slow speed, representing congestion, has been used for this Stage 2 assessment). For Stage 3 the traffic assessment will take into account modelled speeds and queuing rather than just AADT and an arbitrary speed. This may lead to identification of further affected roads to undergo air quality assessment at Stage 3 which will include details of vehicle speed and queuing.

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- 12.8.2 Uncertainty over the Luton Northern Bypass scheme means that the results and traffic flows are subject to change. The proposed AQMA and area of current exceedance is within the footprint of the Junction 11A scheme. However the Woodside Connection scheme is dependent on the Junction 11A scheme.
- 12.8.3 The 2016 Do-Minimum and Do-Something assessment has been carried out assuming the proposed A5-M1 Link, Junction 11A and M1 hard shoulder running schemes are all in place. The cumulative effects of the proposed housing and employment site allocations have been incorporated into the traffic model. However the housing and employment allocations and locations are not yet committed, and may be subject to change.
- 12.8.4 The scheme is located in the Houghton Regis Urban Expansion area where 7,000 new homes are proposed, with a proportion of these in the area around the scheme. The exact locations are not yet known and at the date of this Stage 2 assessment no detailed master plan had been produced, and the development had not been confirmed. The exact location of these potential dwellings is therefore not known. The assessment of air quality at these proposed dwellings against the National Objectives will be made as part of the planning application process for these dwellings.

Diffusion Tube Monitoring

- 12.8.5 HA207/07 requires the consideration of whether there is sufficient existing monitoring data to assess the impact of the scheme against a baseline. There is no monitoring data within 200m of the scheme with the exception of around Luton Road in Chalton Cross which is in the footprint of the Junction 11A scheme and shows an exceedance through monitoring data. There is also no monitoring within the study area defined by the traffic model, limiting comparison of the DMRB screening model with measured data. HA207/07 recommends that, if there is insufficient monitoring data, diffusion tubes for NO₂ should be deployed as a minimum.
- 12.8.6 TG09 recommends at least 6 months monitoring to include both the summer and winter period. It should be noted that winter usually represents a worst case scenario because of temperature inversions in which still, cold air can be trapped by the topography allowing pollution concentrations to build up, which would normally be dispersed by wind. The tubes used will be of the same type used by CBC, i.e. 20% TEA (triethanolamine) in water, supplied by Gradko Ltd, in order to ensure comparability between results. Where possible these will be bias corrected using the CBC diffusion tubes that are co-located with the continuous air quality monitoring station in Dunstable.

12.8.7 The diffusion tube monitoring has now (as at October 2012) been undertaken, to inform the Stage 3 assessment, but is not reported here as it did not form part of the Stage 2 assessment.

12.9 Summary

12.9.1 The Stage 2 air quality assessment using the DMRB HA207/07 methodology and DMRB screening method has shown that the screening calculations indicate there are no predicted exceedances of the air quality objectives and EU limit values in the opening year of the scheme (2016) in both the Do-Minimum and Do-Something scenarios. Nevertheless, existing monitoring data indicates exceedances of the annual mean NO₂ objective at receptors at Chalton Cross for 2010, which would require dispersion modelling. However these dwellings would need to be removed as part of the M1 Junction 11A scheme. Background and roadside diffusion tube data close to the route has been collected and will be used for the Stage 3 assessment. At Stage 3, a Scoping assessment will be conducted based on the revised traffic model and any newly identified affected roads. A Simple assessment will be conducted at Stage 3 for the preferred option and the assessment may proceed to a Detailed assessment with dispersion modelling if required by guidance in HA207/07.

12.9.2 The regional impact has not yet been assessed as the Stage 2 traffic model has not fully identified affected roads, this will be done at Stage 3. Though the creation of a new road would lead to an extra area of emission, the relief of congestion could lead to an overall reduction in emissions of regional air pollutants and greenhouse gases in the area of the scheme.

12.9.3 There is no preferred route in terms of air quality, as in the area where the routes are in close proximity to residential receptors all three routes have a common alignment.

12. References

Central Bedfordshire Council 2009 *Updating and Screening Assessment*

Central Bedfordshire Council 2008 *Air Quality Progress Report*

Defra LAQM tools <http://laqm1.defra.gov.uk/review/tools/background.php>

Highways Agency 2007 *HA207/07*

Institute of Air Quality Management 2009 *Position on the Description of Air Quality Impacts and the Assessment of their Significance*

Luton Borough Council 2009 *Updating and Screening Assessment*

Luton Borough Council 2008 *Air Quality Progress Report*

13 Noise and Vibration

13.1 Introduction, Methodology and Study Area

Introduction

- 13.1.1 The potential noise impact from the scheme has been assessed in relation to the noise generated by vehicular traffic travelling on the scheme, using the methodology as set out in the DMRB (Volume 11 Section 3 Part 7: HD 213/11, Noise and Vibration). In this report dB(A) is used as an abbreviation for dB $L_{A10, 18hr}$.

Methodology

DMRB

- 13.1.2 The DMRB requires either a Simple or a Detailed Assessment of noise and vibration effects following the Scoping Assessment. If it is not clear whether the scheme will result in significant noise and vibration impacts, the assessment process proceeds to the Simple Assessment. However, where *'it is clearly evident that the project will result in significant noise and vibration impacts'* the process proceeds straight to the Detailed Assessment. If the Simple Assessment were to be undertaken initially, it would lead to a requirement for a Detailed Assessment for all options still being considered, if (amongst other matters) the project is found to cause either an increase in noise level of 1 dB(A) or more at any dwelling in the baseline year, or an increase of 3 dB(A) or more during the 15 year design period.
- 13.1.3 Since the current indications are that significant noise effects are likely, and that they will cause noise increases greater than 1 dB(A) in the baseline year with the scheme, the Stage 2 assessments have been undertaken in accordance with the DMRB requirements for Detailed Assessments. Many of those matters covered by the Detailed Assessment are also required in any event by a Simple Assessment, and the principal differences relate to the assessment years/comparisons and the reporting of the noise effects.
- 13.1.4 The noise modelling software NoiseMap 5 was used to calculate predicted noise levels at representative properties. In total, noise levels were predicted at 14 locations using NoiseMap 5 modelling software; 11 existing residential properties and 3 locations indicative of future development of the area (see Figure 13.1). The extent and nature of this development has yet to be confirmed, but the implications for the scheme are that it is likely (in due course) to pass through an area of mixed employment and residential development, rather than the open fields which presently exist along the majority of the route. As properties do not currently exist at the three indicative locations, and will not exist at the time the scheme is permitted or constructed, the scheme will not affect them as such, but they have been included in the assessment in order to be able to characterise the future noise environment in which properties are likely to be constructed at these localities. Further discussion of this is provided in section 13.2. Table 13.1 provides an overview of the properties modelled as part of this assessment.

Table 13.1 ~ Representative Properties and Locations Modelled	
House Number / Name	Street
460	Poynters Road
140, 208, 209	Wheatfield Road
92	Milton Way
29	Kensington Close
10	Thresher Close
123	Conway Close
22	Kirton Way
Osborne House	Off Sundon Road
Chalton Cross Farm	Off Sundon Road
Location A	Grid Reference 503683, 225315
Location B	Grid Reference 503763, 224716
Location C	Grid Reference 503864, 224328

- 13.1.5 Model runs were undertaken for four scenarios; the baseline year (2010), two scenarios for the opening year of the project (2016) and a future year 15 years after opening (2031). The first scenario modelled is the baseline year 2010 with the existing network and no development of the surrounding area. The second scenario is the opening year (2016) with the A5-M1 Link open and no development of the surrounding area. The third scenario is for the opening year (2016) with the A5-M1 Link open, the Woodside Connection scheme in place and no development of the surrounding area. The final scenario is for the future year (2031) with the A5-M1 Link open, the Woodside Connection scheme in place and the surrounding area completely developed. When referring to 2016 the terms 'With Scheme' and 'Without Scheme' will be used.
- 13.1.6 The traffic flows were obtained from the design engineers for the scheme and the flow data used in the noise model are provided in Table 13.2 below. The traffic model will be updated and expanded as part of the next stage in the assessment process.

Table 13.2 ~ Traffic Flows (18hr Annual Average Weekly Traffic) used in the Noise Model for the Scheme				
Road	2010	2016	2016	2031*
	Existing	A5-M1 Link Open: 'Without Scheme'	A5-M1 Link & Woodside Connection Open: 'With Scheme'	A5-M1 Link & Woodside Connection Open: With Full Development
Park Road North	22660	18952	16892	23793
Sandringham Drive	6283	7313	7313	9270
Wheatfield Road	5871	6901	6901	8652
Poynters Road	24411	21218	20600	26883
Porz Avenue	23175	25029	28531	37904
M1 (J11A to J11)	166860	201880	204970	238548
Sundon Road (town end)	19673	21012	19776	26986
Sundon Road (rural end)	19673	21012	22248	28016
Luton Road	11639	9064	9888	15244
Woodside Connection to Ch1100	-	-	7828	13184
Woodside Connection Ch1100 to Roundabout	-	-	7828	22763
Woodside Connection Roundabout to J11A	-	-	9064	29355
Sundon Road Link	-	-	2472	26883

13.1.7 The DMRB states that the magnitude of noise impact from a project should be classified into levels of impact in order to assist with the full assessment of a project. It classifies magnitude of impacts from traffic noise in terms of noise change, as shown in Table 13.3 (short term) and Table 13.4 (long term) below.

Table 13.3 ~ Classification of Magnitude of Noise Impacts in the Short Term	
Noise Change, $L_{A10,18hr}$	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1 – 2.9	Minor
3 – 4.9	Moderate
5+	Major

Table 13.4 ~ Classification of Magnitude of Noise Impacts in the Long Term	
Noise Change, $L_{A10,18hr}$	Magnitude of Impact
0	No change
0.1 – 2.9	Negligible
3 – 4.9	Minor
5 – 9.9	Moderate
10+	Major

13.1.8 In terms of significance, the DMRB states that a change in noise level of 1dB(A) in the short term is considered significant while a change in noise level of 3dB(A) in the long term is considered significant. Such increases should be mitigated if possible.

Study Area

13.1.9 The study area used in this assessment is the area where the roads are predicted to be subject to a change in noise level of more than 1 dB(A) as a result of the scheme. In accordance with the DMRB, a change in noise level of 1dB $L_{A10,18h}$ is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged, and a change in noise level of 3dB $L_{A10,18h}$ is equivalent to a 100% increase or a 50% decrease in traffic flow. Therefore the study area was deemed to be up to 300m from the extent of the scheme and from any other affected roads where the traffic is predicted to change significantly. For dwellings and other sensitive receptors that are within 600m of the scheme extent, a qualitative assessment was undertaken.

13.1.10 Representative receptors were used in the noise model to predict noise levels in the vicinity of the scheme, as outlined in Table 13.1 and illustrated in Figure 13.1.

13.2 Regulatory and Policy Framework

13.2.1 The Environmental Noise Directive (Directive 2002/49/EC) defines environmental noise as unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic and from sites of industrial activity. It requires EU Member States to establish through noise mapping the number of people exposed to noise levels greater than 55 dB(A) during the day and 50 dB(A) at night from major roads, airports, railways and in urban areas.

13.2.2 Part I of the Land Compensation Act 1973 provides a means by which compensation can be paid to owners of land or property which has experienced a loss in value caused by the use of public works, such as new or improved roads. Noise and vibration are two of the factors which would be considered in any claims for compensation, but the claim must consider all

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- changes and effects, including betterment. Claims can be made under Part I of the Act from 1 to 7 years after the opening of a road project. However, consideration of the likely extent of claims may be made during detailed design following the completion of statutory processes.
- 13.2.3 Sections 60 and 61 of the Control of Pollution Act 1974 generally relate to construction and demolition work, road works and maintenance works, and are often used in conjunction with other standards such as BS 5228 (see below). These sections relate to control of noise on construction sites and prior consent for work on construction sites respectively.
- 13.2.4 The Noise Insulation Regulations 1975 (as amended 1988) were made under Part II of the Land Compensation Act 1973. Regulation 3 imposes a duty on authorities to provide, or make a grant towards the installation of, noise insulation at eligible buildings. This is subject to meeting certain criteria given in the relevant Regulations. Regulation 4 provides authorities with discretionary powers to provide noise insulation at other buildings, in situations where existing carriageways are altered, such as additional lanes being provided.
- 13.2.5 Under Part III of the Environmental Protection Act 1990 local authorities have a duty to investigate noise complaints arising from premises (land and buildings) and vehicles, machinery or equipment in the street. This does not apply to road traffic noise, but may be applicable to some construction activities. The Noise and Statutory Nuisance Act 1993 amended Part III of the Environmental Protection Act 1990 by placing additional definitions in the list of statutory nuisances in Section 79 of the Environmental Protection Act. The definitions relate to nuisance caused by vehicles, machinery and equipment in the road. If a local authority's Environmental Health Officer is satisfied that a complaint amounts to a statutory nuisance then the authority must serve an abatement notice on the person responsible or in certain cases the owner or occupier of the property. The notice could require that the noise or nuisance must be stopped altogether or limited to certain times of the day.
- 13.2.6 The Highways Noise Payments and Movable Homes (England) Regulations 2000 provide highway authorities with a discretionary power to provide a noise payment where new roads are to be constructed or existing ones altered. The relevant regulations set out the criteria which should be applied in assessing eligibility for making such payments.
- 13.2.7 BS 5228:2009 Code of practice for noise and vibration control on construction and open sites (Part 1: Noise, Part 2: Vibration, and Part 4: Code of practice for noise and vibration control applicable to piling operations). BS5228:2009 describes a method for predicting noise levels from construction activities. It provides typical source noise levels and takes account of the different types of activity that can occur in predicting the consequential noise level. The method takes account of the distance between sources and receptors, the durations of activities, and the effect of natural or purpose-built barriers and screens.
- 13.2.8 World Health Organisation (WHO) guidelines state that: '*general daytime outdoor noise levels of less than L_{Aeq} 55dB are desirable to prevent any significant community annoyance*'. An aspirational target was also set for dwellings of L_{Aeq} 50dB for day and L_{Aeq} 45dB for night.
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13.2.9 The DMRB provides the procedure for assessing the impact of noise from road schemes, and states:

'In recent years, evidence has also been accumulating from surveys before and after sudden changes in noise exposure. It indicates that people are more sensitive to abrupt changes in traffic noise associated with new road schemes than would be predicted from the steady state evidence. In the period following a change in traffic flow, people may find benefits or disbenefits when the noise changes are as small as 1 dB(A) - equivalent to an increase in traffic flow of 25% or a decrease in traffic flow of 20%. These effects last over a number of years.'

13.2.10 The DMRB also requires evaluation of any potential temporary noise and vibration impacts. This should consist of identifying maintenance or construction activities that are likely to take place and assessing the impact (including duration) on people, dwellings and other sensitive receptors.

13.2.11 The National Planning Policy Framework (NPPF) came into force in March 2012, and replaces Planning Policy Guidance (PPG) 24: Planning and Noise. The NPPF states (in paragraph 123) that:

'Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

13.3 Baseline Conditions

13.3.1 The scheme is mainly located in a suburban environment with the northern end located in a more rural locality. The noise environment throughout is dominated by the M1 motorway which runs in a general north-south direction along the eastern end of the study area.

13.3.2 There are no designated nature conservation sites within 600m of the scheme (see Chapter 9: Nature Conservation for more information). The Sundon Chalk Quarry SSSI & County Wildlife Site (CWS) is located approximately 0.7km from the proposed routes (see Figures 13.2 to 13.4).

13.4 Value of Environmental Resources and Receptors

- 13.4.1 Sensitive receptors are defined as locations where members of the public are regularly present and are likely to be exposed to traffic noise for a prolonged period. This includes residential properties, schools, hospitals and care homes.
- 13.4.2 The area is densely populated with a significant number of residential properties and 28 community sensitive receptors such as schools, hospitals or old people's homes within 600m of the scheme and affected roads.

13.5 Project Proposals including Mitigation Measures

- 13.5.1 The proposed scheme is designed to relieve congestion on the surrounding network and avoid HGVs using routes through residential areas, thereby lowering noise levels at sensitive receptors along the existing road network. The scheme itself can therefore be considered as mitigation of the existing noise problems alongside the road network in this area. The route alignments have been designed to maintain substantial distances between existing properties and the new road, where possible. The speed will also be limited to 30mph from Chainage 0 to 300, 40mph from Chainage 300 to 1100, and 60mph for the remainder of the route.
- 13.5.2 It is assumed that a noise-reducing surface will be used to surface the carriageway of the scheme and noise barriers /bunds will be constructed where required. The effectiveness of a noise barrier is dependent upon its ability to prevent sound passing through, over, or around it. Following installation, this can be managed by undertaking regular inspections to ensure that there is no significant degeneration in its construction and that it remains fit for purpose.

13.6 Assessment of Effects

- 13.6.1 The number of properties in 50m bands up to 600m from the centre line of the proposed route options has been determined using Geographical Information Systems (GIS) software, and is very similar for all three routes, as they all pass through a narrow band of land between Houghton Regis and the Lewsey Farm area of Dunstable - see Table 13.5 for details. Figures 13.2 to 13.4 provide an illustration of the three route options in relation to the existing environment and properties banded by distance.

Distance from Scheme	Blue Route	Green Route	Orange Route
0-50m	101	102	108
50-100m	299	304	288
100-150m	400	407	356
150-200m	413	397	484
200-300m	799	740	780
300-600m	2773	2798	2439

13.6.2 As the numbers of existing properties are large, the assessment has been undertaken for a representative sample of affected properties, which will enable some general statements to be made about the overall numbers of properties likely to be affected.

13.6.3 Once all the parameters were input to the model for each of the scenarios, the model was run for the representative residential properties. For each model run, noise levels were predicted at the façade of the residential dwelling.

Green Route

13.6.4 All route options were modelled for the baseline year, together with the two scenarios for 2016; 'With Scheme' and 'Without Scheme'. Only the Green Route was modelled for the 2031 scenario, with the scheme and future development. This was because the Green Route provided an indicative assessment of the future noise environment with the area fully developed. As outlined previously, the three route options are similar for the first kilometre, where the routes pass through an already developed area. Further north, where the existing environment is greenfield and receptor numbers are very limited, the route options vary to a greater extent. Predicted traffic flows do not vary for the three route options, so modelling of all three options for the future year would not provide any significant additional information, and the Green Route was chosen for the assessment as it is the centrally located route.

13.6.5 The results for the Green Route option for the opening year 2016 and future year 2031 are displayed in Table 13.6 below.

Table 13.6 ~ Summary of Predicted Noise Levels at Representative Properties (Green Route)								
Receptor number	Receptor Address	Floor	Baseline Year 2010: Existing (1)	A5-M1 Link Open: 'Without Scheme' (2)	A5-M1 Link & Woodside Connection Open: 'With Scheme' (3)	A5-M1 Link & Woodside Connection Open: With Full Development (4)	Difference between 2016 Scenarios (3 - 2)	Difference between 2031 & 2016 Scenarios (4 - 2)
			dB(A)					
1	460 Poynters Road	0	68.8	67.5	67.6	68.4	0.1	0.9
		1	71.1	69.8	69.8	70.6	0	0.8
2	209 Wheatfield Road	0	63.4	62.6	64.2	64.2	1.6	1.6
		1	65.6	64.7	66.1	66.1	1.4	1.4
3	208 Wheatfield Road	0	66.2	65.3	66.5	66.5	1.2	1.2
		1	67.4	66.6	68.0	68.0	1.4	1.4
4	92 Milton Way	0	63.4	62.5	64.5	66.0	2.0	3.5
		1	65.5	64.5	66.6	68.2	2.1	3.7
5	29 Kensington Close	0	59.5	58.5	60.4	62.0	1.9	3.5
		1	61.9	61.0	62.5	64.1	1.5	3.1
6	140 Wheatfield Road	0	56.9	56.0	60.5	62.4	4.5	6.4
		1	59.1	58.2	62.0	63.9	3.8	5.7
7	10 Thresher Close	0	59.2	59.3	61.1	62.3	1.8	3.0
		1	60.0	60.0	61.9	63.1	1.9	3.1
8	123 Conway Close	0	45.7	44.8	55.2	57.5	10.4	12.7
		1	46.8	45.9	56.2	58.5	10.3	12.6
9	22 Kirton Way	0	60.7	60.7	61.5	62.1	0.8	1.4
		1	61.5	61.6	62.4	63.1	0.8	1.5
10	Osborne House	0	67.9	66.0	66.4	67.5	0.4	1.5
		1	70.0	67.9	68.4	69.4	0.5	1.5
11	Chalton Cross Farm	0	68.8	68.8	75.5	79.9	6.7	11.1
		1	70.1	70.1	76.6	80.8	6.5	10.7
12	Location A (503683, 225315)	0	-	64.2	66.2	68.4	2.0	4.2
		1	-	65.7	68.2	70.9	2.5	5.2
13	Location B (503763, 224716)	0	-	62.3	64.1	66.4	1.8	4.1
		1	-	66.0	66.6	69.1	2.6	5.1
14	Location C (503864, 224328)	0	-	62.3	64.5	66.4	2.2	4.1
		1	-	63.6	66.3	68.5	2.7	4.9

-
- 13.6.6 The results show an overall increase in noise levels due to the scheme opening in 2016. The greatest increase in noise levels occurs at 123 Conway Close (an increase of over 10dB(A)), Chalton Cross Farm (an increase of over 6dB(A)) and 140 Wheatfield Rd (an increase of 4dB(A)).
- 13.6.7 Comparing the future year (2031) scenario to the opening year scenario, the results show an overall increase in noise levels. The greatest increase is at 123 Conway Close (over 12dB(A)), Chalton Cross Farm shows an increase of over 11dB(A) while all 3 properties representative of future development show an increase of approximately 4 dB(A). These increases take cognisance of natural traffic growth and an increase in local traffic due to the development of the area.
- 13.6.8 A noise contour map was produced to show the difference between the 'With Scheme' and 'Without Scheme' scenarios for the Green Route option (see Appendix 13.1). The contour map shows that the greatest difference between the 'With Scheme' and 'Without Scheme' scenarios occurs approximately between Chainages 400 and 1000. The residential area that shows the greatest increase in noise levels occurs approximately between Chainages 500 and 1000. One of the properties modelled (123 Conway Close) occurs within this residential area and shows an increase in noise levels of approximately 10dB(A) as a result of the scheme.
- 13.6.9 It should be noted that the contour map shows a small anomaly that extends into the residential area north of the route alignment between Chainages 500 and 1000. This is due to an underestimation of noise levels for the 'Without Scheme' scenario for the opening year, as traffic flows are only available for the main routes and not local roads used by residents, therefore the resulting noise model assumes no traffic flows (and therefore no traffic noise) on these local roads.

Blue Route

- 13.6.10 Noise levels were predicted for the baseline year and the two scenarios in the opening year (2016) for the Blue Route option. The predicted noise levels for the representative properties for the Blue Route option are shown in Table 13.7 below.

Table 13.7 ~ Summary of Predicted Noise Levels at Representative Properties (Blue Route)						
Receptor number	Receptor Address	Floor	Baseline Year 2010 (1)	A5-M1 Link Open: 'Without Scheme' (2)	A5-M1 Link & Woodside Connection Open: 'With Scheme' (3)	Difference between 2016 Scenarios (3 - 2)
			dB(A)			
1	460 Poynters Road	0	68.8	67.5	67.5	0
		1	71.1	69.8	69.7	-0.1
2	209 Wheatfield Road	0	63.4	62.6	64.1	1.5
		1	65.6	64.7	66.0	1.3
3	208 Wheatfield Road	0	66.2	65.3	66.5	1.2
		1	67.4	66.6	68.0	1.4
4	92 Milton Way	0	63.4	62.5	64.4	1.9
		1	65.5	64.5	66.6	2.1
5	29 Kensington Close	0	59.5	58.5	60.4	1.9
		1	61.9	61.0	62.5	1.5
6	140 Wheatfield Road	0	56.9	56.0	60.5	4.5
		1	59.1	58.2	62.0	3.8
7	10 Thresher Close	0	59.2	59.3	61.0	1.7
		1	60.0	60.0	61.8	1.8
8	123 Conway Close	0	45.7	44.8	55.2	10.4
		1	46.8	45.9	56.2	10.3
9	22 Kirton Way	0	60.7	60.7	61.3	0.6
		1	61.5	61.6	62.3	0.7
10	Osborne House	0	67.9	66.0	66.4	0.4
		1	70.0	67.9	68.3	0.4
11	Chalton Cross Farm	0	68.8	68.8	69.9	1.1
		1	70.1	70.1	71.2	1.1

13.6.11 The results show an overall increase in noise levels between the 2016 scenarios. The greatest increase occurs at 123 Conway Close (an increase of over 10dB(A)), while 140 Wheatfield Road shows an increase of approximately 4dB(A).

Orange Route

13.6.12 Noise levels were predicted for the baseline year and the two scenarios in the opening year (2016) for the Orange Route option. The predicted noise levels of the representative properties for the Orange Route option are displayed in Table 13.8 below.

Table 13.8 ~ Summary of Predicted Noise Levels at Representative Properties (Orange Route)						
Receptor number	Receptor Address	Floor	Baseline Year 2010 (1)	A5-M1 Link Open: 'Without Scheme' (2)	A5-M1 Link & Woodside Connection Open: 'With Scheme' (3)	Difference between 2016 Scenarios (3 - 2)
			dB(A)			
1	460 Poynters Road	0	68.8	67.5	67.6	0.1
		1	71.1	69.8	69.8	0
2	209 Wheatfield Road	0	63.4	62.6	64.2	1.6
		1	65.6	64.7	66.2	1.5
3	208 Wheatfield Road	0	66.2	65.3	66.5	1.2
		1	67.4	66.6	68.0	1.4
4	92 Milton Way	0	63.4	62.5	64.5	2
		1	65.5	64.5	66.7	2.2
5	29 Kensington Close	0	59.5	58.5	60.4	1.9
		1	61.9	61.0	62.5	1.5
6	140 Wheatfield Road	0	56.9	56.0	61.0	5
		1	59.1	58.2	62.7	4.5
7	10 Thresher Close	0	59.2	59.3	61.3	2
		1	60.0	60.0	62.1	2.1
8	123 Conway Close	0	45.7	44.8	52.8	8
		1	46.8	45.9	54.0	8.1
9	22 Kirton Way	0	60.7	60.7	61.7	1
		1	61.5	61.6	62.6	1
10	Osborne House	0	67.9	66.0	66.5	0.5
		1	70.0	67.9	68.4	0.5
11	Chalton Cross Farm	0	68.8	68.8	75.5	6.7
		1	70.1	70.1	76.5	6.4

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- 13.6.13 The results show an overall increase in noise levels between the 2016 scenarios for the Orange Route option. The property at 123 Conway Close shows the greatest increase of approximately 8dB(A). Chalton Cross Farm shows an increase of approximately 6dB(A) while 140 Wheatfield Road shows an increase in noise levels of approximately 5dB(A).

Night-time Noise Assessment

- 13.6.14 For a road project that involves introducing a new noise source into an area, a key consideration is the change in the level of night time noise. In the WHO's 2009 'Night Noise Guidelines for Europe' a night noise guideline (NNG) of 40 dB $L_{\text{night, outside}}$ is the target objective, with an Interim Target (IT) of 55 dB $L_{\text{night, outside}}$ for situations where the achievement of NNG is not feasible in the short-term. The NNG is considered by the WHO to protect the public and their health.
- 13.6.15 The 2009 WHO guidance considers that the IT can be temporarily considered by policy makers for exceptional local situations, and the proportion of population exposed to levels over this target is gradually reduced within the context of meeting wider sustainable development objectives.
- 13.6.16 The 2002 Transport Research Library (TRL) report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' provides a technique for predicting night time noise levels (L_{night}). It presents three methods, with the applicable method dependent on the detail of traffic information available. The first method in the TRL report is the preferred method, however the level of traffic data available at this stage prevents this from being used. The third method has been used in this instance, which provides a conversion of $L_{A10,18h}$ to L_{night} as outlined below.
- $$L_{\text{night}} = 0.90 \times L_{A10,18h} - 3.77 \text{ dB}$$
- 13.6.17 In deriving the L_{night} noise index using the above conversion it is necessary to subtract 2.5 dB(A) from the result to estimate the $L_{\text{night, outside}}$ level. L_{night} derived from the $L_{A10,18h}$ is a facade level, whereas $L_{\text{night, outside}}$ assumes free-field conditions.
- 13.6.18 For the properties modelled. the highest $L_{A10,18\text{hour}}$ level is predicted at 460 Poynters Road for the Green Route. Noise levels are predicted to be 54.6dB L_{night} for ground floor and 56.55dB L_{night} for the first floor. These levels are borderline unacceptable in terms of the WHO IT for night-time noise and in excess of the target objective NNG.
- 13.6.19 By constructing noise barriers close to the noise source, along the edge of the proposed carriageway, and through the use of a low-noise surface on the carriageway, noise levels are expected to be reduced to under the IT and close to the target objective NNG. Further assessment will be undertaken at the next stage in the assessment process to model the reduction in noise levels from such measures.

Road Traffic Vibration

- 13.6.20 The DMRB recommends that the effects of vibration should be considered where appropriate. Ground-borne vibrations are produced by rolling wheels on the road surface,
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particularly where heavy vehicles pass over irregularities on the road.

- 13.6.21 In the case of ground-borne vibration, the likelihood of perceptible vibration being caused is particularly dependent upon the smoothness of the road surface. Research has shown that vibration levels caused by heavy vehicles travelling at 110kph over a 25mm hump (e.g. a large discontinuity consistent with a poorly backfilled trench) could cause perceptible vibration at up to 40m from the road (Watts, 1990). This would imply that it is unlikely that significant levels of vibration would be generated at distances greater than this. Also, with a newly laid road surface it is a requirement of new highway construction specification that the surface would be smooth and free from any discontinuities of this magnitude.
- 13.6.22 The DMRB states that such vibrations are unlikely to be important when considering disturbance from new roads, and an assessment would only be necessary in exceptional circumstances. No such exceptional circumstances are envisaged for this scheme and hence no effects from ground-borne vibration are predicted.

13.7 Significance of Impacts

- 13.7.1 In accordance with the DMRB (see Tables 13.3 and 13.4), magnitude of change is classified in terms of change in noise level between the 'With Scheme' and 'Without Scheme' scenarios. For the comparison of the opening year scenarios the scheme will be assessed in terms of magnitude of change for the short term. The scheme will be assessed in terms of magnitude of change for the long term when addressing change for the future year 2031.
- 13.7.2 For the opening year 2016, only eleven properties were assessed, as the three future development properties are planned to be constructed after the scheme is in place as part of the development of the surrounding area. For the future year 2031, an assessment has been made for all fourteen properties or locations, for the Green Route only. However, in order to make some comparison of the future year noise levels for the three future development properties it is assumed that for the Green Route the properties are constructed in 2016.

Green Route

- 13.7.3 Table 13.9 below provides a summary of the predicted noise change for the Green Route for the modelled representative receptors in accordance with Table 13.3 (short term impacts).
- 13.7.4 The table shows that all the representative properties modelled have shown an increase in noise levels as a result of the predicted operation of the Green Route option. Eight out of the eleven properties modelled have been assessed as showing a negligible/ minor impact on noise levels. One property has resulted in a moderate impact while two show a major impact in terms of the magnitude of the noise level increase. In terms of impacts in accordance with DMRB, of the properties modelled eight are predicted to be significantly impacted.

Table 13.9 ~ Opening Year 2016: 'With Scheme' Compared to 'Without Scheme' Scenarios (Green Route)		
Change in Noise Level dB(A)	Number of representative dwellings subject to a change in noise level	
	Increase in noise level	Decrease in noise level
0	0	0
0.1 - 0.9	3	0
1 - 2.9	5	0
3 - 4.9	1	0
5+	2	0

13.7.5 In order to gain an understanding of the predicted extent of the significant impacts the scheme will have on the existing environment, an estimate has been made of the total number of affected properties (i.e. the estimated actual number of properties which would be affected, based on the calculations undertaken for the representative sample of properties). This estimate was undertaken only for the Green Route, for the opening year of the scheme.

13.7.6 Table 13.10 below provides an overview of the estimated number of dwellings within 600m predicted to be significantly affected by the Green Route in the opening year of the scheme.

Table 13.10 ~ Opening Year 2016: 'With Scheme' compared to 'Without Scheme' Scenarios (Green Route)		
Change in Noise Level dB(A)	Number of dwellings within 600m subject to a change in noise level	
	Increase in noise level	Decrease in noise level
0	0	0
0.1 - 0.9	2084	852
1 - 2.9	1136	0
3 - 4.9	249	0
5+	427	0

13.7.7 Of the total 4,748 dwellings within 600m of the Green Route, it is estimated that 1,812 would be significantly affected. With traffic flows predicted to decrease along Park Road North noise levels are predicted to slightly decrease at 852 properties located in proximity to this route. However, it must be stressed that this assessment is with no mitigation in place, and the anticipated use of a noise-reducing road surface and noise barriers alongside the road

would significantly reduce the noise levels and the numbers of properties affected, and should bring the impacts within acceptable limits - this will be assessed in detail at Stage 3.

- 13.7.8 In the future year (2031) only the Green Route was assessed, and this was compared to the opening year 'Without Scheme' scenario in accordance with Table 13.4 (long term impacts). The future year scenario modelled is for the future year with the A5-M1 Link open, the Woodside Connection scheme in place and the surrounding area completely developed, and the results are shown in Table 13.11.

Table 13.11 ~ Future Year (2031) With Full Development' compared to Opening Year (2016) 'Without Scheme' (Green Route)		
Change in Noise Level $L_{A10,18hr}$ dB	Number of representative dwellings or locations subject to a change in noise level	
	Increase in noise level	Decrease in noise level
0	0	0
0.1 - 2.9	5	0
3 - 4.9	6	0
5 - 9.9	1	0
10+	2	0

- 13.7.9 Comparing the future year (2031) with the scheme in place to the opening year (2016) without the scheme in place shows an overall increase in noise levels. Five properties or locations show a negligible impact in terms of noise levels between the years, six show a minor impact, one shows a moderate impact and two properties or locations show a major impact in the noise environment in the long term.
- 13.7.10 In the future year, nine of the properties or locations modelled show a significant increase in noise levels. Since the three routes follow a similar alignment it can be inferred that the scheme would (in the absence of mitigation) result in a significant impact on sensitive receptors in the vicinity, whichever route were to be adopted.

Blue Route

- 13.7.11 Table 13.12 provides an overview of the eleven properties modelled for the opening year of the Blue Route option.
- 13.7.12 Nine out of the eleven properties modelled have been assessed as showing a negligible/minor impact on noise levels. One property is shown to have a moderate impact while another has been assessed as having a major impact in terms of the magnitude of the noise level increase.

Table 13.12 ~ Opening Year 2016: With Scheme Compared to Without Scheme (Blue Route)		
Change in Noise Level $L_{A10,18hr}$ dB	Number of representative dwellings subject to a change in noise level	
	Increase in noise level	Decrease in noise level
0	1	0
0.1 - 0.9	2	0
1 - 2.9	6	0
3 - 4.9	1	0
5+	1	0

13.7.13 Overall, eight representative properties are predicted to have significant increases in noise levels from the Blue Route option.

13.7.14 It is predicted that a similar number of total properties will be significantly affected in the opening year by the Blue Route as for the Green Route (see Table 13.10 above).

Orange Route

13.7.15 Table 13.13 provides an overview of the eleven properties modelled for the opening year of the Orange Route option.

Table 13.13 ~ Opening Year 2016: With Scheme Compared to Without Scheme (Orange Route)		
Change in Noise Level $L_{A10,18hr}$ dB	Number of representative dwellings subject to a change in noise level	
	Increase in noise level	Decrease in noise level
0	0	0
0.1 – 0.9	2	0
1 – 2.9	6	0
3 – 4.9	0	0
5+	3	0

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- 13.7.16 Eight out of the eleven properties modelled have been assessed as showing a negligible/minor impact in noise levels, while three properties have been assessed as having a major impact in terms of the magnitude of the noise level increase.
- 13.7.17 Overall, nine representative properties are predicted to have significant increase in noise levels from the Orange Route option.
- 13.7.18 It is predicted that a similar number of total properties will be significantly affected in the opening year by the Orange Route as for the Green Route (see Table 13.10 above).

13.8 Assumptions and Limitations

- 13.8.1 It is assumed that all properties modelled are 2 storey and of a height of 8m. All existing properties were modelled at the façade of the properties, whereas the representative future development properties were modelled as free-field. Therefore, in order to compare directly with façade noise levels a value of 2.5dB was added to the free-field noise levels to represent façade conditions.
- 13.8.2 It is important to note that not all the affected roads have been identified, as speed data is not included in the traffic model produced at Stage 2, and it does not cover roads within Dunstable town centre. An expanded traffic model will be used to identify affected roads to be assessed at Stage 3. In addition, traffic flows are available only for the main routes and not the local roads used predominantly by residential traffic.
- 13.8.3 Detailed topographical survey data for input to the noise model as contour data is available only for the proposed route alignments. The data does not extend beyond the route alignments in any level of detail, therefore assumptions have been made on ground levels beyond this area.
- 13.8.4 The 2016 With and Without Scheme scenarios have been modelled assuming the proposed A5-M1 Link, Junction 11A and M1 hard shoulder running schemes are all in place. A cumulative assessment has not been undertaken at this stage in the assessment process, however any traffic growth from the proposed housing and employment site allocations has been incorporated into the traffic model for 2031. The housing and employment allocations and locations are not yet confirmed, and may be subject to change.
- 13.8.5 The exact locations of any proposed dwellings in the area at the northern end of the scheme are not yet known and at the date of this Stage 2 assessment no detailed masterplan has been produced, and the development has not been confirmed. An assumption has therefore been made as to the location of a number of these dwellings in order to predict the future noise climate in the area around them.

13.9 Construction Noise and Vibration

- 13.9.1 The assessment of construction noise impact cannot be undertaken in detail at Stage 2 as there is no detail available on the construction methodology. The assessment of construction noise impact will be conducted at Stage 3, when more information will be
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available, though detailed mitigation measures cannot be set out until a contractor has been appointed, which would be after Stage 3.

- 13.9.2 There is the potential for the noise environment to be affected during construction, due to noise generated by plant or vehicle movements.
- 13.9.3 A Construction Environmental Management Plan (CEMP) will be produced prior to the commencement of work on site. It will incorporate appropriate measures from best practice guidance into the management of the site.

13.10 Summary

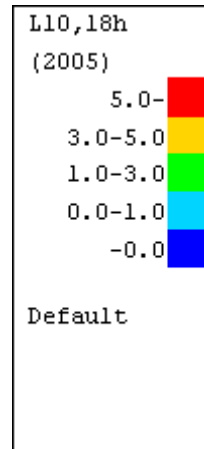
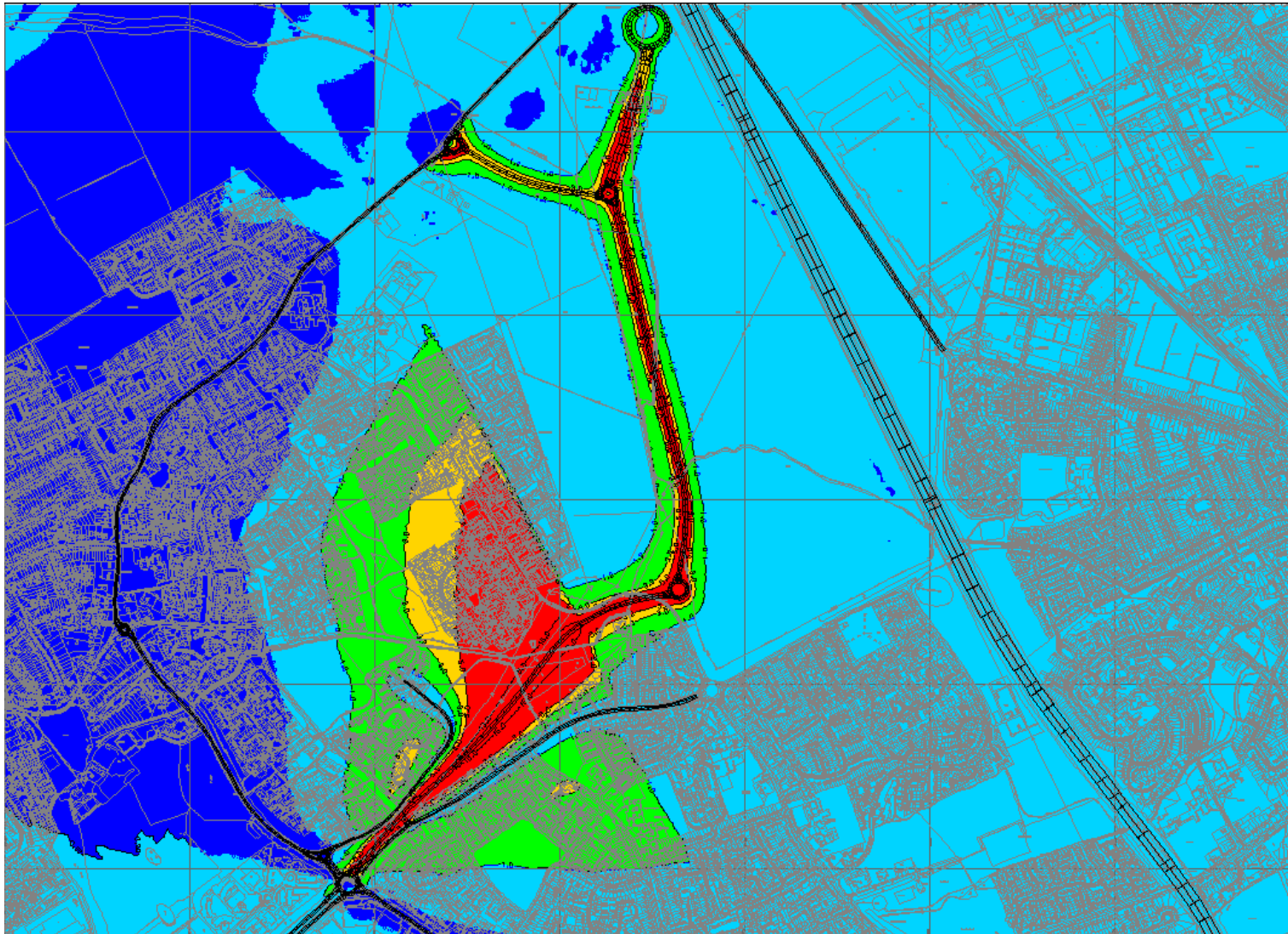
- 13.10.1 Noise levels predicted for the opening year indicate there is no significant difference between the three route options in terms of impact on the noise environment. The Green and Blue Route options are predicted to result in significant impact on eight of the eleven representative properties modelled, with the Orange Route predicted to significantly impact nine representative properties.
- 13.10.2 An estimate of the actual number of dwellings likely to be affected by the Green Route was undertaken for the opening year 'With Scheme' and 'Without Scheme' scenarios. Initial predictions indicate that noise levels at approximately 1,812 properties would be significantly increased as a result the Green Route Option, but that noise levels at 852 properties would be slightly lower with the scheme in place.
- 13.10.3 The assessment indicates that the most significant impacts would occur between Chainages 400 and 1000, affecting residents located to both the north and south of this section of road. It is proposed that noise barriers will be used to mitigate the noise impact for residents at least between these chainages, and possibly extending to the southern end of the scheme. Further assessment of the design specification of the noise barriers, including their height, length and location, will be undertaken at the next stage in the assessment process.
- 13.10.4 This assessment does not consider the numbers and locations of properties that may qualify for compensation in terms of noise insulation or devaluation of property. This would be undertaken later in the assessment process, when the traffic model has been extended and updated, and baseline noise monitoring has been undertaken.
- 13.10.5 It is recommended that a Detailed Assessment is undertaken at the next stage in the assessment process once the updated and extended traffic model is available. It is assumed that the design of the scheme will incorporate suitable mitigation measures to ensure the predicted impact on the noise environment is within acceptable levels. It is proposed that further assessment of night-time levels is undertaken. This would include night-time noise monitoring and prediction of night-time noise levels in accordance with Method 1 of the TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping'.

Chapter 13 Noise and Vibration ~ Appendices

Appendix 13.1 ~ Noise Contour Map showing difference between 2016 'With Scheme' and 2016 'Without Scheme' for the Green Route option.

Notes:

1. The assessment which has produced the information shown on this map is with no mitigation in place, and the anticipated use of a noise-reducing road surface and noise barriers alongside the road would significantly reduce the noise levels and the numbers of properties affected, and should bring the impacts within acceptable limits - this will be assessed in detail at Stage 3.
2. The contour map shows a small anomaly that extends into the residential area north of the route alignment between Chainages 500 and 1000. This is due to an underestimation of noise levels for the 'Without Scheme' scenario for the opening year, as traffic flows are only available for the main routes and not local roads used by residents, therefore the resulting noise model assumes no traffic flows (and therefore no traffic noise) on these local roads. This will be corrected at Stage 3.



14 Effects on All Travellers

14.1 Introduction, Methodology and Study Area

14.1.1 The current DMRB guidance is that effects should be grouped under the above heading, but the extant topic guidance is still under the separate headings (dating from 1993) of 'Vehicle Travellers' and 'Pedestrians, Cyclists, Equestrians and Community Effects'. IAN 125/09 states that assessments should be reported under the new heading but that the assessment should be based on relevant extracts from the existing topic guidance.

Methodology

14.1.2 This chapter therefore covers the following topic areas, and uses the methodologies set out in the existing DMRB guidance, as appropriate:

- 'View from the road' - this is set out in the DMRB as a potential benefit where a new road may enable people to see an attractive landscape, or an adverse effect where the view obtained is generally unattractive. The views which users of the new road would experience is therefore included in the assessment, but is given relatively little weight in comparison with views of the new road and the effects which it may have on the surrounding landscape.
- 'Driver stress' is the other main topic area covered by the extant DMRB guidance on vehicle travellers, and is defined in the DMRB as '*the adverse mental and physiological effects experienced by a driver traversing a road network*'. Driver stress is noted as being due to three main components; frustration, fear of potential accidents and uncertainty as to the route being followed. The DMRB suggests levels of driver stress (high, moderate or low) according to the type of road in question, the traffic flows and the average journey speed, with slow journeys on very busy roads leading to higher levels of stress.
- Journeys by pedestrians, cyclists and equestrians - under the new DMRB structure any such journeys relating to access to community facilities will be covered by the assessment reported in chapter 11, so the assessment here will be of effects on specific routes and on general accessibility within the area around the scheme. The DMRB suggests that assessments are made of changes in journey times, and also of any changes in the amenity of the journeys concerned. Effects can be adverse, where a new road interrupts or affects the amenity of existing journeys, but can also be beneficial - the new road would be open to cyclists and would create a new route. It would also relieve traffic flows on existing roads, thereby improving conditions for pedestrians and cyclists.

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- 14.1.3 In general the assessment has focused on the effects which are considered most likely to matter to local people - these include potential effects on existing public rights of way or cycle routes, and on levels of congestion and driver stress on existing local roads.

The Study Area

- 14.1.4 The nominal study area for vehicle travellers is the local road network, extending to the proposed Junction 11A in the north, Junction 11 of the M1 to the south east, Dunstable town centre to the south west and the proposed junction of the new A5-M1 Link road with the A5 to the north west. For other travellers (pedestrians, cyclists and equestrians), the study area is a corridor 500m to either side of each route option, though this may be extended where a given right of way or other route which may be affected extends beyond the 500m limit.

14.2 Baseline Conditions

The Local Road Network

- 14.2.1 The local road network is shown on Figure 14.1, and includes the following main existing components or proposed new roads:
- The M1 motorway, with junctions at Toddington (Junction 12) to the north, Dunstable/Luton (Junction 11) to the south east and Luton Airport (Junction 10) further to the south. There is also the proposed Junction 11A just to the north, into which the scheme would connect. The motorway is currently being improved between Junctions 10 and 13, as a 'Hard Shoulder Running' (i.e. with live traffic using the existing hard shoulder at peak times) scheme, with some further improvements also proposed to Junctions 11 and 12.
 - The A5, which runs through the centre of Dunstable, from Milton Keynes in the north to Junction 9 of the M1 to the south east.
 - The A6, which runs northwards from the centre of Luton to Bedford.
 - The A505, which runs from the centre of Dunstable eastwards through Luton and on to Hitchin and Royston.
 - The A5120 which runs from the A5 in Houghton Regis northwards to Toddington and Junction 12 of the M1.
 - Sundon Road, which runs from the village of Sundon on the east side of the M1 and into the Parkside area of Houghton Regis.
 - The proposed A5-M1 Link, running from the proposed Junction 11A on the M1, westwards to the north of Houghton Regis to connect with the A5.

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- The Luton Northern Bypass - this road would run to the east from the new Junction 11A on the M1, to connect with the A6 to the north of Luton and then the A505 to the north east. This road has no current funding and no firm timescale for implementation.

14.2.2 The existing urban areas of Dunstable and Houghton Regis are already congested at peak times, with a high proportion of HGVs using the existing network to access the Woodside Industrial Area (to the south of the Porz Avenue/Park Road North roundabout at the south end of the scheme). The existing levels of congestion would be likely to increase with the planned growth to the north of Houghton Regis and also elsewhere around Dunstable and Luton, and the objective of the scheme is to avoid or reduce such congestion as far as possible, and to provide an alternative route to reduce the number of HGV movements along the A5 and A505 through Dunstable town centre.

14.2.3 No specific assessment has been undertaken, and no data is available, but it is likely that the congestion on the existing network would contribute to driver stress.

Public Footpaths

14.2.4 The Ordnance Survey (OS) 1:25,000 mapping shows the following, with numbers from the CBC Definitive Map for routes close to or crossed by the scheme (see Figure 14.1):

- Footpath FP17 runs northwards from close to the electricity substation south of Parkside Drive. It runs towards Chalton Cross Farm but terminates to the south of it.
- A further route (FP7) runs to the north, again towards the farm, from a point close to the Houghton Brook. It divides to the south of the farm, with one branch running north east to terminate at the edge of the motorway, and the other (FP6) running north west, across Sundon Road to the village of Chalton. The branch running to the north east would be diverted as part of the HA's Junction 11A proposals. There is a network of rights of way around the village and connections with Upper Sundon to the north east and Toddington to the north west.
- A third route (FP8) runs to the east from close to the Houghton Brook to the motorway, where there is a connection beneath the M1 to the Leagrave area of Luton.
- There is also a short section of public footpath (FP39) at the southern end of the scheme, running parallel to Sandringham Drive.

Cycle Routes

14.2.5 Parkside Drive forms part of the National Cycle Network Route 6, connecting with Luton to the east (via the motorway underpass at the east end of Kestrel Way) and Leighton Buzzard to the west.

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- 14.2.6 There is also a short section of cycleway along the south side of Sandringham Drive, close to the roundabout on Park Road North (see photograph 11).

Bridleways

- 14.2.7 There are no bridleways in the area around the scheme, and there is not thought to be any significant use of local roads or tracks by equestrians.

Informal Access Routes

- 14.2.8 As noted above, the existing public footpath routes between Parkside Drive and Sundon Road appear to have some gaps, and some of them terminate at apparently random points. The route shown on the OS mapping as running to the east from Houghton Brook to the motorway also runs across the middle of a field, and is not present on the ground. However, there appears to be a more coherent and comprehensive network of routes which are actually in use than the theoretical network shown on the mapping. These routes run along the field margins and also alongside the Houghton Brook, and appear to be used for informal recreation and for dog walking in particular. There are also well used tracks through the areas of rough grass which run alongside the urban edge to the west of the scheme.

- 14.2.9 Parkside Drive is used by pedestrians as well as by cyclists, and the area to the south of it is criss-crossed by informal routes and appears to be well used by pedestrians and also to some extent by cyclists. The main informal routes include those crossing the line of the scheme at the south end of Windsor Drive and the north end of Tomlinson Avenue. There is also a formal, surfaced footpath running to the north from just to the east of Tomlinson Avenue, northwards towards Fensome Drive (the pedestrian counts described in chapter 11 were undertaken at the south end of this path).

Planning Policy

- 14.2.10 The South Bedfordshire Local Plan contains saved Policy R15, which states:

'THE DISTRICT PLANNING AUTHORITY WILL SEEK THE RETENTION OF THE EXISTING PUBLIC RIGHTS OF WAY NETWORK IN SOUTH BEDFORDSHIRE IN ITS ENTIRETY AND WILL OPPOSE PROPOSALS FOR THE DIVERSION OR CLOSURE OF PUBLIC RIGHTS OF WAY WHICH ARE CONTRARY TO THE INTERESTS OF MAINTAINING AND IMPROVING ACCESS TO THE COUNTRYSIDE FOR INFORMAL RECREATION.'

14.3 Project Proposals Including Mitigation Measures

- 14.3.1 One of the principal objectives of the scheme is to relieve existing congestion, which would also have the effect of reducing driver stress. The amenity of journeys on the roads which would be relieved of traffic would also be improved. The scheme itself is therefore intended to provide some mitigation and enhancement in these respects.

14.3.2 In addition, the scheme contains the following features which have been designed to cater for journeys whether in vehicles or by 'non-motorised users' (NMUs):

- Connectivity of side roads would be maintained in all cases apart from Wheatfield Road, where the existing link to the Park Road North/ Poynters Road roundabout would be lost, and a new junction linking Wheatfield Road with the new Woodside Connection would be provided at around Chainage 220. The remaining 200m or so of Wheatfield Road to the south west of this junction would become a dead end. There is also a possibility, to be investigated further at Stage 3, that a connection from the new road into Parkside Drive to the north could be provided. The scheme would also provide a connection between the proposed Junction 11A and Sundon Road - without the Woodside Connection there would be no connectivity between the two.
- Where each route option crosses existing public rights of way or other significant pedestrian routes, at grade crossing points would be provided wherever possible. Where practicable the crossing points would be located at the junctions, but dedicated at grade crossing points would also be provided - details are shown on Figures 2.1 to 2.6, and are also described in chapter 11.
- Where public rights of way cross the route, and at grade crossing points are not possible, diversions to maintain the connectivity of the route would be provided. In the central part of the scheme, around the proposed area of Exchange Land, there would be the potential for some enhancement to the existing situation, with new links between the rights of way, connections to the existing informal routes and improved waymarking and surfacing for the formal and informal routes.
- Consultation with CBC has identified a need to provide a grade separated crossing facility at Parkside Drive/ Pastures Way by making use of one of the proposed river crossings. This crossing would provide for the National Cycle Network Route 6 which currently uses Parkside Drive as well as making provision for pedestrian use. The viability of incorporating this NMU route as part of the river crossing will be investigated during the Stage 3 Assessment.

14.4 Assessment of Effects

The Local Road Network

14.4.1 The scheme would be a new element in the local road network, and would provide a new link to the Woodside area of Dunstable and Houghton Regis, improving access to that area from the strategic road network. It would remove traffic, especially HGVs, from the urban areas of Houghton Regis and Dunstable. This would relieve congestion, improve air quality and

promote regeneration in those urban areas. The detailed design of the scheme will ensure that there would be no adverse effect on the immediate local road network.

Public Rights of Way

14.4.2 All three of the route options would require some diversion of the existing public rights of way along the line of the scheme (see also drawings 2.2. to 2.8):

- The Blue Route would require minor diversions of the southern ends of FP8 and FP17, and these routes would cross the scheme by means of the river crossing underbridge at Chainage 1100. At the north end of the scheme, FP7 would be stopped up near Chalton Cross Farm but a connection to the north would be provided by means of FP6, which would link with the diversion proposed under the A5 - M1 Link scheme.
- The Green Route would require longer diversions of FP17 and FP8 at its southern end, and FP7 would be diverted to run on the west side of the new road in its central section. Arrangements at the northern end would be similar to those for the Blue Route.
- The Orange Route would require the least amount of footpath diversion, as FP7, 8 and 17 are almost entirely to its east at the southern end. Arrangements at the northern end would be similar to those for the Blue Route.

14.4.3 Effects for all three routes would be adverse, but those for the Green Route would be greatest, and those for the Orange Route would be least. Effects would be in terms of the partial stopping up of some routes, the diversion of others to create a longer route, and also loss of amenity where existing or diverted routes are affected in terms of views of or noise from the new road (though all of the routes are already affected by the sight and sound of the M1 motorway and its traffic). Visual effects on public rights of way are considered in chapter 10.

14.4.4 In each case, the adverse effects would be to some extent balanced by improved waymarking and connectivity for the formal (and also the informal) routes at the southern end of the scheme, particularly those within and around the proposed area of Exchange Land. Using the methodology set out in the DMRB guidance (Volume 11 Section 3 Part 8), effects would be **slight adverse**, in that people would be unlikely to be deterred from making a trip, but there would be some added difficulty of movement.

14.4.5 Effects in all cases would be greater during the construction period, and some routes may need to be closed for a period if temporary diversions cannot be provided while construction severs the existing route and prior to the diverted route becoming available.

Cycle Routes

- 14.4.6 If the proposed link beneath the new road at Chainage 1100 provides for the National Cycle Network Route 6, then there would be **no significant adverse effects** on cycle routes in the medium to long term. However there would be some short term disruption during the construction period, and temporary diversions would be necessary to maintain the route during construction.
- 14.4.7 Once the new road is completed, people will be able to cycle along it, and a new route will therefore be made available, producing **some beneficial effects**.

Bridleways

- 14.4.8 There are no bridleways in the area around the scheme, and there is not thought to be any significant use of local roads or tracks by equestrians. There would therefore be no effects.

Informal Access Routes

- 14.4.9 There would be some effects on the informal routes both to the south of Parkside Drive in the area of informal open space, and to the north, around the field margins and alongside the Houghton Brook. These routes are unofficial and have no status, but are nevertheless well used. There would be some disruption to this use, both during construction and as a result of the completed scheme, but this would be minimised by means of the various crossing points and footpath diversions noted above, and there would also be some beneficial effects in terms of improved surfacing and connectivity within and around the area of proposed Exchange Land. On balance effects would be **slight adverse**.

Driver Stress

- 14.4.10 As the objective of the scheme is to improve access and minimise congestion, it would result in a **net overall decrease in driver stress** on the local road network. There may be some short term increases in driver stress during the construction period, when there may be some delays due to the works on the tie-in sections and prior to the completed road being available to traffic.

The View From the Road

- 14.4.11 As the new road would be relatively short in terms of length and travel time along it, considerations of potential driver boredom and the need to introduce some variety of experience would not be particularly relevant. In any case the experience of driving along the road would vary, ranging from enclosed, largely urban views at the southern end, to more expansive views across agricultural land (though still with some urban elements) in the central section, and ending with a section in cutting with more restricted views, leading to a connection to a major motorway junction at the northern end. Views would be more contained to the south of Parkside Drive, and the proposed planting would tend to further contain them over time, whereas views in the central section would be more open, especially

where the new road is on embankment.

- 14.4.12 If the wider development to the north and east of Houghton Regis proceeds, then this would significantly affect and curtail views from the road in any case, and the experience of driving along the section to the north of Parkside Drive would be very different.

14.5 Summary

- 14.5.1 The existing urban areas of Dunstable and Houghton Regis are already congested at peak times, with a high proportion of HGVs using the existing network to access the Woodside Industrial Area. The existing levels of congestion would be likely to increase with the planned growth to the north of Houghton Regis and also elsewhere around Dunstable and Luton.
- 14.5.2 There are several public rights of way along the line of the scheme, including a cycleway which is part of the National Cycle Network. There is also informal public access in the area to the south of Parkside Drive and around the field margins to the north of Parkside Drive.
- 14.5.3 The scheme would be a new element in the local road network, and would provide a new link to the Woodside area of Dunstable and Houghton Regis, improving access to that area from the strategic road network. It would remove traffic, especially HGVs, from the urban areas of Houghton Regis and Dunstable, thereby relieving congestion in those urban areas. The detailed design of the scheme will ensure that there will be no adverse effect on the immediate local road network.
- 14.5.4 The scheme design includes a variety of measures such as at grade crossing points or local diversions to provide for access along public rights of way. The minor diversions would result in some slight adverse effects for users of the rights of way, though there would be also beneficial effects in terms of improved waymarking. There would also be slight adverse effects for users of the informal access routes to the south of Parkside Drive, though again there would also be some benefits in terms of rationalisation of the routes and improved surfacing and connectivity.
- 14.5.5 The scheme would result in a net overall reduction in driver stress on the local network, as a result of decreased congestion and improved connectivity.

15 Assessment of Cumulative Effects

15.1 Introduction and Methodology

15.1.1 The aim of this part of the assessment is:

- To consider whether any of the effects identified in the above chapters may be cumulative, or may interact in such a way that the combined effects on any given receptor are greater than the sum of the individual effects.
- To place the assessment in the wider context of other schemes in the area, and consider whether the effects of the scheme may interact with those of other schemes.

15.1.2 Guidance on the assessment and reporting of cumulative effects is provided to some extent in IAN 125/09 and also in the DMRB Volume 11 Section 2, Parts 5 and 6, though this guidance is quite brief. IAN 125/09 notes that:

'Project teams should concentrate on the main likely significant cumulative effects, rather than trying to report every interaction.'

15.1.3 The DMRB Volume 11 Section 2, Part 5 notes that the individual topic effects on a given receptor may not necessarily be significant, but that when all of the various topic effects are considered together, then the overall, cumulative effects on a receptor may be significant. The following is a reproduction of Table 2.6 from the DMRB guidance, which suggests criteria for determining the significance of cumulative effects in terms of their impact on project decision making.

Table 15.1 ~ Determining the Significance of Cumulative Effects	
Significance	Effect
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issues.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

15.2 Cumulative Effects of Various Topics

15.2.1 Potential interactions between environmental topics and issues assessed at Stage 2 are shown in Table 15.2 below.

Table 15.2 ~ Potential Interactions Between Environmental Topics										
	Geology and Soils	Road Drainage & the Water Environment	Materials	Cultural Heritage	Nature Conservation	Landscape	Community and Private Assets	Air Quality	Noise & Vibration	Effects on All Travellers
Geology and Soils										
Road Drainage & the Water Environment										
Materials										
Cultural Heritage										
Nature Conservation										
Landscape										
Community and Private Assets										
Air Quality										
Noise & Vibration										
Effects on All Travellers										

Interactions Between Topics

15.2.2 Interactions are possible between (for example) road drainage and nature conservation, where effects on watercourses or the provision of new drainage ponds may have effects on nature conservation, or between noise and visual effects, if new noise barriers are proposed.

15.2.3 In the case of the Woodside Connection, the main potential interactions between topics have been identified as follow:

- The road drainage proposals, nature conservation and landscape, in terms of the creation of new wetland areas and grass swales. The interaction should be positive, in that the proposals would provide mitigation or enhancement for all of the topics concerned.

-
- Landscape and noise, in terms of the provision of noise barriers at the southern end of the scheme. The barriers, while provided for noise mitigation, would also screen lower levels views of the new road and the traffic using it, but there is the potential for the barriers themselves to be unsightly and create adverse visual effects. The barrier design will seek to avoid this by use of appropriate materials and/or screen planting.
 - Landscape and cultural heritage, in terms of possible effects on the historic landscape. This is a question of overlap between topics rather than interaction, and the effects on the historic landscape are assessed in chapter 8 in terms of Heritage Assets such as historic hedgerows.
 - Landscape and effects on all travellers - this is again a question of overlap, as some of the effects on pedestrians and also vehicle travellers are expressed in terms of changes in their views. Visual effects on all receptors, including travellers, are assessed in chapter 10.
 - Geology and road drainage, in terms of potential effects on groundwater - these are assessed in chapter 6.
 - Landscape and nature conservation, in terms of the potential for joint mitigation or enhancement resulting from the scheme landscape proposals, which have been designed in principle to use almost entirely native species and create areas of landscape and amenity benefit which will also have some nature conservation value. The scheme landscape proposals are described in chapter 10.
 - Geology and soils and community assets - this is also a question of potential overlaps between topics rather than interaction, in that consideration of soils and agricultural land quality to some extent comes under both headings. Details of the on site assessment of agricultural land quality and soil types are set out in the Agricultural Land Assessment report in Volume 2 of the EAR, and summarised in chapter 11.

15.2.4 Individual receptors may also experience effects in terms of more than one topic - for example, properties close to the southern part of the route could potentially experience effects in terms of air quality, noise, visual effects and also loss of land used for informal recreation. There would therefore be some potential for cumulative effects on these properties. The assessment will therefore take this into account, and address the potential

cumulative effects on these receptors, and any others which may experience a variety of effects.

15.2.5 Table 15.2 below summarises the main, potentially significant cumulative effects on individual receptors or groups of receptors which are anticipated to arise from the scheme.

15.2.6 In terms of the significance criteria set out in Table 15.1 above, the cumulative effects identified in Table 15.2 would be of **minor to moderate significance**, in that they are locally significant and will need to be taken carefully into account as the scheme design and assessment progress, but are unlikely to become issues as to whether or not the scheme should proceed.

15.2.7 In terms of the choice between the three route options, there would be little difference in respect of the cumulative effects identified. This is because the greatest potential for cumulative effects is to the south of Parkside Drive, where the routes are very similar.

Table 15.3 ~ Summary of Cumulative Effects

Receptor	Individual Topic Effects on Receptor					Cumulative Effects	
	Drainage	Nature Conservation	Landscape	Air Quality	Noise & Vibration	Nature	Notes
Properties around Sandringham Drive	N/A	N/A	Adverse visual effects, up to moderate to large adverse in Year 1.	Some increase in pollutant levels but changes would not be significant, and levels would be within air quality objectives.	Significant effects predicted in the absence of mitigation.	Effects would be direct and persistent, though visual effects would decline over time.	Up to moderate adverse effects for visual effects, insignificant for air quality. Significant adverse effects for noise, but will be reduced by proposed mitigation.
Properties around Wheatfield Road	N/A	N/A					
Properties on eastern edge of Houghton Regis	N/A	N/A					
Chalton Cross Farm (as a residential receptor)	N/A	N/A	Moderate adverse visual effects.	Slight adverse effects.	Significant noise increase predicted.	Direct and persistent effects due to proximity of new road.	Moderate adverse visual effects, slight adverse effects for air quality and significant adverse effects for noise. It is likely that the property would be demolished as part of the wider development in this area.
Chalton Cross Farm (as a farming operation)	N/A	N/A	N/A	N/A	N/A	Farm would experience loss of land, loss of some buildings and severance. Farm also affected by A5-M1 Link. Farm operations would be able to continue, with appropriate mitigation.	Farming operation would cease completely if the wider development in this area goes ahead.

Table 15.3 ~ Summary of Cumulative Effects (continued)

Receptor	Individual Topic Effects on Receptor					Cumulative Effects	
	Drainage	Nature Conservation	Landscape	Air Quality	Noise & Vibration	Nature	Notes
Area of informal open space south of Parkside Drive	N/A	Some loss of vegetation, some low level effects on nature conservation interest.	Slight to moderate adverse landscape effects and up to moderate adverse visual effects for users.	Potential effects for users as they pass close to the new road, but duration of exposure would be short and no significant adverse effects anticipated.	Significant effects predicted in the absence of mitigation.	Direct and persistent effects, would also be some disruption to usage and necessity to cross the new road.	A range of adverse effects would result, but there would also be some beneficial effects in terms of improved provision of usable open space, better management and surfacing of informal access routes.
Users of public rights of way	N/A	Some low level effects on nature conservation interest may affect enjoyment of routes.	Moderate adverse visual effects for users close to crossing points.		Some effects where rights of way are close to or crossing the routes.	Direct and persistent effects, would also be some disruption to usage and necessity to cross the new road.	A range of adverse effects would result, but there would also be some beneficial effects in terms of improved waymarking.

Notes:

1. Most of the above receptors would also experience some additional short term, temporary effects during construction, but they would not be persistent enough to lead to medium or long term cumulative effects. Residential properties may experience effects in terms of air quality, noise and visual effects during construction, but these would be temporary only and the noise and air quality effects would be mitigated by good construction practice.

15.3 Interactions With Other Projects

15.3.1 Development projects within the area around the scheme are summarised below, together with their current status:

- The A5-M1 Link will be a major new road running immediately to the north of the scheme, which would to some extent create a barrier between the area around the scheme and the village of Chalton to the north. The Public Inquiry for this HA scheme, originally set for July 2010, was postponed and eventually held in February 2012. Construction is now anticipated to commence in 2014. While the timing of this scheme is to some extent uncertain at the moment, the Stage 2 assessment has assumed it to be present, as the Woodside Connection scheme cannot proceed without it. The construction works for the scheme would need to be programmed with those for the A5-M1 Link to avoid any conflicts, though there may be some benefits if the A5-M1 Link were to be completed first, as it would provide improved access for scheme construction traffic.
- The new M1 Junction 11A would form part of the A5-M1 Link proposals and is subject to the timing constraints noted above.
- The M1 is currently being improved between Junctions 10 and 13, as a 'Hard Shoulder Running' scheme, with some further improvements also proposed to Junctions 11 and 12.
- The wider employment and residential development to the north and east of Houghton Regis has not yet been formally, and the assessment has assumed that it will not be in place. However, if this development were to proceed then there could be some potential conflict with the scheme in terms of cumulative construction effects (depending on the timing of the respective works). Conversely, the scheme would help to facilitate the wider development in terms of the provision of new access to the area to the east of Houghton Regis.
- The Luton Northern Bypass, M1 to the A505, is an aspiration rather than a firm proposal, and is likely (if it proceeds at all) to follow a later programme than the Woodside Connection. This scheme is in two parts, with the western part (M1 to the A6) more advanced and more likely to proceed to further assessment than the eastern part (A6 to the A505).
- The Environment Agency Houghton Brook Flood Storage Area (FSA) scheme near the M1 (see Figure 6.7). There would be no real conflict between this proposal and the scheme, and the drainage proposals for the scheme could interact with this proposal in a positive manner, but there could be some conflict between the proposed FSA and the wider development described above in terms of loss of

potential development land.

- 15.3.2 The main effects in terms of the interaction of these projects would be on landscape character zone 5 (see chapter 10 for details), through which the scheme route options pass to the north of Parkside Drive. This area would be affected by the scheme itself, by the new Junction 11A and the A5-M1 Link and also to some extent by the FSA and the M1 Junctions 10 to 13 scheme. There could therefore be significant cumulative landscape effects on this area if all of the above were to proceed, though if the wider employment and residential development also proceeds then this area would be developed anyway, and would to a large extent cease to be landscape, as it would be incorporated within the urban area.

16. Summary of Significant Effects

16.1 Introduction

16.1.1 As noted in section 4.3, the environmental assessment process is geared towards the identification of the likely significant effects on the environment, and this section considers whether any of the anticipated effects are of sufficient significance to be taken into account in the decision making process. Any effects of moderate or greater significance have been taken to be important to the decision making process, and these are summarised below.

16.1.2 However, environmental assessment is an iterative process, and the scheme design and associated mitigation will seek to minimise all adverse effects of whatever level of significance and to seek opportunities for additional or increased beneficial effects where possible in Stage 3. Thus, while (for example) slight to moderate adverse visual effects on a number of properties would not in principle be taken as an indication that the scheme should not proceed or that its design should be specifically amended to avoid or reduce those effects, the developing design will still, as a matter of good practice, seek to minimise those effects wherever possible.

16.2 Summary of Significant Effects

16.2.1 Adverse effects of moderate or greater significance are:

- A potentially moderate adverse effect on groundwater during the construction phase has been identified, as a result of the route alignments being located in a Source Protection Zone. However, this is a provisional assessment only, pending the development of more detailed and specific mitigation measures - these will be developed at Stage 3 for inclusion in the CEMP, which will reduce the risk of pollution to the groundwater, and significant adverse effects can then be avoided.
- Moderate or moderate to large adverse visual effects for around 80 properties, mostly to the south of Parkside Drive. These effects would be for the winter of the first year after the opening of the scheme, and should decline over time such that no effects would be moderate adverse or greater by the summer of Year 15.
- Moderate adverse visual effects for users of public rights of way crossed by the scheme. These effects would be for the winter of the first year after the opening of the scheme, and should decline over time such that no effects would be moderate adverse or greater by the summer of Year 15.
- Moderate adverse visual effects for users of the informal open space area to the south of Parkside Drive. These effects would be for the winter of the first year after the opening of the scheme, and should decline over time such that no effects would be moderate adverse or greater by the summer of Year 15.

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- Significant noise effects have been identified for a large number of properties towards the southern end of the scheme. However, the assessment to date has not taken account of the use of a noise-reducing road surface or of the noise barriers which are likely to be provided. These mitigation measures will be further investigated at stage 3 and incorporated into the scheme design. They should be capable of reducing any noise increases to a level at which there would be no significant adverse noise effects.
- 16.2.2 There are no beneficial effects of moderate or greater significance in terms of the various environmental topics assessed, but the scheme itself has been designed to provide significant benefits in terms of improved access to the Woodside area and reduction of congestion along existing routes.
- 16.2.3 In summary, this Stage 2 EAR has shown that there are no overriding environmental obstacles to the construction of the scheme, and that there are expected to be few significant adverse effects. Any effects of moderate or greater significance which have been identified are expected to decline in significance over time, or (in the case of noise) to be effectively mitigated by the measures to be included within the scheme design at Stage 3.
- 16.2.4 There are a number of other areas which will require further assessment and design refinement at Stage 3, with the aim of reducing those effects which are at moderate or greater levels of significance, and the developing design will also seek to ensure the 'best environmental fit' and the lowest practicable level of adverse effects.
- 16.2.5 As the design proceeds, it will also seek to maximise beneficial environmental effects, in particular those which are expected to arise from the provision and future management of the area of Exchange Land and the residual areas of open space alongside the road to the south of Parkside Drive.

Glossary of Technical Terms and Abbreviations

AADT (Annual Average Daily Traffic) flows - the total volume of vehicle traffic in both directions of a road over the course of a year, divided by 365 days.

AAS (Areas of Archaeological Significance) - places of special archaeological interest.

Accessible Greenspace - an area of land which provides opportunities to the public for (usually) informal recreational purposes.

Air Quality Strategy (AQS) Objectives - objectives for key air pollutants to protect health

ALC (Agricultural Land Classification) - the system used by Defra to classify agricultural land value.

Ambient Monitoring Stations (AMS) - locations where the sound pressure level (noise) is measured.

Amenity - the pleasant or normally satisfactory aspects of a location that contribute to its overall character and the enjoyment of residents or visitors.

AOD - Above Ordnance Datum, or mean sea level.

AONB - Area of Outstanding Natural Beauty.

APIS - Air Pollution Information System.

ATM (Active Traffic Management) - a new form of traffic management on motorways designed to tackle congestion and improve the reliability of journey times, combining technologies, infrastructure and procedures. The aim of ATM is to make the best use of the existing road space, providing extra capacity for vehicles, whilst minimising environmental disruption.

AQMA (Air Quality Management Area) - places where air quality objectives are not likely to be achieved. Where an AQMA is declared, the local authority is obliged to produce an Action Plan in pursuit of the achievement of the air quality objectives.

Archaeological Data Service - online archaeological database.

Archaeological Desk-Based Assessment - an archaeological desk study including baseline and archaeological/ heritage impact assessment.

ARW (Ancient Replanted Woodland) - woodland which has been felled and replanted at some stage.

ASNW (Ancient Semi-Natural Woodland) - Natural England's definition for a woodland which has had continuous cover since at least 1600AD.

AST (Appraisal Summary Table) - a one page tabular summary of the main economic, environmental and social impacts of a transport solution. Providing the information in this way enables a clearer and more consistent view to be taken about the value of projects.

Aquifer - a below ground rock formation which contains water, which is often used for water supply.

BAP (Biodiversity Action Plan) - a document which designates species that at a national or regional scale are exhibiting a significant decline in numbers and for which specific action plans are being put into effect to reverse this trend.

Baseline - the situation against which future effects of a development are compared. The baseline is not necessarily the same as the existing situation, as other changes may be certain or likely to take place in the absence of the development, so the comparison to be made in some cases is between the future situation with the development in place and the baseline (the future situation without the development in place).

BGS - British Geological Survey.

Biodiversity - the biological diversity of the earth's living resources.

Birds of Conservation Concern - the UK's leading bird conservation organisations have produced a quantitative review of the status of the birds that occur regularly. A total of 246 species have been assessed against a set of objective criteria to place each on one of three lists - green, amber and red - indicating an increasing level of conservation concern.

BPM - Best Practicable Means

Built Form - the component features of buildings, streets and spaces that make up the urban environment.

CAFÉ - Clean Air for Europe

Calcareous - containing calcium carbonate (lime). Usually refers to limestone or chalk if used in reference to rock types.

CEMP (Construction Environmental Management Plan) - a plan that sets out the procedures which site contractors must follow during construction to ensure a high standard and best practice protection of the environment.

Chainage - unit of measurement used in road schemes, in metres.

CIRIA - Construction Industry Research and Information Association.

Connectivity - a measure of the functional availability of the habitats needed for a particular species to move through a given area.

Conservation Area - an area given statutory protection under the Planning Acts, in order to preserve and enhance its character and townscape.

Contaminated Land - land is designated as 'contaminated' provided it meets the criteria set out in Part 2A of the Environmental Protection Act, 1990. Otherwise, land may be classed as 'potentially' contaminated.

Controlled waters - In England, Scotland and Wales, a term used to describe groundwater and surface waters which are subject to control to maintain their quality.

CWS (County Wildlife Sites) - non-statutory designated areas of land that are important at a County level because of their wildlife.

Cumulative effects - the summation of impacts that result from changes caused by a development in conjunction with other past, present or reasonably foreseeable actions, or a range of different effects arising from a single development on the same receptor.

Cyprinid - coarse fish such as carp, tench, barbel, rudd and roach. These fish are generally found in slower moving waters or lakes.

dB (decibel) - a unit used for measuring noise levels, or the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2×10^{-5} Pa).

dB(A) - an 'A-weighted' decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Determinand - a chemical being measured and used, in this case, as an index for water quality.

Defra - Department for Environment, Food and Rural Affairs.

DfT - Department for Transport.

DMRB (Design Manual for Roads and Bridges) - a series of 15 volumes produced by the Highways Agency, which provides official standards, advice notes and other documents relating to the design, assessment and operation of trunk roads (including motorways).

EA - Environment Agency.

EAR (Environmental Assessment Report) - a report setting out the results of an EIA, in accordance with DMRB methodology and guidance.

EC - European Community.

EIA (Environmental Impact Assessment) - the evaluation of the impacts on the environment of particular development proposals.

ES - Environmental Statement.

Environment - our physical surroundings including air, water and land.

EQS (Environmental Quality Standards) - A list of prescribed thresholds for assessing water quality as set out in EC Dangerous Substances Directive 76/464/EEC.

EPAQS - Expert Panel on Air Quality Standards

Façade Level - sound field (noise level) defined 1 metre from a solid, reflecting surface, such as a building. Typically it is 3dB higher than a free-field level.

Free-field Level - sound field (noise level) determined at a point away from reflective surfaces other than the level ground, with no significant contributions due to sound from other reflective surfaces. Generally it is measured outside and at least 3.5 metres away from buildings.

GQA (General Quality Assessment) - an assessment procedure used to define the quality of a surface watercourse. It may be defined as chemical or biological.

Green Belt - specially designated area of countryside protected from most forms of development in order to prevent urban sprawl and the coalescence of settlements, preserve the character of existing settlements and encourage development to locate within existing built-up areas.

Green Infrastructure - the Natural England definition is:

'Green Infrastructure (GI) is a strategically planned and delivered network of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering a wide range of environmental and quality of life benefits for local communities. Green Infrastructure includes parks, open spaces, playing fields, woodlands, allotments and private gardens.'

Groundwater - water occupying space in rocks (aquifers) or the subsoil.

Groundwater status - the general expression of the status of groundwater determined by the poorer of its quantitative status and chemical status.

Habitat - a place in which a particular plant or animal lives. Often used in the wider sense referring to major assemblages of plants and animals found together.

Habitats and Species of Principal Importance - the Natural Environment and Rural Communities (NERC) Act came into force on 1st Oct 2006. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England.

HSR (Hard Shoulder Running) - the controlled use of the Hard Shoulder of motorways during periods of high vehicle flow or incidents.

HA - Highways Agency.

HGV- Heavy Goods Vehicle.

HER - Historic Environment Record - the archaeological sites and monuments database developed and maintained by local authorities for planning control and research purposes.

HLC - Historic Landscape Character.

IFA - Institute of Field Archaeologists.

Indirect impacts - impacts on the environment that are not a direct result of the development but are often produced away from it or as a result of a complex association, such as off-site traffic movements.

Integrity - the coherence of a site's ecological structure and function across its whole area that enables it to sustain the habitat, complex of habitats and/or levels of populations of the species for which it was classified.

L_{Aeq} - the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. It is used to characterise intermittent sources of noise such as railways or construction sites.

L_{Amax} - the maximum A-weighted sound pressure (noise) level recorded over the period stated. L_{Amax} is often used as a measure of the most obtrusive facet of the noise, even though it may only occur for a very short time and is the level of the maximum Root Mean Square reading. The time weighting response of the sound level meter (fast (F), slow (S) or impulse (I)) should also be specified to make the reading meaningful, which is reported as L_{AF,max} in dB, for example. Unless specified otherwise, it is measured using the 'fast' time weighting response.

L_{A10} & L_{A90} - if a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_{An} indices are used for this purpose, and the term refers to the A-weighted level exceeded for n% of the time. Hence L_{A10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{A90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{A10} index to describe traffic noise.

LAQM - Local Air Quality Management.

Listed Building - building or other structure of special architectural or historic interest included on a statutory list and assigned a grade (I, II* or II).

L/s - litres per second.

LDV - Light Duty Vehicle.

Made Ground - ground formed by filling in natural or artificial pits with hardcore or rubbish.

Main River - a river maintained directly by the EA.

Mitigation - measures (including any process, activity or design) to avoid, reduce, remedy or compensate for the adverse impacts of a development project.

NAQS - National Air Quality Strategy.

NATA - New Approach To Appraisal.

Natural Areas - Biogeographic regions in England, as specified by Natural England.

NMR (National Monuments Record) - the records and archives section of English Heritage.

NVC - National Vegetation Classification.

Noise - is defined as unwanted sound, and the unit of measurement is the decibel (dB). Noise levels range from the threshold of hearing at 0 dB to levels of over 130dB at which point the noise becomes painful.

NMU (Non-Motorised User) - users of roads or rights of way including cyclists, pedestrians and equestrians.

NO₂ - Nitrogen Dioxide.

NO_x - Oxides of Nitrogen.

O₃ - Ozone.

OS - Ordnance Survey.

PAH - Polycyclic Aromatic Hydrocarbons.

PPV (Peak Particle Velocity) - the maximum value of particle velocity obtained during a given interval, used as a measure of vibration.

PM_{2.5} - particulate matter smaller than 2.5 Micrometer (µm) in diameter.

PM₁₀ - particulate matter smaller than 10 Micrometer (µm) in diameter.

PPG - Planning Policy Guidance, issued by the Government in a series of Planning Policy Guidance Notes, now largely superseded by PPSs. .

PPS (Planning Policy Statements), planning policy as issued by the Government in a series of topic papers.

Public Open Space - land provided in urban or rural areas for public recreation.

PRoW (Public Right of Way) - footpaths, bridleways or other routes on which the public have a legally protected right to pass.

Reach - a stretch of a river used in the assessment of water quality.

Receptor - a resource, location, person, group or property that will experience (or receive) an environmental impact.

RIGs (Regionally Important Geological Sites) - important geological or geomorphological sites (not statutorily protected)

River Ecosystem Classification - a classification system defined in the Surface Waters (River Ecosystem) (Classification) Regulations 1994 to determine standards of water quality for fisheries.

River Quality Objective - objectives set for water quality in rivers.

Salmonid - salmon and trout. These fish are generally found in waters that are fast flowing stretches of river that have high oxygen content and a low level of nutrients.

Scheduled Monument - a nationally important archaeological site or historic building, which has been given protection against unauthorised change.

SINC (Site of Importance for Nature Conservation) - a site with wildlife that is of value at a County level (not statutorily protected).

SSSI (Site of Special Scientific Interest) - wildlife and geological sites of national importance, protected by legislation.

SMR (Sites and Monuments Record) - a County level record of sites and finds of archaeological importance.

SGVs (Soil Guideline Values) - contamination screening criteria generated by the Environment Agency for assessing the risk posed to human health from long term exposure to contamination.

SO₂ - Sulphur Dioxide

Sound - consists of vibrations transmitted to the ear as rapid variations in air pressure, the more rapid the fluctuation the higher the frequency of the sound. However the sensitivity of the human ear varies with frequency. Therefore most everyday noise is measured in dB(A), the (A) suffix indicating that the measured level has been modified to allow for this phenomenon. It has been found that changes in noise level when measured in dB(A) most closely correlate with the changes in subjective reaction.

Strata - rock layer.

Sustainability - meeting the needs of the present without compromising the ability of future generations to meet their own needs (environmental, social and economic).

Surface water - water features present above ground including rivers, lakes, reservoirs, canals, streams, ditches, coastal waters and estuaries.

TAG (Transport Analysis Guidance) - DfT guidance on the appraisal of transport projects.

THC - Total Hydrocarbons

UKAQA - United Kingdom Air Quality Archive

Visual envelope - extent of potential visibility to or from a specific area or feature (see also ZVI).

WHO - World Health Organisation,

ZVI (Zone of Visual Influence) - area within which a proposed development may have an influence or impact (see also visual envelope).

Appendix 1 Scoping Report Consultee Comments

Summary of Responses to Environmental Assessment Scoping Report, as at 7.9.10

Notes:

1. In order to assist with the preparation of the EAR, and as a matter of good practice, a Scoping Report was prepared which set out the proposed scope of the assessment, under the topic headings used in the Design Manual for Roads and Bridges (DMRB). The Scoping Report was sent out to a range of statutory and non-statutory environmental consultees, in order to seek their views on the proposed scope of assessment and also to ascertain whether the consultees were aware of any additional information which may be useful in the assessment.
2. Copies of the report were provided to the bodies listed in the summary table on the following pages, on the dates shown. Responses were received from most of the organisations concerned, as indicated, and further consultation also took place during the course of the assessment.
3. The 'Proposed Action' column of the summary table indicates the actions which were proposed at the time (September 2010) in response to the various comments, and all those actions have now been carried out.

Woodside Connection, Houghton Regis

Summary of Responses to Stage 2 Environmental Assessment Scoping Report

Organisation	Report Sent	Response Received	Summary of Response	Proposed Action	Notes
English Heritage (Cambridge)	1.4.10	28.4.10	<ol style="list-style-type: none"> 1. Consider potential effects on setting of listed buildings in Chalton and at Houghton Hall. 2. Consider effects on AONB to the north east, as well as to the south. 3. Consider cumulative effects on/of other projects including the M1 Junctions 10 to 13 improvements. 	Assessment to include all these points.	
Environment Agency (Huntingdon)	1.4.10	12.5.10	<ol style="list-style-type: none"> 1. Consider effects on proposed Houghton Brook flood storage area to the south east. 2. Scope of Flood Risk Assessment agreed. 3. Recommends water vole survey. 4. Recommends survey for white clawed crayfish. 5. Consider requirements of the Water Framework Directive. 	<ol style="list-style-type: none"> 1. Assessment to include this. 2. Noted. 3/4. Water vole and crayfish surveys included in assessment. 5. Assessment will include this. 	Further discussion with EA resulted in agreement that formal FRA more appropriate at Stage 3, for the adopted route, and is not required at Stage 2.
Natural England (Peterborough)	1.4.10	22.4.10	<ol style="list-style-type: none"> 1. Consider potential effects on Houghton Regis Marl Lakes SSSI. 2. Consider potential presence of and effects on scarce arable plants. 3. Assessment for nature conservation to distinguish between mitigation and enhancement. 4. Identify opportunities for landscape enhancement. 5. Consider agricultural land classification and soil survey, consider sustainable use of soil resource, soil handling during construction and potential effects on land drainage. 6. Relate assessment to Strategic Green Infrastructure Plan. 7. Consider relationship with proposed flood management works to south east. 	<ol style="list-style-type: none"> 1. Assessment to include this. 2. Scarce arable plant assessment included. 3. Noted. 4. Assessment to include this. 5. ALC, soil and farm impact study to form part of the assessment. 6. Assessment to include this. 7. Assessment to include this. 	

Woodside Connection, Houghton Regis					
Summary of Responses to Stage 2 Environmental Assessment Scoping Report (continued)					
Organisation	Report Sent	Response Received	Summary of Response	Proposed Action	Notes
Central Bedfordshire Council	14.4.10	20.5.10	<ol style="list-style-type: none"> Welcome suggestion to produce a landscape masterplan for the residual areas of informal open space around the south western part of the route. Meeting to be arranged to discuss landscape design for these residual areas. Refer to CBC Green Infrastructure Plan. Agree that baseline for landscape assessment should be the existing situation, as development to the north of Houghton Regis is not yet committed. 	<ol style="list-style-type: none"> Proposals to be developed. Meeting to be arranged once road and residual area proposals have developed. Assessment to include this. Noted. 	<ol style="list-style-type: none"> Meeting held on 24.8.10 and approach agreed. <p>Agreed with EHOs that Simple Assessment only can be carried out for noise, with Detailed Assessment to follow at Stage 3.</p>
Luton Borough Council	14.4.10	No written response, but various discussions have taken place.	LBC had no specific comments at this stage.	Liaison with LBC to continue, LBC likely to make more detailed comments at Stage 3.	
Chilterns Conservation Board, Chinnor	1.4.10	16.4.10	No comments.	Assessment to proceed on basis as set out in Scoping Report.	
The Wildlife Trust (Bedfordshire), Bedford	1.4.10	8.4.10	Recommend water vole survey be included, as some signs of water vole were found in 2008.	Water vole survey included in assessment.	
The Wildlife Trust (Hertfordshire), St Albans	1.4.10	23.4.10	No comments - would defer to response from Bedfordshire.	-	
Campaign to Protect Rural England, Bedford	1.4.10	26.4.10	<ol style="list-style-type: none"> Query over relationship of this scheme to HA scheme for future Junction 11A on M1, and local connectivity. Assessment should consider night and also day time effects of any new lighting. 	<ol style="list-style-type: none"> Proposals have changed since the early version of the route sent out with the Scoping Report. Both day and night time effects to be considered. 	
Friends of the Earth, Luton	1.4.10	No response received.	-	-	

Woodside Connection, Houghton Regis					
Summary of Responses to Stage 2 Environmental Assessment Scoping Report (continued)					
Organisation	Report Sent	Response Received	Summary of Response	Proposed Action	Notes
Ramblers, London	1.4.10	4.5.10	Response from local (Leighton Buzzard) group - scope of assessment accommodates Ramblers' interests.	Assessment to proceed on basis as set out in Scoping Report.	
Sustrans, Bedfordshire	1.4.10	14.4.10	Main concern would be over continuity of existing National Cycle Network Route 6.	Design to take account of need to maintain route with minimal interruption.	
Dechert LLP, London	1.4.10	16.4.10	No specific response, as land holdings not directly affected.	-	