



UNIVERSAL DESTINATIONS & EXPERIENCES UK PROJECT

Former Kempston Hardwick Brickworks
and adjoining land, Bedford

Environmental Statement Volume 3

Appendix 3.2 - Significance Criteria for all ES Technical Topics

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APPENDIX 3.2: SIGNIFICANCE CRITERIA FOR ALL ES TECHNICAL TOPICS

This appendix provides a summary of the significance criteria used to define the effects reported in the Environmental Statement (ES) by each of the environmental technical topics. The significance criteria for **Chapter 7: Landscape and Visual Impact Assessment (Volume 1)** has been provided in **Appendix 7.3: LVIA Methodology (Volume 3)** of the ES. The significance of effect criteria for **Chapter 10: Cultural Heritage (Volume 1)** is presented in Section 10.4 of that chapter.

This appendix also sets out summaries of the standard assessment methodologies employed for **Chapter 5: Traffic and Transport (Volume 1)**, **Chapter 11: Ground Conditions, Soils and Agricultural Land (Volume 1)**, and **Chapter 14: Greenhouse Gases (Volume 1)**.

1 TRAFFIC AND TRANSPORT

1.1 SIGNIFICANCE CRITERIA

- 1.1.1. As identified in **Chapter 5: Traffic and Transport (Volume 1)** of the ES, there is the potential for significant effects on transport during the Construction and Operational Phases of the Proposed Development.
- 1.1.2. The methodology for the assessment of transport impacts has used weekday annual average daily traffic (AADT) flows, to reflect the construction and operational demand of the Proposed Development.

SCREENING

- 1.1.3. The assessment has been undertaken in accordance with the Institute of Environmental Management and Assessment (IEMA) Guidelines and has also been used within the **Chapter 5: Traffic and Transport (Volume 1)** of the ES. Within the IEMA Guidelines, two broad rules are suggested which can be used as a screening process to limit the scale and extent of the assessment which in turn assists in identifying links which need to be assessed. These comprise:
 - 'Rule 1: include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles (HGV) will increase by more than 30%); and
 - Rule 2: include any other specifically sensitive areas where traffic flows will increase by 10% or more.'
- 1.1.4. Where the predicted increase in traffic flows is lower than the above thresholds, the IEMA Guidelines suggest the significance of the effects can be stated to be negligible and further detailed assessments are not warranted. Furthermore, increases in traffic flows below 10% are generally considered to be insignificant in environmental terms given that daily variations in background traffic flow may vary by this amount.

ASSESSMENT

- 1.1.5. The traffic and transport impacts of the Proposed Development have been assessed in line with the IEMA guidelines and informed by scoping discussions with key stakeholders.
- 1.1.6. The scope of assessment reported in **Chapter 5: Traffic and Transport (Volume 1)** of the ES has included consideration of:
 - Identify the sensitivity of each receptor;
 - Assessment Year and Time;
 - Temporal Scope; and
 - Magnitude of Change.

ASSESSMENT YEARS

- 1.1.7. As reported in **Chapter 5: Traffic and Transport (Volume 1)** of the ES, the assessment includes the following scenarios:
 - Scenario 1 – 2023 Existing;

- Scenario 2 – 2023 Existing plus Peak Construction;
- Scenario 2a – 2023 Existing plus Average Construction;
- Scenario 3 – Opening Year Reference Case;
- Scenario 4 – Opening Year Reference Case plus Development;
- Scenario 4a – Opening Year Reference Case plus Development plus Construction;
- Scenario 5 – Future Year Reference Case plus Development;
- Scenario 5a – Future Year Reference Case plus Development plus full East West Rail (EWR) – Sensitivity Test; and
- Scenario 5b – Future Year Reference Case plus Development plus Removal of Rail Discount – Sensitivity Test.

1.1.8. The **Appendix 5.1: Transport Assessment (Volume 3)** also includes a further scenario as a sensitivity test only:

- Scenario 5c - Future Year - Reference Case plus Development - J13 as a constraint, Transport Assessment Sensitivity Test Only.

1.1.9. The description of each of the scenarios is set out below for further information.

CONSTRUCTION ASSESSMENT SCENARIOS

1.1.10. The construction traffic assessment has provided an understanding of the performance of the local highway network on the day of peak construction along with construction related transport movements and for the period of ‘average’ construction. The calculation of construction-related traffic movements, details of the construction programme, vehicle routing and phasing are set out in detail in the Transport Assessment (TA) and its associated appendices (**Appendix 5.1: Transport Assessment (Volume 3)**).

CORE ASSESSMENT SCENARIOS

1.1.11. The Core Assessment Scenarios provide an understanding of the performance of the local highway network with the known committed developments and infrastructure included as set out in **Appendix 5.1: Transport Assessment (Volume 3)**.

1.1.12. The committed developments that are included within the assessment have been informed by discussions with key stakeholders. **Appendix 5.1: Transport Assessment (Volume 3)** and associated documents have assessed the committed developments as agreed with National Highways in early 2024 to inform the traffic modelling exercise undertaken. This is explained within the **Appendix 3.4 Table 1-Summary of Assumptions-Transport**. As with any Transport Assessment which includes strategic assessment, it is an assessment undertaken at a point in time to predict the likely effects of the Proposed Development and identify any necessary mitigation. An updated review of committed developments was undertaken in February 2025 for robustness. This identified a small number of sites where planning applications have been submitted but not approved and were not considered previously (as of 17th February 2025) and do not have agreed transport mitigation packages. As a result, these sites were not included as committed developments within the **Appendix 5.1: Transport Assessment (Volume 3)**. One additional site was identified which has now been approved (Site 5 in Cranfield - CB/23/01751/OUT) and was not

included within the previous assessments. A further two sites subject to submitted but not approved applications, and one subject to an approved application, were identified that were not included within the original modelling exercise either, however, these were reserved matters applications and so the traffic associated with them had already been included as the outline approval had been included in the previous work. A qualitative review of the effect of all of the additional sites identified in the February 2025 review on the study network was undertaken which identified that it would result in a very small / negligible volume of traffic on the A421 as a result it would not have a material effect on the conclusions of the Appendix 5.1: Transport Assessment (Volume 3), therefore no update to the committed development assessment has been undertaken since the initial agreement in early 2024;. This is the assessment that any planning application should be assessed against to determine the required infrastructure and is the future baseline. A plan showing the location of the committed development schemes in the Transport Assessment (TA) and its associated appendices (**Appendix 5.1: Transport Assessment (Volume 3)**).

- 1.1.13. As part of the core assessment, a multi modal trip generation assessment has been undertaken to identify the quantum of movements by mode by time as a result of the Proposed Development and these have then been assigned to the transport network and assessed against the future baseline. Full details of the trip generation are provided in the Transport Assessment (TA) and its associated appendices (**Appendix 5.1: Transport Assessment (Volume 3)**).
- 1.1.14. The assessment of the effect of the Proposed Development on sensitive receptors has assumed the implementation of new transport infrastructure. The new transport infrastructure is further described in the Transport Assessment (TA) and its associated appendices (**Appendix 5.1: Transport Assessment (Volume 3)**).

Assessment Times

- 1.1.15. **Chapter 5: Traffic and Transport (Volume 1)** of the ES has reported the assessment of the following time periods for each scenario;
 - Weekday AM Network Peak Hour (08:00-09:00);
 - Weekday PM Network Peak Hour (17:00-18:00); and
 - 24 Hour AADT.
- 1.1.16. The weekday AM and PM network peak hour assessments have been derived by identifying the hours with the greatest combined background and Proposed Development traffic flows. These are the hours of 08:00-09:00 and 17:00-18:00.
- 1.1.17. The 24-Hour AADT flows have been derived by establishing the average daily trip generation for the Proposed Development, based on 'average' weekday attendance, 'busy' Saturday attendance and 'average' Sunday attendance. Detailed information on these scenarios is provided within the Transport Assessment at ES Volume 3 **Appendix 5.1: Transport Assessment (Volume 3)**.

Temporal Scope

- 1.1.18. The temporal scope of the study is essential to consider within the assessment and has been used to identify whether the resultant effects of the Proposed Development are permanent or temporary in nature and categorised as follows:

- Permanent – these are effects that will remain even when the Proposed Development is complete, although these effects may be caused by environmental changes that are permanent or temporary; and
- Temporary – these are effects that are related to environmental changes associated with an activity and that will cease when that activity finishes (construction activity). Temporary effects can be further categorised by the time period of which they will last; short-term (0-2 year impact), medium-term (3-5 year impact) and long-term (5-10 year impact).

SIGNIFICANCE CRITERIA

Sensitive Receptors

- 1.1.19. Sensitive receptors have been identified as relevant to Traffic and Transport within the study area based on the principles set out in **Table 1-1**.
- 1.1.20. The sensitivity of receptors will be considered on a scale of high, medium, low or negligible. The sensitivity of a receptor can be defined by the vulnerability of the user group who may be affected by changes in traffic conditions, for example, elderly people or children.
- 1.1.21. A sensitive receptor may be related to an area where pedestrian activity is high, for example a road in the vicinity of a school.
- 1.1.22. The existing character of a road and its receptors is also considered. For example, an 'A' road is likely to have lower sensitivity to changes in traffic flows than a minor residential road as it is less likely to be used by pedestrians/cyclists (receptors), and it will already be used by a larger volume of traffic and therefore a small increase would have a smaller impact, and therefore create a smaller change in the character of that road.

Table 1-1 - Sensitivity of Receptors for Traffic and Transport

Receptor Type	Receptor Sensitivity
Receptors of greatest sensitivity to traffic flow: schools, colleges, playgrounds, accident clusters, retirement homes, roads without footways that are used by pedestrians.	High
Traffic flow sensitive receptors: congested junctions, doctors' surgeries, hospital, shopping areas with roadside frontage, roads with narrow footways, recreation facilities.	Medium
Receptors with some sensitivity to traffic flow: place of worship, public open space, tourist attractions and residential areas with adequate footway provision.	Low
Receptors with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions: links where no pedestrian activity occurs and where there is no provision for pedestrians. For example, strategic roads such as motorways and trunk roads or rural roads where there are no pedestrian-generating land uses within the vicinity.	Negligible

Determining the Magnitude of Change

- 1.1.23. IEMA has published Guidance Notes No:1 Guidelines for the Environmental Assessment of Road Traffic (2023) commonly referred to as the IEMA guidelines. The guidelines provide a thorough approach to the assessment of environmental effects of traffic associated with proposed major developments.
- 1.1.24. Under the IEMA guidelines, it is recommended that the impacts of major developments are considered under each category:
 - Severance of communities;
 - Road vehicle driver and passenger delay;
 - Non-motorised users delay;
 - Non-motorised users amenity;
 - Fear and Intimidation; and
 - Accidents and Safety.
- 1.1.25. The following paragraphs cover each of the impacts that have been considered and are reported within **Chapter 5: Traffic and Transport (Volume 1)** of the ES and how the magnitude of change has been derived.

Severance of Communities

- 1.1.26. Severance is defined as the perceived division that can occur within a community when it becomes separated by a major traffic artery and describes a series of factors that separate people from places and other people. Such division may result from the difficulty of crossing a heavily trafficked road and a physical barrier created by the road itself.
- 1.1.27. The measurement and prediction of severance is difficult, but relevant factors include road width, traffic flow, speed, the presence of crossing facilities and the number of movements across the affected route.
- 1.1.28. IEMA guidelines refer to the Department for Transport's (DfT) 'Manual of Environmental Appraisal', which states that “changes in traffic flow of 30%, 60% and 90% are regarded as producing slight, moderate and substantial changes in severance respectively”. It is advised that these broad indicators should be used with care and regard paid to specific local conditions.
- 1.1.29. However, caution needs to be observed when applying these thresholds as very low baseline flows are unlikely to experience severance impacts even with high percentage changes in traffic.
- 1.1.30. Where severance is thought likely to require more detailed investigation, it is recommended the assessment involves:
 - Defining the facilities to which access is potentially impaired;
 - Defining facility catchment areas from which users may be drawn; and
 - Estimating the populations within those areas, both in total and in vulnerable groups.
- 1.1.31. These indicators have been used as the basis of assessing the significance of the effect, along with the application of professional judgement to take account of local conditions and the character of each link.

Road Vehicle Driver and Passenger Delay

- 1.1.32. IEMA guidelines note that driver delay can occur at several points on the network, although the effects are only likely to be significant when the traffic on the highway network is predicted to be at or close to the capacity of the system.
- 1.1.33. The TA contains a detailed assessment of the highway network. These assessments have been summarised in **Chapter 5: Traffic and Transport (Volume 1)** of the ES where necessary and used to determine the significance of the effect, whilst applying professional judgement.

Non-Motorised User Delay

- 1.1.34. IEMA guidelines note that changes in the volume, composition and/or speed of traffic may affect the ability and time required for people to cross roads. Typically, increases in traffic levels result in increased pedestrian delay, although increased pedestrian activity itself also contributes.
- 1.1.35. Pedestrian and cyclist delay may also change where:
 - Pedestrians and cyclists cross existing roads where traffic flows are projected to change;
 - Pedestrians and cyclists cross new roads;
 - Existing roads which pedestrians and cyclists would have crossed are removed;
 - Road speeds change;
 - Pedestrian and cycle volumes change;
 - New crossing facilities are provided; and
 - Existing pedestrian crossing facilities change.
- 1.1.36. The guidelines do not set any thresholds, recommending instead that assessors use their professional judgement to determine the significance of the effect.
- 1.1.37. The IEMA guidelines refer to a report published by the Transport Research Laboratory¹ (TRL) as providing a useful approximation for determining pedestrian delay. The TRL research concluded that mean pedestrian delay was found to be eight seconds at flows of 1,000 vehicles per hour and just below 20 seconds at 2,000 vehicles per hour for various types of crossing condition.
- 1.1.38. A two-way flow of 1,400 vehicles per hour has been adopted as a lower threshold for assessment (equating to a mean ten second delay for a link with no pedestrian facilities) in the TRL report. Below this flow pedestrian delay is unlikely to be a significant factor and therefore it has been discounted from further assessment. This flow has been used to determine which links require further assessment, taking into account the characteristics of each link i.e. motorways and trunk roads with no pedestrian facilities and where pedestrians are not permitted has not been assessed. These have been assessed in further detail and professional judgement has been used to determine the significance of the effect on each link.

¹ Goldschmidt J. (1977) *Pedestrian Delay and Traffic Management*.

Non-Motorised User Amenity

- 1.1.39. IEMA guidelines define pedestrian amenity as the relative pleasantness of a journey and can include fear and intimidation if they are relevant. As with pedestrian delay, amenity is affected by traffic volumes and composition along with pavement width/separation from traffic and pedestrian activity.
- 1.1.40. The 1993 guidelines suggest a tentative threshold for judging the significance of change in pedestrian amenity where traffic flow/HGV flow is halved or doubled, which would be considered a high change in magnitude. A change of less than half or double would be low and will therefore be discounted from further assessment. The updated 2023 IEMA Guidelines set out that although these thresholds no longer appear in DfT guidance, they have not been superseded by subsequent changes to guidance and are established through planning case law.
- 1.1.41. These thresholds have been used as the basis of assessing the significance of the effect along with professional judgement. Links where pedestrians are not permitted i.e. motorways, trunk roads etc. and where there are no pedestrian facilities have not been taken forward for further assessment.

Fear and Intimidation

- 1.1.42. The extent of fear and intimidation is dependent on:
- The total volume of traffic;
 - The heavy vehicle composition;
 - The speed these vehicles are passing; and/or
 - The proximity of traffic to people – and/or the feeling of the inherent lack of protection created by factors such as a narrow pavement median, a narrow path, or a constraint (such as a wall or fence) preventing people stepping further away from moving vehicles.
- 1.1.43. While this is recognised as an important environmental effect there are no commonly agreed thresholds for estimating fear and intimidation from known traffic and physical conditions. The 2023 IEMA Guidelines have introduced a weighting system to help assessors provide a first approximation of the likelihood of pedestrian fear and intimidation based on average traffic flow, total 18-hour heavy vehicle flow and average vehicle speed. A combination of the following provides a degree of hazard score.
- 1.1.44. **Table 1-2** shows the criteria for the hazard score each link receives.

Table 1-2 - Fear and Intimidation Degree of Hazard

Average Traffic Flow Over 18-Hour Day - All Vehicles/Hour 2-Way (a)	Total 18-Hour Heavy Vehicle Flow (b)	Average Vehicle Speed (c)	Degree of Hazard Score
1800+	3,000+	>40	30
1,200-1,800	2,000-3,000	30-40	20
600-1,200	1,000-2,000	20-30	10
<600	<1,000	<20	0

1.1.45. **Table 1-3** shows the level of fear and intimidation based on the hazard score each link receives.

Table 1-3 - Levels of Fear and Intimidation

Level of Fear and Intimidation	Total Hazard Score (a) + (b) + (c)
Extreme	71+
Great	41-70
Moderate	21-40
Small	0-20

1.1.46. **Table 1-4** subsequently details the magnitude of impact based on the change in step/traffic flows from the baseline conditions.

Table 1-4 - Fear and Intimidation Magnitude of Impact

Magnitude of Impact	Change in Step/Traffic Flows (AADT) from Baseline Conditions
High	Two step changes in level
Medium	One step change in level, but with >400 vehicles increase in average 18-hour vehicle two-way flows, and/or >500 heavy vehicle increase in total 18-hour flows
Low	One step change in level, wit <400 vehicles increase in average 18-hour vehicle two-way flows, and/or <500 heavy vehicle increase in total 18-hour flows
Negligible	No step change in level

Accidents and Safety

- 1.1.47. The IEMA guidelines do not include any definition in relation to accidents and safety, necessitating professional judgement to assess the implications of local circumstance, or factors which may increase or decrease the risk of accidents.
- 1.1.48. Professional judgement has therefore been applied when assessing existing accident records and whether the Proposed Development will have any effect which may increase or decrease the risk of accidents. A review of recorded accidents within the study area has been undertaken within the **Appendix 5.1: Transport Assessment (Volume 3)** and has been summarised in **Chapter 5: Traffic and Transport (Volume 1)** of the ES in order to make a professional judgement regarding the significance of the effect.

Summary of Magnitude of Change Derivation

- 1.1.49. Based on the definitions of each impact identified above, a summary of the criteria that have been used to determine magnitude of change from the baseline conditions as a result of the proposed development are set out in **Table 1-5** below.

- 1.1.50. It should also be noted however, that the absolute effect is also important e.g. the total flow of traffic or HGVs on a link. This is because an increase of 100% in the traffic flow on a road is likely to lead to an insignificant impact if the existing flows are low. Where this is applicable, professional judgement has been applied and commentary has been clearly provided within **Chapter 5: Traffic and Transport (Volume 1)** of the ES.

Table 1-5 - Definitions of Magnitude of Change

Effects	Negligible	Low	Medium	High
Severance	Change in total traffic or HGV flows of less than 30%	Change in total traffic or HGV flows of 30-60%	Change in total traffic or HGV flows of 60-90%	Change in total traffic or HGV flows over 90%
Driver delay	A professional judgement based on the overall network statistics and journey time assessment within the traffic model.			
Non-Motorised User delay	Two-way traffic flows < 1,400 vehicles per hour	A professional judgement based on the road links with two-way traffic flow exceeding 1,400 vehicles per hour in the context of the individual characteristics.		
Non-Motorised User amenity	Change in total traffic or HGV < 100%	A professional judgement based on the routes with > 100% change in the context of their individual characteristics.		
Fear and Intimidation	No change in step level	One step change in level, with <400 vehicle increase in average 18-hour average vehicle two-way all vehicle flow; and/or <500 heavy vehicle increase in total 18-hour heavy vehicle flow.	One step change in level, but with >400 vehicle increase in average 18-hour average vehicle two-way all vehicle flow; and/or >500 heavy vehicle increase in total 18-hour heavy vehicle flow.	Two step changes in level
Accidents and Safety	A professional judgement based on quantitative analysis as set out in the Transport Assessment (Appendix 5.1: Transport Assessment (Volume 3)) and summarised in this Chapter 5: Traffic and Transport (Volume 1) .			

Determining the Significance of Effects

- 1.1.51. Appropriate criteria have been used to determine whether the potential traffic and transportation effects of the Proposed Development are significant or not. The following terms have been used to define the significance of the effects:
- **Major effect:** where the Proposed Development is likely to cause a considerable change from the baseline conditions and the receptor has limited adaptability, tolerance or recoverability or is of the highest sensitivity. This effect is considered to be 'Significant';

- **Moderate effect:** where the Proposed Development is likely to cause either a considerable change from the baseline conditions at a receptor which has a degree of adaptability, tolerance or recoverability or a less than considerable change at a receptor that has limited adaptability, tolerance, or recoverability. This effect is considered more likely to be 'Significant' but will be subject to professional judgement;
- **Minor effect:** where the Proposed Development is likely to cause a small, but noticeable change from the baseline conditions on a receptor which has limited adaptability, tolerance or recoverability or is of the highest sensitivity; or where the proposed development is likely to cause a considerable change from the baseline conditions at a receptor which can adapt, is tolerant of the change or/and can recover from the change. This effect is considered to be 'Not Significant' but will be subject to professional judgement; and
- **Negligible:** where the Proposed Development is unlikely to cause a noticeable change at a receptor, despite its level of sensitivity or there is a considerable change at a receptor which is not considered sensitive to a change. This effect is 'Not Significant.'

1.1.52. The significance of the effect is judged on the relationship of the magnitude of impact to the assessed sensitivity and/or importance of the receptor. The predicted significance of the effects is summarised in **Table 1-6** below.

Table 1-6 - Significance Evaluation Matrix

Magnitude of Change	Receptor Sensitivity			
	High	Medium	Low	Negligible
High	Major (Significant)	Major (Significant)	Moderate (Significant or Not significant)	Minor (Not significant)
Medium	Major (Significant)	Moderate (Significant or Not Significant)	Minor (Not Significant)	Minor (Not Significant)
Low	Moderate (Significant or Not Significant)	Minor (Not Significant)	Minor (Not Significant)	Negligible (Not Significant)
Very Low	Minor (Not Significant)	Minor (Not Significant)	Negligible (Not Significant)	Negligible (Not Significant)

1.1.53. Potential effects are therefore concluded to be of negligible, minor, moderate or major significance. For each effect, it has been concluded whether the effect is 'beneficial' or 'adverse'. Major significance effects are significant in terms of EIA guidance. Moderate significance effects require further investigation and the application of professional judgement to determine whether they are significant in terms of EIA guidance and the context of Proposed Development and surrounding area.

2 ECOLOGY AND NATURE RESERVE

2.1 ASSESSMENT OF EFFECTS AND SIGNIFICANCE CRITERIA

- 2.1.1. An assessment of likely ecological effects associated with the Proposed Development has been undertaken in **Chapter 6: Ecology and Nature Conservation (Volume 1)**. This has had regard to the Ecological Impact Assessment (EclA) methodology published by the Chartered Institute of Ecology and Environmental Management (CIEEM)². This method has three key stages:
- Identification of important ecological features;
 - Determining the geographic scale at which each feature is important; and
 - Determining likely significant effects on each feature.
- 2.1.2. The following professional guidance documents have been referred to during the preparation of this Chapter:
- CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1*. Chartered Institute of Ecology and Environmental Management, Winchester;
 - CIEEM (2017a). *Guidelines for Ecological Report Writing*. Technical Guidance Series³; and
 - CIEEM (2017b). *Guidelines for Preliminary Ecological Appraisal, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester⁴.

Determining Feature Importance

- 2.1.3. The scale at which designated sites, habitats, species assemblages and populations of species are important is determined with reference to their nature conservation status (i.e. rarity, threat status); their 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations); and legal status. **Table 2-1** shows how CIEEM guidance has been interpreted in the context of this assessment.

² CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1*. Chartered Institute of Ecology and Environmental Management, Winchester.

³ CIEEM (2017a) *Guidelines for Ecological Report Writing*. Winchester. Chartered Institute of Ecology and Environmental Management.

⁴ CIEEM (2017b) *Guidelines for Preliminary Ecological Appraisal*. Winchester. Chartered Institute of Ecology and Environmental Management.

Table 2-1 - Description of Geographical Scales of Ecological Importance

Importance	Typical Examples of Each Level
International (Europe)	<p><u>Habitats</u></p> <p>An internationally designated site or candidate site (Special Protection Area (SPA), provisional SPA, Special Area of Conservation (SAC), candidate SAC, Ramsar Site, Biogenetic/Biosphere Reserve, World Heritage Site) or an area that would meet the published selection criteria for designation. A viable area of a habitat type listed in Annex I of the Habitats Directive, or smaller areas of such habitat, which are essential to maintain the viability of a larger whole.</p> <p><u>Species</u></p> <p>Any regularly occurring population of internationally important species, threatened or rare in an international context (e.g. International Union for the Conservation of Nature Red Data Book species listed above 'Least Concern'). A regularly occurring species population which exceeds the threshold for national importance as set by guidelines for designation of biological Sites of Special Scientific Interest (SSSI) in the UK or similar guidance where available).</p>
National (England)	<p><u>Habitats</u></p> <p>A nationally designated site, SSSI, National Nature Reserve (NNR), Marine Nature Reserve (MNR) or a discrete area, which would meet the published selection criteria for national designation (e.g. SSSI selection guidelines). An area of a Habitat of Principle Importance (HPI), Ancient Woodland or Wood Pasture and Parkland HPI.</p> <p><u>Species</u></p> <p>Any regularly occurring/large population of a nationally important species (e.g. England Red Data Book). A large population of a species identified as a Species of Principal Importance. A species population which would qualify for SSSI designation.</p>
Regional (East Midlands/East of England)	<p><u>Habitats</u></p> <p>High or medium importance and rarity, regional scale, limited potential for substitution, or viable areas of habitat identified in the Regional/County Biodiversity Action Plan (BAP) or smaller areas of such a habitat which are essential to maintain the viability of the larger whole. Regionally significant and viable areas of habitat identified as being of regional value in the appropriate Natural England Natural Area. Sites such as Country Wildlife Sites (CWS) selected on Regional/County criteria.</p> <p><u>Species</u></p> <p>Any regularly occurring significant population of a species listed as being nationally scarce, Species of Principle Importance (SPI) or defined at a regional scale or relevant Natural Area on account of its regional rarity or localisation.</p> <p>Any regularly occurring significant population of a SPI on account of its rarity or localisation at a regional scale.</p>
County (Bedfordshire)	<p><u>Habitats</u></p> <p>Sites recognised by local authorities, e.g. CWS and Roadside Nature Reserves (RNR). Degraded areas of HPI (excluding Wood Pasture and Parkland HPI and Ancient Woodland Lowland Mixed Deciduous Woodland HPI which is Ancient Woodland).</p> <p><u>Species</u></p> <p>Any regularly occurring, locally significant population of a SPI or a species listed in a county BAP (where available). A regularly occurring, locally significant population of a county important species. Sites supporting populations of internationally/nationally/regionally important species that are not threatened or rare in the region or county, and not integral to maintaining those populations. Sites/features scarce in the county or that appreciably enrich the county habitat resource.</p>

Importance	Typical Examples of Each Level
Local (of importance up to the scale of Bedford Borough)	<p><u>Habitats</u></p> <p>Areas of habitat that appreciably enrich the local habitat resource (e.g. species-rich hedgerows, ponds). Sites that retain other elements of semi-natural vegetation that, due to their size, quality, or the wider distribution within the local area, are not considered for the above classifications.</p> <p><u>Species</u></p> <p>Populations/assemblages of species that appreciably enrich the biodiversity resource within the local context. Sites supporting populations of county/district important species that are not threatened or rare in the region or county and are not integral to maintaining those populations.</p>
Site	<p><u>Habitats/Species</u></p> <p>Common or widespread habitats/species. In addition to the geographic frames of reference recommended in the CIEEM guidelines, an additional category of 'Site Importance' has been included to account for features that are of some value in the context of the Site but are not considered to be of sufficient value to be categorised as 'Local Importance'.</p>
Negligible	<p><u>Habitats/Species</u></p> <p>Areas of heavily modified/improved vegetation. Areas of habitat or populations of species which do not meet the above criteria.</p>

SIGNIFICANCE CRITERIA

Sensitive Receptors

- 2.1.4. Effect significance is assessed with regard to the CIEEM 2018 guidance which states that:
- “Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of EclA, ‘significant effect’ is an effect that either supports or undermines biodiversity conservation objectives for ‘important ecological features’...or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local” (CIEEM, 2018; paragraph 5.24).*
- 2.1.5. CIEEM recommends that when considering significant effects, the following should be taken into account:
- **“For designated sites** – *is the project and associated activities likely to undermine the conservation objectives of the site, or positively or negatively affect the conservation status of species or habitats for which the site is designated, or may it have positive or negative effects on the condition of the site or its interest/qualifying features?”; and*
 - **For ecosystems** – *is the project likely to result in a change in ecosystem structure and function?” (CIEEM, 2018; paragraph 5.29).*

- 2.1.6. Consideration of conservation status is important for evaluating the effects of impacts on individual habitats and species and assessing their significance:
- **Habitats** – *conservation status is determined by the magnitude of the influences acting on the habitat that may affect its extent, structure, and functions as well as its distribution and its typical species within a given geographical area; and*
 - **Species** – *conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area”* (CIEEM, 2018; paragraph 5.32).
- 2.1.7. Ecological effects are described in relation to the geographic scale at which they are regarded as significant – from international to local. Ecological features of ‘Site’ or ‘Negligible’ importance are deemed of too low a value to be subject to significant effects. It should be noted that in line with the guidance issued by CIEEM, an impact which has been considered significant in ecological terms is considered significant in EIA terms.
- 2.1.8. The assessment of likely significant effects arising as a result of the Proposed Development are considered at the Construction Phase and Operational Phase.

Magnitude of Change

- 2.1.9. The magnitude of change is considered within the assessment for each potential effect (where this has been possible). Examples of where a distinct magnitude of change can be determined would include the ‘size’ or ‘amount’ of a physical change i.e. measured area of loss of habitats or ‘intensity’ of an effect e.g. maximum decibel rating for a predicted noise impact. The magnitude of change as a result of the Proposed Development’s effects is more difficult to predict for ecological features such as species communities or populations where the baseline conditions are variable or not fully known. Equally, where there is limited information on the location and type of construction activities, the magnitude of change cannot be established accurately. Furthermore, where insufficient information is available to accurately predict the magnitude of change professional judgement has been applied when considering the potential magnitude and other characteristics of potential effect.

Significance of Effect

- 2.1.10. A potential effect is then considered to be either significant or not significant and likely to be either beneficial or adverse. An impact is considered to be significant if it has the potential to affect the integrity of a habitat or the conservation status of a species. Technical definitions of integrity and conservation status take into account the CIEEM guidance. To allow consistency with other disciplines, a category has been assigned to significance based upon the criteria in **Table 2-2**.

Table 2-2 - Significance Criteria

Level of Effect	Criteria and Resultant Effect
Major	<p>For significant effects, where the potential change is permanent (or over the long-term) and results in fundamental changes to the conservation status or integrity of a habitat/species, reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a large area of habitat or large proportion of the wider species population is affected. For designated sites, integrity is compromised. There may be a change in the level of importance of the feature in the context of the project.</p> <p>Major effects to an Ecological Feature are significant at any geographical scale apart from 'Local' and 'Negligible'.</p>
Moderate	<p>The potential change is permanent (or over the long-term if temporary) affects the conservation status of a habitat/species reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a small-medium area of habitat or small-medium proportion of the wider species population is affected. There may be a change in the level of importance of this receptor in the context of the Proposed Development.</p> <p>Moderate effects to an Ecological Feature are significant at any geographical scale apart from 'Local' and 'Negligible'.</p>
Minor	<p>The quality or extent of designated sites or habitats or the sizes of species' populations, experience some small-scale permanent or temporary reduction or increase, or species experience behavioural changes. The change is unlikely to modify the evaluation of the receptor in terms of its importance.</p> <p>Minor scale effects are Not Significant below a County geographical level (e.g. a minor adverse effect on a local level IEF is not significant).</p> <p>Although there may be some effects on individuals or parts of a habitat area or designated site, the quality or extent of sites and habitats, or the size of species populations, means that the overall feature would experience little or no change. Any changes are also likely to be within the range of natural variability and there would be no short-term or long-term change to conservation status of habitats/species receptors or the integrity of designated sites.</p> <p>Minor effects are not significant at any geographical scale.</p>
Negligible	<p>A change, the level of which is so low, that it is not discernible on designated sites or habitats or the size of species' populations, or changes that balance each other out over the lifespan of the Proposed Development.</p> <p>Negligible effects are not significant at any geographical scale.</p>

- 2.1.11. In response to the above, and to make sure significant effects on ecological features are still placed within an appropriate context, a geographical approach is adopted to determine the ecological value of a feature. Significance is then considered at the same geographical level. For example, when a significant effect is predicted on a feature of Local Ecological Value, it may be considered significant 'at a local level'. However, where only a small part of an ecological feature is affected, the geographical level at which the significant impact is predicted to occur may be lower, for example an ecological feature of Local Ecological Value may be subject to an impact that is relevant 'at a Site level' and is therefore not significant.

3 AIR QUALITY

- 3.1.1. In general, the significance of effect due to impacts on air quality takes account of receptor sensitivity and the magnitudes of the impacts.

3.2 SIGNIFICANCE OF EFFECT CRITERIA

SENSITIVITY OF RECEPTORS

- 3.2.1. The sensitivity of receptors has been determined with reference to relevant published guidance, references, and professional judgement. Details are provided in **Table 3-1**.

Table 3-1 - Sensitivity of Receptors (Air Quality)

Element Scoped In	Receptor Sensitivity
Fugitive dust emissions affecting amenity and human health at human receptors, and ecological receptors.	<p>Determined with regard to the <i>Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction</i>⁵ and air quality specialist professional judgement.</p> <p>Amenity - Highly sensitive receptors generally include residential premises, museums, and other culturally important collections, medium- and long-term car parks and car showrooms. Medium sensitivity receptors can include parks and places of work. Low sensitivity receptors may include playing fields, farmland (except horticulture when may be considered as high or medium sensitivity), footpaths, short term car parks and roads.</p> <p>Human health - Highly sensitive receptors generally include residential premises (including care homes), hospitals and schools. Medium sensitivity receptors can include offices and commercial premises. Low sensitivity receptors may include public footpaths, playing fields, parks, and shopping streets.</p> <p>Ecology - Highly sensitive receptors generally include Ramsar wetland sites, SAC and SPA. Medium sensitivity receptors can include SSSI and Ancient Woodland sites. Low sensitivity receptors may include Sites of Importance for Nature Conservation and CWS.</p> <p>In all cases the assignment of sensitivity is subject to professional judgement and may be substantially influenced by other factors regarding historical and pre-existing conditions such as baseline annual mean PM₁₀ concentrations and prevailing winds, and circumstances such as time of year and human environment.</p> <p>The assessment methodology considers the sensitivities of the surrounding area in terms of the numbers and sensitivities of receptors within the following distance bands measured from the edge of the dust source: 0 to 20 m, 20 to 50 m, 50 to 100 m, and 100 to 250 m. For example, if there are ten or more residential receptors within 20m of the source then the overall sensitivity of the area to dust soiling is high but where there are less than ten then the sensitivity is medium.</p>

⁵ Institute of Air Quality Management (2024) *Guidance on the assessment of dust from demolition and construction. January 2024 (Version 2.2)*. Available at: <https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf> [Accessed: 21 May 2025].

Element Scoped In	Receptor Sensitivity
Road traffic emissions affecting air quality at human receptors.	This has been determined with regard to <i>Environmental Protection UK (EPUK)/IAQM guidance</i> ⁶ , <i>Defra's guidance LAQM.TG(22) Box 1-1 – Examples of Where the Air Quality Objectives Should Apply</i> ⁷ and air quality specialist professional judgement. In general, human receptors where members of the public might be regularly present are considered to be highly sensitive. Exceptions include places of work where access is restricted, and health and safety regulations apply; such locations can be considered to have medium to low sensitivity.
Road traffic emissions affecting air quality at ecological receptors.	For the purposes of the air quality assessment, all ecological receptors have been considered as highly sensitive.

MAGNITUDE OF IMPACT

Fugitive Dust Emissions

- 3.2.2. The magnitude of impact from fugitive dust emissions in the Construction Phase is described in relative terms as high risk, medium risk, low risk, or negligible. The relative risk of potential dust soiling, human health and ecological impacts is determined using professional judgement – taking into consideration the dust emission magnitude (large, medium, or small) and sensitivity of the area (high, medium, or low) for demolition, earthworks, construction and track out activities.

Road Traffic Emissions

- 3.2.3. *EPUK/IAQM guidance*⁶ provides a matrix of impact descriptors for annual mean pollutant concentrations at individual human receptors (**Table 3-2** below is adapted from the guidance). (Note: *EPUK/IAQM guidance*⁶ was developed prior to the introduction of the annual mean PM_{2.5} target for 2040 and non-statutory interim target for 2028. The current *EPUK/IAQM guidance*⁶ is not suitable for describing impacts on PM_{2.5} in relation to these targets since compliance will not be materially affected by local, primary emissions of PM_{2.5} that could be influenced by the Proposed Development).

Table 3-2 - Impact Descriptors for Individual Human Receptors (Air Quality)

Annual Mean Concentration at Receptor in Assessment Year	Percentage (%) Change in Concentration Relative to the Air Quality Standard			
	1	2-5	6-10	>10
75% or less than the air quality standard	Negligible	Negligible	Slight	Moderate

⁶ Moorcroft and Barrowcliffe et al. (2017) *Land-use Planning & Development Control: Planning for Air Quality*. v1.2. Institute of Air Quality Management, London. Available at: <https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf> [Accessed: 21 May 2025].

⁷ Department for Environment, Food and Rural Affairs (2022) *Local Air Quality Management Technical Guidance (TG22)*. Available at: <https://iaqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf> [Accessed: 21 May 2025].

Annual Mean Concentration at Receptor in Assessment Year	Percentage (%) Change in Concentration Relative to the Air Quality Standard			
	1	2-5	6-10	>10
76-94% of the air quality standard	Negligible	Slight	Moderate	Moderate
95-102% of the air quality standard	Slight	Moderate	Moderate	Substantial
103-109% of the air quality standard	Moderate	Moderate	Substantial	Substantial
110% or more of the air quality standard	Moderate	Substantial	Substantial	Substantial

Notes:

The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e., less than 0.5%, will be described as 'negligible'. Also, any change that is less than 1% of the air quality standard is considered to be 'imperceptible'.

Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

When defining the concentration as a percentage of the air quality standard, 'without Proposed Development' (i.e., DM) concentration should be used where there is a decrease in pollutant concentration and the 'with Proposed Development' (i.e., DS), concentration where there is an increase.

Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial.

SIGNIFICANCE OF EFFECT

Fugitive Dust Emissions

- 3.2.4. *IAQM Guidance on the assessment of dust from demolition and construction*⁵ recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from construction activities following implementation of appropriate mitigation measures. Therefore, the significance criteria are used to assess the significance of residual effects only. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be 'not significant'.

Road Traffic Emissions

- 3.2.5. Where the magnitude of impact is determined to be negligible or slight the resulting effect is unlikely to be significant effect, whereas moderate and substantial impacts could give rise to a significant effect if there is new exceedance of one or more air quality standard or an existing exceedance of a standard is made worse. Whilst **Table 3-2** has been used to describe the impacts, professional judgement is necessary to determine if the overall effect for human receptors is significant. The *EPUK/IAQM guidance*⁶ states:

“Any judgement on the overall significance of effect of a development will need to take into account such factors as:

- *the existing and future air quality in the absence of the development;*
- *the extent of current and future population exposure to the impacts; and*
- *the influence and validity of any assumptions adopted when undertaking the prediction of impacts.*

Other factors may be relevant in individual cases.”

- 3.2.6. For ecological receptors, the *IAQM guidance on air quality impacts on nature sites*⁸ recommends that significance of effect is determined by an ecologist. Consequently, this is not reported in **Chapter 8: Air Quality (Volume 1)** and the reader is referred to **Chapter 6: Ecology and Nature Conservation (Volume 1)**.

⁸ Holman et al. (2020) *A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.1*, Institute of Air Quality Management, London. Available at: <https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf> [Accessed: 21 May 2025].

4 NOISE AND VIBRATION

4.1 INTRODUCTION

4.1.1. This section details the assessment methodology and significance criteria for the following elements of the noise assessment:

- On-site construction noise and vibration, the assessment for which is provided in **Appendix 9.2: Construction Noise and Vibration Assessment (Volume 3)**.
- Construction and operational road traffic noise, the assessment for which is provided in **Appendix 9.3: Construction and Operational Road Traffic Noise Assessment (Volume 3)**.

4.1.2. The assessment methodology, significance criteria and noise limits relating to operational noise from the Core Zone and Utility Compound are provided in **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

4.2 CONSTRUCTION ACTIVITY NOISE

4.2.1. The magnitude and significance of effects for construction noise has been determined by comparing predicted construction noise levels with the defined Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) values. The methodology for defining values for LOAEL and SOAEL is explained in the next paragraph, and the methodology for determining the magnitude and significance of effect is subsequently presented.

4.2.2. The LOAEL for each time period (day, evening/weekends, and night) has been set as the baseline noise level for each receptor or group of receptors. The SOAEL is the threshold level determined using section E.3.2 and Table E.1 of BS 5228-1 (the ABC method), which is replicated in **Table 4-1**

Table 4-1 - Threshold of Potential Significant Adverse Construction Noise Effects used to Determine the SOAEL

Assessment Category and Threshold Value Period	Threshold Value, in Decibels (dB, $L_{Aeq, T}$)		
	Cat. A ^{A)}	Cat. B ^{B)}	Cat. C ^{C)}
Night-time (23:00 - 07:00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1 - A potential significant adverse effect is indicated if the $L_{Aeq, T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 - If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant adverse effect is indicated if the total $L_{Aeq, T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3 - Applied to residential receptors only.

Assessment Category and Threshold Value Period	Threshold Value, in Decibels (dB, $L_{Aeq,T}$)		
	Cat. A ^{A)}	Cat. B ^{B)}	Cat. C ^{C)}
<p>A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.</p> <p>B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.</p> <p>C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.</p> <p>D) 19:00–23:00 weekdays, 13:00–23:00 Saturdays and 07:00–23:00 Sundays.</p>			

- 4.2.3. The magnitude of impact of construction noise has been determined using the LOAEL and SOAEL values defined in Paragraph 4.2.2 in accordance with the thresholds defined in **Table 4-2**.

Table 4-2 - Magnitude of Impact - Construction Noise

Magnitude of Impact	Construction Noise Level
High	Above or equal to SOAEL +5 dB
Medium	Above or equal to SOAEL and below SOAEL +5 dB
Low	Above or equal to LOAEL and below SOAEL
Very Low	Below LOAEL

4.3 CONSTRUCTION ACTIVITY VIBRATION

- 4.3.1. An assessment of temporary construction vibration impacts has been undertaken in line with the guidance contained in BS 5228:2009+A1:2014 Part 2: Vibration as well as reference to LA111.
- 4.3.2. LA111 defines the LOAEL and SOAEL for construction vibration as follows:
- LOAEL – 0.3 mm/s peak particle velocity; and
 - SOAEL – 1 mm/s peak particle velocity.
- 4.3.3. The magnitude of impact of construction vibration has been determined using the LOAEL and SOAEL values defined above, as set out in **Table 4-3**.

Table 4-3 - Magnitude of Impact – Construction Vibration

Magnitude of Impact	Construction Vibration Level Peak Particle Velocity (PPV) MM/S
High	Above or equal to 10 mm/s PPV
Medium	Above or equal to 1 mm/s and below 10 mm/s PPV
Low	Above or equal to 0.3 mm/s and below 1 mm/s
Very Low	Below 0.3 mm/s

4.4 CONSTRUCTION ROAD TRAFFIC NOISE

- 4.4.1. An assessment of the potential magnitude of impacts and associated significance of effects has been undertaken of the predicted noise level changes, using guidance presented in LA 111. The short-term magnitude of impact scales as defined in LA 111 are presented in **Table 4-4**. The long-term magnitude of impact scales as defined in LA 111 are also presented as, whilst these will not be needed for the construction road traffic noise assessment, they are likely to be appropriate for the operational road traffic noise assessment.

Table 4-4 - Magnitude of Impact Scales from LA 111

Magnitude of Impact	Short Term Noise Change (dB L _{A10,18hr} or L _{night})	Long Term Noise Change (dB L _{A10,18hr} or L _{night})
Negligible	Less than 1.0	Less than 3.0
Minor	1.0 to 2.9	3.0 to 4.9
Moderate	3.0 to 4.9	5.0 to 9.9
Major	Greater than or equal to 5.0	Greater than or equal to 10.0

- 4.4.2. LA 111 states that the initial assessment of any potential likely significant adverse effects should be based on the short-term magnitude of impact scale, and that an impact of 'moderate' or 'major' corresponds to a potential likely significant adverse effect; however, an impact of 'negligible' or 'minor' corresponds to a likely non-significant adverse effect.
- 4.4.3. Following this initial assessment of potential significance, LA 111 suggests that other factors should be considered when determining the potential likely significant adverse effect at an individual, or group of receptors. These factors include:
- The long-term magnitude of impact (as determined by the scale presented in **Table 4-4**);
 - The absolute noise level in terms of the LOAEL and SOAEL thresholds - for example, LA 111 suggests that a receptor experiencing a minor adverse impact which is also above SOAEL would be a potential likely significant adverse effect;
 - Location of the noise sensitive parts of a receptor;
 - Acoustic context; and
 - Likely perception of change by residents.
- 4.4.4. The absolute noise levels predicted at noise sensitive receptors have also been compared to the LOAEL and SOAEL thresholds, as advised in the Noise Policy Statement for England. The operational noise LOAEL and SOAEL thresholds are set out in LA 111 Table 3.49.1 which is reproduced below in **Table 4-5**. These are also considered to be appropriate to use for the construction road traffic noise assessment.

Table 4-5 - Construction Road Traffic Noise LOAEL and SOAEL Thresholds (from LA 111)

Time Period	LOAEL	SOAEL
Day (06:00 – 24:00)	55 dB $L_{A10,18hr}$ (façade)	68 dB $L_{A10,18hr}$ (façade)
Night (00:00 – 06:00)	40 dB L_{night} , outside (free-field)	55 dB L_{night} , outside (free-field)

4.5 OPERATIONAL PHASE

NOISE FROM NEW CONNECTIONS AND ALTERATIONS TO THE EXISTING ROAD NETWORK

- 4.5.1. The magnitude of noise impacts arising as a result of traffic on new connections and alterations to the existing road network has been assessed using the same criteria as set out for construction road traffic.

NOISE FROM CORE ZONE AND UTILITY COMPOUND

- 4.5.2. The assessment methodology, significance criteria and noise limits relating to operational noise from the Core Zone and Utility Compound are provided in **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

5 CULTURE HERITAGE

5.1 SIGNIFICANCE OF EFFECT CRITERIA

- 5.1.1. Significance of effect criteria, magnitude of change, and significance of environmental effect for Cultural Heritage is reported within Chapter 10: Cultural Heritage (Volume 3) in Section 10.4.

6 GROUND CONDITIONS, SOILS AND AGRICULTURAL LAND

6.1 METHOD OF BASELINE DATA COLLATION

- 6.1.1. A desk-based data collection exercise has been undertaken in the form of a Phase 1 Preliminary Risk Assessment (PRA).
- 6.1.2. Key sources of information used to determine the baseline ground, soils and agricultural land conditions are detailed as follows:
- Groundsure report, within **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**;
 - BBC land use enquiry response dated 26 March 2024, within **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**;
 - British Geological Survey (BGS) Geology Online Viewer;
 - British Geological Survey (BGS) Geoindex Onshore Online Viewer;
 - Coal Authority Interactive Map;
 - Flood Map for Planning website;
 - Multi Agency Geographic Information for the Countryside (MAGIC);
 - Public Health England, UK Maps of Radon;
 - Zetica UXO Risk Maps;
 - Google Earth satellite imagery;
 - British Geological Survey (BGS);
 - Online GeoIndex Onshore;
 - Online Viewer – Hydrogeological Map of the UK, 1: 625,000;
 - Bedford Business Park at Land South of Bedford Environmental Statement Volume I, Main Report, November 2018;
 - Landscape Agricultural Land Classification and Agricultural Considerations of Land at Kempston Hardwick for Bedford Business Park;
 - SLR Former Kempston Brickworks, Bedfordshire, Factual Geotechnical Investigation Report October 2016; and
 - Arcadis, Project 320 Phase 2 Due Diligence Site Investigation Report, June 2023.

6.2 ASSESSMENT METHODOLOGY

- 6.2.1. The assessment of Agricultural Land Classification (ALC) and soil function is distinct and separate from the methodology followed for the contaminated land assessment.

6.2.2. The assessment of environmental impacts relating to ground conditions, soils and agricultural land comprise:

- a) Short (two to five years) and medium term (five to ten years), temporary effects; and
- b) Long term (ten years or more), permanent effects.

CONTAMINATED LAND ASSESSMENT (RISK ASSESSMENT)

6.2.3. The contaminated land assessment is based on the risk presented by the presence of a hazard (for example, contamination) for a given circumstance, i.e., the probability and consequence of an event occurring.

6.2.4. The process of managing land contamination, as set out in the Environment Agency guidance land contamination risk management (LCRM)⁹, is based on risk assessment which is proportionate to the given circumstances. In the context of ground conditions and soils, the LCRM provides a technical framework in the understanding of how contamination issues that may arise could be managed.

6.2.5. The assessment of risks from land contamination is based upon the identification and subsequent appraisal of contaminant linkages, which are specifically relevant to the project under consideration. A contaminant linkage requires the presence of:

- a source of contamination;
- a receptor capable of being adversely affected by the contamination; and
- an active pathway capable of exposing a receptor to the contaminant.

6.2.6. The LCRM recommends the use of a Conceptual Site Model (CSM), comprising three elements: a source, a pathway, and a receptor. Without each of a source, pathway and receptor being present, there can be no contamination risk. The CSM has been used to identify source, pathway, and receptor linkages by integrating the intended end use for the Site, the Site's characteristics, and the Site's surroundings. Thereafter, mitigation measures to manage the risks identified in the CSM have also been identified.

6.2.7. In order to define the baseline risk, the initial assessment and classification of risk has been carried out for the Site in its pre-development state. A separate assessment of risk has then been conducted for the site post-development to enable an evaluation of the change in risk due to the Proposed Development.

6.2.8. The risk assessment process for the Proposed Development has addressed the significance of each relevant contaminant linkage, noting that the designation of risk is based upon the consideration of:

- the magnitude of the potential consequence (severity) – taking into account both the potential severity of the hazard and the sensitivity of the receptor; and
- the magnitude of probability (likelihood) – taking into account both the presence of the hazard and receptor and the potential for a pathway to be realised between them.

⁹ Environment Agency (2023) *Land contamination risk management (LCRM)*. Available at: <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm> [Accessed: 21 May 2025].

- 6.2.9. The level of risk has been evaluated in accordance with the methodology set out in *CIRIA C552*¹⁰. The definitions for the qualitative risk assessment have been taken from *Guidance for the Safe Development of Housing on Land Affected by Contamination Annex 4, R&D Publication 66: 2008*¹¹. Lastly, professional judgement has also been used when evaluating the change in risk from baseline conditions to those during and following the Proposed Development.
- 6.2.10. The likelihood classifications for the contaminant linkages being realised is presented in **Table 6-1**.

Table 6-1 - Likelihood Classification of Contaminant Linkage Being Realised

Classification	Definition	Examples
High Likelihood	There is a contaminant linkage, and an event would appear very likely in the short-term and almost inevitable over the long-term. Or there is evidence at the receptor of harm or pollution.	a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m of ground where direct contact is possible. b) Ground/groundwater contamination could be present from chemical works, containing a number of Underground Storage Tanks (USTs).
Likely	There is a contaminant linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.	A) Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m where direct contact is possible, or the top 0.5m of ground where direct contact is not possible. b) Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.
Low Likelihood	There is a contaminant linkage, and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.	A) Elevated concentrations of toxic contaminants are present in soils at depths >1m where direct contact is possible, or 0.5-1.0m of ground where direct contact is not possible. b) Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.

¹⁰ CIRIA (2001) *Contaminated land risk assessment. A guide to good practice (C552)*. Available at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C552&Category=BOOK [Accessed: 21 May 2025].

¹¹ NHBC and EA (2008) *Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008 Volume 1*. Available at: <https://www.middevon.gov.uk/media/114549/volume-1-guidance-for-the-safe-development-of-housing-on-land-affected-by-contamination.pdf> [Accessed: 21 May 2025].

Classification	Definition	Examples
Unlikely	There is a contaminant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.	a) Elevated concentrations of toxic contaminants are present below hardstanding. b) Light industrial unit <10 years old containing a double skinned UST with annual integrity testing results available.

6.2.11. The assessment of the magnitude of a potential consequence of a contaminant linkage has taken into account the sensitivity of a given receptor to a particular source or contaminant of concern. The assessment has taken into account the full exposure via the relevant linkage. The classification of consequence is presented in **Table 6-2**.

Table 6-2 - Classification of Consequence

Severe	Highly elevated concentration is likely to result in "significant harm" to human health as defined by the Environmental Protection Act (EPA) 1990, Part 2A, if exposure occurs.	Equivalent to Environment Agency Category 1 pollution incident ¹² including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce.	Major damage to a geodiversity site, which is likely to result in a substantial adverse change in its functioning or harm to a site of special interest that endangers the long-term maintenance of the site.	Catastrophic damage to crops, buildings, or property.	Significant harm to humans is defined in the Contaminated Land Statutory Guidance as death, life threatening diseases (for example, cancers), other diseases likely to have serious impacts on health, serious injury, birth defects, and impairment of reproductive functions. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of Hazardous or priority substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).
Medium	Elevated concentrations which could result in "significant	Equivalent to Environment Agency Category 2 pollution	Significant damage to a geodiversity site, which may result in	Significant damage to crops, buildings, or property.	Significant harm to humans is defined in the Contaminated Land Statutory Guidance as death, life threatening

¹² Environment Agency (2017) *Incidents and their classification: the Common Incident Classification Scheme (CICS)* Available at: <https://www.ofwat.gov.uk/wp-content/uploads/2017/12/20171129-Incidents-and-their-classification-the-Common-Incident-Classification-Scheme-CICS-23.09.16.pdf> [Accessed: December 2021].

	harm” to human health as defined by the EPA 1990, Part 2A if exposure occurs.	incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce.	a substantial adverse change in its functioning or harm to a site of special interest that may endanger the long-term maintenance of the site.		diseases (for example, cancers), other diseases likely to have serious impacts on health, serious injury, birth defects, and impairment of reproductive functions. Damage to building rendering it unsafe to occupy, for example, foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.
Mild	Exposure to human health unlikely to lead to “significant harm”.	Equivalent to Environment Agency Category 3 pollution incident including minimal or short-lived effect on water quality; marginal effect on amenity value, agriculture, or commerce.	Minor or short-lived damage to a geodiversity site, which is unlikely to result in a substantial adverse change in its functioning or harm to a site of special interest that would endanger the long-term maintenance of the site.	Minor damage to crops, buildings, or property.	Exposure could lead to slight short-term effects (for example, mild skin rash). Surface spalling of concrete.
Minor	No measurable effects on humans.	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.	Equivalent to insubstantial pollution incident with no observed effect on a geodiversity site or site of special interest.	Repairable effects of damage to buildings, structures.	The loss of plants in a landscaping scheme. Discoloration of concrete.

6.2.12. The risk matrix which links the likelihood and consequence for the Proposed Development is shown in **Table 6-3**.

Table 6-3 - Risk Matrix

Likelihood Potential Consequence	Unlikely	Low	Likely	High
Severe	Moderate/Low Risk	Moderate Risk	High Risk	Very High Risk
Medium	Low Risk	Moderate/Low Risk	Moderate Risk	High Risk
Mild	Very Low Risk	Low Risk	Moderate/Low Risk	Moderate Risk
Minor	Very Low Risk	Very Low Risk	Low Risk	Low Risk

6.2.13. The relevant risk definitions are summarised in **Table 6-4**.

Table 6-4 - Risk Definitions

Risk	Definition
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action or there is evidence that severe harm to a designated receptor is already occurring. Realization of that risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.
High	Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realization of the risk is likely to present a substantial liability to the site owner or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner or occupier. Some remediation works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst that this harm if realized would normally be mild. It is unlikely that the site owner or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.
Very Low	It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realized would normally be mild or minor.

AGRICULTURAL LAND AND SOIL FUNCTION ASSESSMENT

- 6.2.14. In order to categorise agricultural land receptor sensitivity, the methodology in The *Design Manual for Roads and Bridges (DMRB) LA 109*¹³ states that an Agricultural Land Classification (ALC) survey is required where data is not already available for agricultural land. The Ministry of Agriculture, Fisheries and Food (MAFF)¹⁴ revised guidelines and criteria for grading the quality of agricultural land lays out the methodology to assign grades to agricultural land. The process considers site, climate, and soil conditions at a site. MAFF and *NPPF*¹⁵ defines best and most versatile (BMV) land as land of excellent (ALC Grade 1), very good (Grade 2) and good (Subgrade 3a) agricultural quality. BMV land is afforded a degree of protection against development within planning policy. Lower-quality Subgrade 3b and Grades 4 and 5 land is restricted to a narrower range of agricultural uses.
- 6.2.15. Following *IEMA A New Perspective on Land and Soil in Environmental Impact Assessment (2022)*¹⁶, the gradation of sensitivities from very high to negligible is not necessarily one of discrete categories for all of the soil functions, and it is not possible to anticipate all possible permutations of soil resources and soil functions. Therefore, this process involves an element of professional judgement.
- 6.2.16. Soil contamination reduces soil health and soil functionality. With regards to potential contamination impacts to ALC grade, land is not graded higher than Subgrade 3b if it is considered to be unsuitable for growing crops for direct human consumption. Land which is limited to grass production and on which there are significant restrictions on grassland management will be no better than Grade 4. Where only extensive grazing is possible the land will be Grade 5 and, where it is unfit for all forms of agricultural production, can be regarded as non-agricultural.

6.3 SIGNIFICANCE EVALUATION CRITERIA

VALUE (SENSITIVITY) OF RECEPTORS

- 6.3.1. The classification of receptor value (sensitivity) for the contaminated land, ALC and soil function assessments has followed the framework described in **Table 6-5**, which is based on Table 3.11 of the *DMRB Sustainability & Environmental Appraisal, LA 109: Geology and Soils*. Negligible sensitivity has been removed, as it is deemed irrelevant as no receptor (in terms of ground conditions) is classed as negligible.
- 6.3.2. Factors that may affect the sensitivity of the likely receptor include:
- Human Health – age, weight, sex, duration onsite and distance from the Site;
 - Controlled Waters - distance from the Site and resource potential;

¹³ Standards for Highways (2019) *Sustainability & Environment Appraisal, LA 109, 'Geology and soils'*, Design Manual for Roads and Bridges. Available at: <https://www.standardsforhighways.co.uk/search/adca4c7d-4037-4907-b633-76eae30b9c0> [Accessed: 21 May 2025].

¹⁴ Ministry of Agriculture, Fisheries and Food (MAFF) (1988) *Agriculture Land Classification of England and Wales, Revised guidelines, and criteria for grading the quality of agricultural land*, October 1988.

¹⁵ Ministry of Housing, Communities and Local Government (2024) *National Planning Policy Framework (NPPF)*. Available at: [National Planning Policy Framework - GOV.UK](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/123456/nppf-2024.pdf) [Accessed: 22 May 2025].

¹⁶ IEMA (2022) *A New Perspective on Land and Soil in Environmental Impact Assessment*. Available at: <https://www.iema.net/resources/blog/2022/02/17/launch-of-new-eia-guidance-on-land-and-soils> [Accessed: 22 May 2025].

- Building Fabric and Services: building design including factors such as gas protection measures and depth (below ground level) of services installations; and
- Agricultural land and soil receptors: Resource quality and, soil health and functions based on current or previous land uses.

6.3.3. Details of sensitive receptors included in the assessment are provided in ES **Chapter 11: Ground Conditions, Soils and Agricultural Land (Volume 1)**.

Table 6-5 - Classification of Value (Sensitivity) of Receptors

Receptor Value (sensitivity)	Criteria	Typical Examples	
Very High	Very rare and of international importance with no potential for replacement.	Geology	UNESCO World Heritage Sites, UNESCO, Global Geoparks, SSSI and Geological Conservation where citations indicate features of international importance. Review sites where citations indicate features of international importance.
	Soils directly supporting an EU designated site. Agricultural land.	Soil Resource and Soil Function	Biomass production: ALC Grades 1 & 2 Ecological habitat, soil biodiversity and platform for landscape: Soils supporting protected features within a European site (e.g., SAC, SPA, Ramsar); Peat soils; Soils supporting a National Park, or Ancient Woodland. Soil carbon: Peat soils, Soils with potential for ecological/landscape restoration Soil hydrology: Very important catchment pathway for water flows and flood risk management. Archaeology, Cultural heritage, Community benefits and Geodiversity: SAMs and adjacent areas; World Heritage and European designated sites; Soils with known archaeological interest; Soils supporting community/recreational/educational access to land covered by National Park designation.
	Human health: very high sensitivity land use.	Contamination	Residential properties or allotments.
	Nationally significant attribute of high importance.	Surface water	Watercourses having a WFD classification shown in a River Basin Management Plan (RBMP) and $Q95 \geq 1.0 \text{ m}^3/\text{s}$ where Q95 is the flow in cubic metres per second which was equalled or exceeded for 95% of the surface water feature's flow record.

Receptor Value (sensitivity)	Criteria	Typical Examples	
	Nationally significant attribute of high importance.	Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site protected under European Commission (EC) and UK Biodiversity legislation. Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE). Source Protection Zone (SPZ)1.
High	Rare and of national importance with little potential for replacement. Geology meeting national designation criteria which is not designated as such.	Geology	Geological SSSI, NNR.
	Soils directly supporting a UK designated site. Agricultural land.	Soil Resource and Soil Function	Biomass production: ALC Grade 3a. Ecological habitat, soil biodiversity and platform for landscape: Soils supporting protected features within a UK designated site (e.g., UNESCO Geoparks, SSSI or AONB, Special Landscape Area, and Geological Conservation Review sites); Native Forest and woodland soils; Unaltered soils supporting semi-natural vegetation. Soil carbon: Organo-mineral soils (e.g., peaty soils). Soil hydrology: Important catchment pathway for water flows and flood risk management. Archaeology, Cultural heritage, Community benefits and Geodiversity: Soils with probable but as yet unproven (prior to being revealed by construction) archaeological interest; Historic parks and gardens; Regionally Important Geological Sites (RIGS); Soils supporting community/recreational/educational access to RIGS and AONBs.
	Human Health: high sensitivity land use.	Contamination	Public open space.
	Locally significant attribute of high importance.	Surface water	Watercourses having a WFD classification shown in a RBMP and Q95 < 1.0 m3/s where Q95 is the flow in cubic metres per second which was equalled or exceeded for 95% of the surface water feature's flow record.

Receptor Value (sensitivity)	Criteria	Typical Examples	
	Locally significant attribute of high importance.	Groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE. SPZ2.
Medium	Of regional importance with limited potential for replacement. Geology meeting regional designation citation criteria which is not designated as such.	Geology	Regionally Important Geological Sites (RIGS).
	Soils supporting non-statutory designated sites. Agricultural land.	Soil Resource and Soil Function	Biomass production: ALC Grade 3b. Ecological habitat, soil biodiversity and platform for landscape: Soils supporting protected or valued features within non-statutory designated sites (e.g. Local Nature. Reserves (LNR), Local Geological Sites (LGSS), Sites of Importance for Nature Conservation (SINCs), Special Landscape Areas; Non-Native Forest and woodland soils. Soil carbon: Mineral soils. Soil hydrology: Important minor catchment pathway for water flows and flood risk management. Archaeology, Cultural heritage, Community benefits and Geodiversity: Soils with possible but as yet unproven (prior to being revealed by construction) archaeological interest; Soils supporting community/recreational/educational access to land.
	Human Health: medium sensitivity land use.	Contamination	Commercial or industrial properties.
	Of moderate quality and rarity	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001 m3/s where Q95 is the flow in cubic metres per second which was equalled or exceeded for 95% of the surface water feature's flow record.
	Of moderate quality and rarity	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.

Receptor Value (sensitivity)	Criteria	Typical Examples	
Low	Of local importance/interest with potential for replacement	Geology	Non designated geological exposures, former quarries/mining sites.
	Soils supporting non-designated notable or priority habitats. Agricultural land.	Soil Resource and Soil Function	Biomass production: ALC Grades 4 & 5. Ecological habitat, soil biodiversity and platform for landscape: Soils supporting valued features within non-designated notable or priority habitats/landscapes. Agricultural soils. Soil carbon: Mineral soils. Soil hydrology: Pathway for local water flows and flood risk management. Archaeology, Cultural heritage, Community benefits and Geodiversity: Soils supporting no notable cultural heritage, geodiversity nor community benefits; Soils supporting limited community/recreational/educational access to land.
	Low sensitivity land use	Contamination	Infrastructure (roads, bridges, railways, buildings, and services).
	Low sensitivity quality	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 <0.001 m3/s where Q95 is the flow in cubic metres per second which was equalled or exceeded for 95% of the surface water feature's flow record.
	Low sensitivity quality	Groundwater	Unproductive strata.

CONTAMINATED LAND ASSESSMENT (RISK ASSESSMENT)

- 6.3.4. There is no established guidance on how to use the LCRM risk assessment approach as the basis for the evaluation of the significance of effects within the EIA process.
- 6.3.5. For the purposes of the EIA, the magnitude of a change in status from baseline is identified as an impact caused by the Proposed Development and the consequences of those changes are identified as effects. Consequently, for the assessment, the impact and its effect have been defined as a change in risk and the magnitude of the change in risk from baseline, through construction pre- and post-mitigation measures. In considering the post-development risks, embedded environmental measures will be taken into account.
- 6.3.6. An assessment has been undertaken for each of the identified likely significant effects. This has followed the methodology outlined in the assessment methodology above (i.e. collection of baseline desk study data and a qualitative assessment of the change in level of risk). This assessment approach is analogous to the Preliminary Risk Assessment stage of LCRM.

- 6.3.7. Where a risk classification of moderate or greater is determined, it is considered that the source–pathway–target contaminant linkage requires some form of risk management or intervention, and the first next step being a more ‘detailed’ assessment.
- 6.3.8. Such ‘detailed’ assessment would normally take the form of further investigation, such as an intrusive ground investigation, with the additional knowledge gained allowing the risk to be more accurately assessed and potentially the classification may be lowered. This first step of the more ‘detailed’ assessment is analogous to the Site Investigation and Detailed Quantitative Risk Assessment stages of LCRM.
- 6.3.9. However, if after this first step, the risk classification remains at moderate or above then remediation, in the form of environmental measures, may be required to reduce or remove the source of contamination or disrupt the pathway to the receptor. This final step will be analogous to undertaking the Remediation Implementation and Verification stage of LCRM.
- 6.3.10. ‘Detailed’ assessments, where required, will typically be undertaken following planning proposal at detailed design stage. As part of the ES, the requirements for further ‘detailed’ assessment will be identified and set out as commitments within the planning proposal.
- 6.3.11. **Table 6-6** presents the risk classification pre- and post-development as the basis for the significance evaluation matrix that has been used in the EIA.

Table 6-6 - Risk Significance Evaluation Matrix

			Risk Post-Development (including embedded environmental measures)					
			Very Low	Low	Moderate/Low	Moderate	High	Very High
Risk Pre-Development	Existing Receptors	Very High	Major Positive (Significant)	Major Positive (Significant)	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)
		High	Major Positive (Significant)	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)
		Moderate	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)
		Moderate /Low	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)
		Low	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)
		Very Low	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)	Major Negative (Significant)

			Risk Post-Development (including embedded environmental measures)					
			Very Low	Low	Moderate/Low	Moderate	High	Very High
	No Receptor Present development	N/A	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)	Major Negative (Significant)	Major Negative (Significant)
<p>Risks that remain at moderate, high, or very high post-development may require further measures during the construction phase to mitigate those risks depending on the specific circumstances (for example remediation in line with LCRM).</p> <p>Where effects are indicated to be Potentially Significant in EIA terms based on the change in risk from pre- to post-development, professional judgement will be applied to determine whether they are Significant or Not Significant.</p>								

AGRICULTURAL LAND AND SOIL FUNCTION ASSESSMENT

- 6.3.12. The significance of effects to agricultural land is based on the permanent or temporary land take impacts or reduction in soil functions as a result of the Proposed Development.

Magnitude of Impact

- 6.3.13. The expected magnitude of impact to agricultural soils and soil function receptor will be assigned in accordance with the principles established in *LA 109: Geology and Soils* and *LA 104: Environmental Assessment and Monitoring* along with professional judgement. The terms used to describe magnitude of impact are defined in *LA 104* and *LA 109* and directly reproduced in **Table 6-7**.

Table 6-7 - Classification of Magnitude of Impact (Change)

Magnitude of Impact (Change)		Definition
Major	Adverse	<i>Soil: Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features, or elements; exposure to acutely toxic contaminants. >20 ha of agricultural land of soil features.</i>
	Beneficial	<i>Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality". Potential for permanent improvement in one or more soil functions or soil volumes due to remediation or restoration over an area of more than 20 ha.</i>
Moderate	Adverse	<i>Soil: Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features, or elements; short-term exposure to contaminants with chronic (long-term) toxicity. Permanent, irreversible loss of one or more soil functions or soil volumes, over an area of between 5 and 20ha of soil features.</i>
	Beneficial	<i>Benefit to, or addition of, key characteristics, features, or elements; improvement of attribute quality.</i>
Minor	Adverse	<i>Soil: Permanent, irreversible loss over less than 5 ha or a temporary, reversible loss of one or more soil functions or soil volumes), or temporary, reversible loss of soil features.</i>
	Beneficial	<i>Minor benefit to, or addition of, one (maybe more) key characteristics, features, or elements; some beneficial impact on attribute or a reduced risk of adverse impact occurring. Potential for permanent improvement in one or more soil functions or soil volumes due to remediation or restoration over an area of less than 5ha.</i>
Negligible	Adverse	<i>Soils: No discernible loss or reduction or improvement of soil functions or soil volumes that restrict current or proposed land use</i>
	Beneficial	<i>Soils: No discernible loss or reduction or improvement of soil functions or soil volumes that restrict current or proposed land use.</i>
No change		<i>No loss or alteration of characteristics, features, or elements; no observable impact in either direction.</i>

Significance of Effects Criteria

- 6.3.14. Once the sensitivity of the affected receptor to change and the magnitude of change have been established, the matrix presented in **Table 6-8**, which is based on *LA 104: Environmental Assessment and Monitoring*¹⁷, will be used to determine the level of risk, ranging from 'neutral' to 'very large'. The likely duration of the effect and likelihood of the effect occurring is also considered when assessing each effect.
- 6.3.15. Where a range has been provided, e.g. 'moderate or large', professional judgement will be used to define the significance. The effects are described as adverse and beneficial. An effect would be considered significant if assessed as moderate or above.

Table 6-8 - Significance of Effects Matrix

		Magnitude of Impact (Change)				
		No Change	Negligible	Minor	Moderate	Major
Receptor Value (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	Moderate	Moderate or large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate

- 6.3.16. **Table 6-9**, which is based on Table 3.7 in *DMRB LA 104*, provides typical descriptions of these significance categories.

Table 6-9 - Significance Categories (Effects) and Typical Descriptions

Significance Category	Typical Description
Very Large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

¹⁷ DMRB Sustainability & Environment Appraisal, LA 104: Environmental assessment and monitoring.

7 WATER RESOURCES

7.1 SIGNIFICANCE CRITERIA

- 7.1.1. The significance level attributed to each effect are to be assessed based on the magnitude of change/effect due to the Proposed Development and the sensitivity of the affected receptor/receiving environment to changes. The magnitude of change/effect and sensitivity of the affected receptor/receiving environment will be assessed by adapting the relevant tables within the following documents:
- *Design Manual for Roads and Bridges (DMRB) LA113: Road Drainage and the Water Environment*; Although the *LA113* standard is intended to guide the assessment of highways related projects, it is common practice to apply it to assess water environment effects of varying development types and the broad principles are applicable to the Proposed Development; and
 - TAG Unit A3 Environmental Impact Appraisal – Impacts on the **Chapter 12: Water Resources (Volume 1)**. This document is intended for appraisal of environmental impacts related to transport appraisals, but the principles within can be applied to the Proposed Development.

7.2 DETERMINING RECEPTOR SENSITIVITY

- 7.2.1. **Table 7-1** details the assessment methodology which has been used to determine the Value (sensitivity) of receptor. These criteria are based on those provided in the *DMRB LA 104* Table 3.2N.

Table 7-1 - Environmental Value (Sensitivity) and Descriptions

Value (Sensitivity) of Receptor/ Resource	Typical Description
Very High	Very High Very high importance and rarity, international scale and very
High	limited potential for substitution.
Medium	High High importance and rarity, national scale, and limited
Low	potential for substitution.
Negligible	Medium Medium or high importance and rarity, regional scale, limited

- 7.2.2. **Table 7-2** details the assessment framework which has been used to determine the importance of water environment attributes sensitivity of water resources. These criteria are based on those provided in the *DMRB LA 113* table 3.70.

Table 7-2 - Estimating the Importance of Water Environment Attributes

Importance	Typical Criteria	Typical Examples
Very High	Nationally significant attribute of high importance	<p>Surface Water:</p> <ul style="list-style-type: none"> Watercourse having a WFD classification shown in a RBMP and with $Q_{95} > 1\text{m}^3/\text{s}$; and Site protected/designated under EU or UK habitat legislation (SAC, SPA, SSSI, Ramsar site, salmonid water), or species protected by EC Legislation LA 108. <p>Groundwater:</p> <ul style="list-style-type: none"> Principal aquifer providing a regionally important resource or protected site under EC and UK legislation LA 108; Groundwater locally supports a GWDTE; and Source Protection Zone (SPZ) 1. <p>Flood Risk:</p> <ul style="list-style-type: none"> Essential infrastructure or highly vulnerable development.
High	Locally significant attribute of high importance	<p>Surface Water:</p> <ul style="list-style-type: none"> Watercourse having a WFD classification shown in a RBMP and with $Q_{95} < 1\text{m}^3/\text{s}$; and Species protected under EC or UK Legislation LA 108. <p>Groundwater:</p> <ul style="list-style-type: none"> Principal aquifer providing locally important resource or supporting a river ecosystem; Groundwater supports a GWDTE; and Source Protection Zone (SPZ) 2. <p>Flood Risk:</p> <ul style="list-style-type: none"> More vulnerable development.
Medium	Moderate quality and rarity	<p>Surface Water:</p> <ul style="list-style-type: none"> Watercourse not having a WFD classification shown in a RBMP and with $Q_{95} > 0.001\text{m}^3/\text{s}$. <p>Groundwater:</p> <ul style="list-style-type: none"> Aquifer providing water for agriculture or industrial use with limited connection to surface water; and Source Protection Zone (SPZ) 3. <p>Flood Risk:</p> <ul style="list-style-type: none"> Less vulnerable development.
Low	Lower quality	<p>Surface Water:</p> <ul style="list-style-type: none"> Watercourse not having a WFD classification shown in a RBMP and with $Q_{95} < 0.001\text{m}^3/\text{s}$. <p>Groundwater:</p> <ul style="list-style-type: none"> Unproductive strata. <p>Flood Risk:</p> <ul style="list-style-type: none"> Water compatible development.

7.3 DETERMINING THE MAGNITUDE OF IMPACT

7.3.1. **Table 7-3** details the assessment framework which has been used to determine the magnitude of impact upon water resources. These criteria are based on those provided in Table 3.71 of the *DMRB LA 113*.

Table 7-3 - Estimating the Magnitude of an Impact on an Attribute

Magnitude	Criteria	Typical Examples	
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute.	Surface Water	<p>Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT and compliance failure with EQS values.</p> <p>Calculated risk of pollution from a spillage $\geq 2\%$ annually (spillage assessment).</p> <p>Loss or extensive change to a fishery.</p> <p>Loss of regionally important public water supply.</p> <p>Loss or extensive change to a designated nature conservation site.</p> <p>Reduction in water body WFD classification.</p>
		Groundwater	<p>Loss of, or extensive change to, an aquifer.</p> <p>Loss of regionally important water supply.</p> <p>Potential high risk of pollution to groundwater from routine runoff - risk score > 250 (Groundwater quality and runoff assessment).</p> <p>Calculated risk of pollution from spillages $\geq 2\%$ annually (Spillage assessment).</p> <p>Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies.</p> <p>Reduction in water body WFD classification.</p> <p>Loss or significant damage to major structures through subsidence or similar effects.</p>
		Flood Risk	Increase in peak flood level ($> 100\text{mm}$).
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Surface Water	<p>Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values.</p> <p>Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually.</p> <p>Partial loss in productivity of a fishery.</p> <p>Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies.</p> <p>Contribution to reduction in water body WFD classification.</p>
		Groundwater	<p>Partial loss or change to an aquifer.</p> <p>Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies.</p>

Magnitude	Criteria	Typical Examples	
			<p>Potential medium risk of pollution to groundwater from routine runoff - risk score 150-250.</p> <p>Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually.</p> <p>Partial loss of the integrity of GWDTE.</p> <p>Contribution to reduction in water body WFD classification.</p> <p>Damage to major structures through subsidence or similar effects or loss of minor structures.</p>
		Flood Risk	Increase in peak flood level ($> 50\text{mm}$).
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability.	Surface Water	<p>Failure of either acute soluble or chronic sediment related pollutants in HEWRAT.</p> <p>Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually.</p> <p>Minor effects on water supplies.</p>
		Groundwater	<p>Potential low risk of pollution to groundwater from routine runoff - risk score < 150</p> <p>Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ Annually</p> <p>Minor effects on an aquifer, GWDTEs, abstractions and structures</p>
		Flood Risk	Increase in peak flood level ($> 10\text{mm}$)
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	Surface Water	<p>No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants).</p> <p>Risk of pollution from spillages $< 0.5\%$.</p>
		Groundwater	No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages $< 0.5\%$.
		Flood Risk	Negligible change to peak flood level ($\leq \pm 10\text{mm}$).
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	Surface Water	<p>HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition.</p> <p>Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually).</p>
		Groundwater	Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk $< 1\%$ annually).

Magnitude	Criteria	Typical Examples	
			Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
		Flood Risk	Creation of flood storage and decrease in peak flood level (> 10mm).
Moderate Beneficial	Results in moderate improvement of attribute quality.	Surface Water	HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually). Contribution to improvement in water body WFD classification.
		Groundwater	Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually). Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE.
		Flood Risk	Creation of flood storage and decrease in peak flood level1 (>50mm).
Major Beneficial	Results in major improvement of attribute quality.	Surface Water	Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.
		Groundwater	Removal of existing polluting discharge to an aquifer removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.
		Flood Risk	Creation of flood storage and decrease in peak flood level (> 100mm).
No change		No loss or alteration of characteristics, features, or elements; no observable impact in either direction.	

7.4 SIGNIFICANCE OF EFFECT CRITERIA

- 7.4.1. The combination of receptor sensitivity and magnitude of impact has been used to determine the significance of each effect by using the matrix in **Table 7-4**. This matrix is based on that provided in Table 3.8.1 of the *DMRB LA 104*. Effects which are moderate or above would be considered to be significant.

Table 7-4 - Significance Matrix

Importance of Environment Attributes (Receptor Sensitivity)	Magnitude of Impact (degree of change)				
	Major	Moderate	Minor	Negligible	No change
Very High	Very Large	Large or Very Large	Moderate or Large	Slight	Neutral
High	Large or Very Large	Moderate or Large	Slight or Moderate	Slight	Neutral
Medium	Moderate or Large	Moderate	Slight	Neutral or Slight	Neutral
Low	Slight or Moderate	Slight	Neutral or Slight	Neutral or Slight	Neutral

8 SOCIO-ECONOMICS

8.1 SIGNIFICANCE OF EFFECT CRITERIA

- 8.1.1. The methodology for assessing socio-economic impacts follows standard EIA guidance and involves:
- Consideration of local policy, plans, and development constraints;
 - Assessment of the likely scale, permanence, and classification of impacts; and
 - An assessment of the residual impacts of the Proposed Development.
- 8.1.2. The assessment considers the likely direct, indirect, induced, and cumulative impacts associated with socio-economics during demolition and construction and operation. For socio-economics there is no accepted definition of what constitutes a significant (or not significant) socio-economic effect. It is however recognised that classification of an effect reflects the relationship between the scale of an impact (magnitude) and the sensitivity (or value) of the affected resource or receptor.
- 8.1.3. As such effects are assessed on the basis of:
- Consideration of sensitivity to effects: Specific values in terms of sensitivity are not attributed to socio-economic resources/receptors due to their diverse nature and scale. However, the assessment takes account of the qualitative (often informed by quantitative metrics and comparators) 'sensitivity' of each receptor;
 - Magnitude of the impact: This entails consideration of the size of the effect on people or business in the context of the area in which effects would be experienced;
 - Scope for adjustment or mitigation: The socio-economic study is concerned in part with economies. These adjust themselves continually to changes in supply and demand, and the scope for the changes brought about by the project to be accommodated by market adjustment conforms to that outlined in **Chapter 3: Approach to EIA (Volume 1)**;
 - Duration: This entails consideration of the duration of impact as either short, medium, or long term. Impacts lasting less than two years are considered short term, impacts lasting between two and ten years are considered medium term and impacts lasting ten or more years are considered long term; and
 - Permanence: This involves identifying whether the impact would be permanent or temporary. Generally, impacts during the construction phase of the Proposed Development are considered temporary, and impacts during the operational phase of the Proposed Development are considered permanent.

RECEPTOR SENSITIVITY

- 8.1.4. The receptor sensitivity is assessed on a case-by-case basis, using professional judgement informed by baseline statistics.

SENSITIVE RECEPTORS

- 8.1.5. The sensitivity of receptors considered in this assessment have been defined as high, medium, low, or negligible. In the context of socio-economics the level of sensitivity depends upon the baseline

and future baseline conditions (e.g. the extent to which unemployment is an issue in an area and thus how sensitive the people in that area might be to changes in job opportunities).

- 8.1.6. Specific values in terms of sensitivity are not always attributed to socio-economic due to their diverse nature and scale. Where quantitative metrics are available (for example on unemployment) these are used to inform the sensitivity. However, the assessment takes account of the qualitative (rather than purely quantitative) 'sensitivity' of each receptor. The receptor sensitivity is assessed on a case-by-case basis, using professional judgement. Broad definitions of the receptor sensitivities are given in **Table 8-1**.

Table 8-1 - Broad Definitions of Sensitivity Levels for Socio-Economic and Human Health Receptors

Sensitivity	Evidence for sensitivity assessment
High	High responsiveness of a receptor to changes in baseline conditions, characterised by low capacity or high scarcity of a socio-economic indicator when compared to targets or compared to other geographies. The receptor is very sensitive to most temporary or permanent changes. For example, if all residents in an area were unemployed and looking for a job, then they would be highly sensitive to a change in the provision of new employment opportunities.
Medium	Moderate responsiveness of a receptor to changes in baseline conditions. For example, if slightly more residents in an area were unemployed and looking for a job compared to comparator geographies, then residents in that area would have a medium sensitivity to a change in the provision of new employment opportunities.
Low	Limited responsiveness of a receptor to changes in baseline conditions. For example, if slightly the same proportion of residents in an area were unemployed and looking for a job as in comparator geographies (and such geographies were performing well relative to historic trends), then residents in that area would have a low sensitivity to a change in the provision of new employment opportunities.
Negligible	The study area is performing well and/or does not represent a socio-economic problem for the receptor. For example, if all residents in an area were employed in well paid, good quality jobs then they would not be sensitive to a change in the provision of new employment opportunities.

BASELINE APPROACH

- 8.1.7. A variety of data sources are used to determine baseline conditions. These range from government sources (ONS, MHCLG, NHS) which have a high degree of confidence, through to industry sources (Construction Industry Training Board, VisitBritain, AECOM theme park index, International Association of Amusement Parks and Attractions) which have medium degree of confidence, and other sources (Local government planning and forecasting documents, news reports, agency

publications) which mostly have medium confidence, but some of which are lower confidence. Where baseline information is provided, it is fully referenced. Where some manipulation or interpretation of information is required, this is explained and justified.

FUTURE BASELINE APPROACH

- 8.1.8. Information on the future baseline is presented where available, based upon economic, social or community infrastructure plans or projections. This involves relying upon projections from relevant Local Plans, which set out how population, housing, employment and retail expenditure are expected to change in the future. Where these are used, their source and basis is explained. Where these are not available, the receptor population affected in the future assessment years are assumed to have the same sensitivity as the population in the current baseline.
- 8.1.9. The future baseline also considers when other relevant economic, social or community trends might influence the assessment. For example, the future baseline considers trends in leisure expenditure, investment from other theme parks, growth in conferencing, international and domestic tourism trends and performance of retail. Trends and sources for statements made about the future baseline with respect to these indicators are presented throughout but are inherently uncertain.

IMPACT MAGNITUDE

- 8.1.10. This entails consideration of the size of the effect on people or business in the context of the area in which effects would be experienced.
- 8.1.11. The assessment of the magnitude of potential impacts has aimed to be objective, quantifying the magnitude of impacts wherever possible. Where quantification has not been possible, qualitative assessments (professional judgement) have been made and justified. The classification of magnitude of impact on receptors takes account of such factors as:
- The spatial scale at which the effect is assessed;
 - The frequency of the effect;
 - The degree of change relative to existing environmental conditions;
 - The reversibility of the effect;
 - The duration over which the effect occurs; and
 - Magnitude is assessed as high, medium, low, or negligible.

Table 8-2 – Magnitude of impact

Magnitude of impact	Description
High	Total loss or major/substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post-development character/composition/attributes will be fundamentally changed.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post-development character/composition/attributes of the baseline will be materially changed.

Magnitude of impact	Description
Low	A minor shift away from baseline conditions. Change arising from the loss or alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

SIGNIFICANCE OF EFFECT

- 8.1.12. Socio-economic effects reflect the relationship between the sensitivity of the affected receptor and the magnitude of the impact. **Table 8-3** shows how the assessment of the significance of effects has been determined. Effects classified as major, major/moderate, or moderate are significant. Significant effects are highlighted in bold. Effects can be either beneficial or adverse; temporary or permanent; and, direct or indirect.

Table 8-3 - Effect Significance Matrix

		Magnitude			
		High	Medium	Low	Negligible
Sensitivity	High	Major	Major/moderate	Moderate/minor	Minor/negligible
	Medium	Major/moderate	Moderate	Minor	Minor/negligible
	Low	Moderate/minor	Minor	Minor	Negligible
	Negligible	Minor/negligible	Minor/negligible	Negligible	Negligible

- 8.1.13. Embedded mitigation refers to measures built into the project design from the start to prevent or reduce adverse environmental impacts. Additional mitigation involves additional actions taken after the project design is finalised to further reduce or offset impacts not fully addressed by embedded measures. Embedded mitigation is referred to and included in the assessment of effects. If the effect does not require additional mitigation (or none is possible), the residual effect will remain the same. If, however, additional mitigation is required, an assessment of the post mitigation residual effect is provided. Embedded and additional mitigation measures can also represent enhancements of positive effects where actions are taken to improve or amplify the beneficial outcomes of the Proposed Development what would naturally occur.

9 GREENHOUSE GASES

9.1 ASSESSMENT METHODOLOGY

- 9.1.1. The assessment approach considers the likely magnitude of additional or avoided greenhouse gas (GHG) emissions in comparison to the baseline, without the Proposed Development. It considers emissions throughout the in-scope lifecycle stages and sub-stages of the Proposed Development. The associated emissions have been calculated through the collection of available data/information on the scale of GHG emitting activities relevant to the baseline scenario and for the Proposed Development (e.g. development area, transport modelling, energy consumption). Where available, primary raw data has been used in calculations, where this information is not available proxies or industry benchmarks have been used to estimate emissions. In each case this covers an estimated initial Primary Phase construction period of five years (covering 2026-2031) and a minimum operational period for the Proposed Development of 60 years (from 2031-2050 for the Primary Phase and from 2051-2090 for the 2051 Build Out scenario). Timescales for construction of the 2051 Build Out scenario are not confirmed but are assumed to take place before 2051.
- 9.1.2. There are no plans to decommission and remove the Proposed Development. However, removal would likely to require a similar degree of plant, equipment, and disturbance to that predicted during construction and so similar effects would arise (or indeed could be improved given expected decarbonisation to achieve net zero targets and developments in technology over time). Given that there are no plans to decommission the Proposed Development, consideration of decommissioning is not considered appropriate.
- 9.1.3. The sources of activity and emissions data, alongside the assessment methodology for the effects resulting from the Construction and Operational Phases are outlined below.

BASELINE

- 9.1.4. In the baseline, without the Proposed Development, GHG emissions occur constantly and widely as a result of human and natural activity. In accordance with the process set out in IEMA guidance for Assessing Greenhouse Gas Emissions and Evaluating their Significance¹⁸, the GHG assessment only considers instances in which the Proposed Development results in additional or avoided emissions in comparison to the baseline scenario and its assumed evolution. The baseline therefore focuses on those emissions sources subject to change between the baseline and the Proposed Development, which for the GHG assessment relates to a desk study evaluation of emissions associated with road transport.
- 9.1.5. Traffic model flow data from the transport assessment (**Chapter 5: Traffic and Transport (Volume 1)**) for the 2030 baseline reference year was used to determine future baseline emissions, without the Proposed Development. The future baseline transport user emissions were calculated in accordance with DMRB Volume 11, Section 3, Part 14 Climate; LA114¹⁹, based on the following information from the traffic modelling data:

¹⁸ IEMA (2022) *Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance*. Available at: <https://www.iema.net/> [Accessed: 22 May 2025].

¹⁹ Standards for Highways (2021) *Sustainability & Environment Appraisal LA 114 Climate* (DMRB Volume 11, Section 3, Part 14 Climate; LA114). Available at: <https://standardsforhighways.co.uk/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0> [Accessed: 22 May 2025].

- Road network Link IDs;
- Daily traffic flows;
- Proportion of Heavy Duty Vehicles (HDVs); and
- Vehicle speed.

9.1.6. Emissions were quantified using TAG data from the Department for Transport (DfT)²⁰. This took into account the proportions of the vehicle types, fuel type, forecast fuel consumption parameters and emission factors. From this, traffic emissions without the Proposed Development were quantified for the baseline reference year (2030) and extrapolated over the indicative 60-year minimum operational period.

CONSTRUCTION PHASE

9.1.7. The quantification of construction emissions was calculated based on outline information on the built development footprint from the indicative use categories from the **Parameter Plans - Entertainment Resort Complex Land Use (Document Reference 1.10.0)** for the Proposed Development, along with supplementary information on the estimated construction budget and traffic modelling for the Construction Phase. The quantification of GHG emissions for the Construction Phase covers the following emission sources with reference to PAS 2080:2023 lifecycle stages²¹:

- A1-A3 Product Stage (manufacture and transport of raw materials to suppliers);
- A4 Transport to Project Site; and
- A5 Plant and Equipment Use and Waste Management.

9.1.8. Land use, land use change and forestry (A5 Construction Phase) was scoped out of the assessment as a review of existing land uses (arable land and areas of hardstanding) indicates that emissions from the change in land use for the Proposed Development is not expected to be significant.

9.1.9. The quantification of GHG emissions for the Construction Phase has been undertaken using best practice carbon management methods, professional judgement, and guidance including, but not limited to, PAS 2080:2023²¹, Royal Institute of Chartered Surveyors (RICS) guidance^{22,23,24} and RIBA case studies²⁵. The construction carbon footprint is divided into three main categories: embodied carbon; transportation; plant equipment; transport of construction waste; and land use change.

²⁰ HM Government, Depart for Transport (2023) *Guidance TAG data book*. Available at: <https://www.gov.uk/government/publications/tag-data-book> [Accessed: 22 May 2025].

²¹ PAS 2080 (2023). Available at: <https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/pas-2080-carbon-management-in-infrastructure-and-built-environment/> [Accessed: 22 May 2025].

²² RICS (2012) *RICS Professional Information, UK. Methodology to calculate embodied carbon of materials* (Carbon Critical Tool, Atkins cited: Methodology to calculate embodied carbon of materials). Available at: https://www.igbc.ie/wp-content/uploads/2015/02/RICS-Methodology_embodied_carbon_materials_final-1st-edition.pdf [Accessed: 22 May 2025].

²³ RICS (2017) *Whole Life Carbon Assessment for the Built Environment*. Available at: https://www.rics.org/content/dam/ricsglobal/documents/standards/whole_life_carbon_assessment_for_the_built_environment_1st_edition_rics.pdf [Accessed: 22 May 2025].

²⁴ RICS (2023) *Whole life carbon assessment for the built environment*. Global. 2nd edition. Available at: <https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment> [Accessed: 22 May 2025].

²⁵ RIBA (2018) *Embodied and whole life carbon assessment for architects*. Available at: <https://www.architecture.com/-/media/GatherContent/Whole-life-carbon-assessment-for-architects/Additional-Documents/11241WholeLifeCarbonGuidanceev7pdf> [Accessed: 22 May 2025].

A1-A3 Product Stage (manufacture and transport of raw materials to suppliers)

9.1.10. Emissions 'embodied' within the construction materials are calculated as follows:

- Built development footprint (m²) X RICS emissions factor (tCO₂e/m²) = Emissions (tCO₂e).

9.1.11. The built development footprint for the Proposed Development was estimated based on the high-level use categories for the Proposed Development identified in the **Parameter Plans - Entertainment Resort Complex Land Use (Document Reference 1.10.0)** for the 2051 Build Out scenario including expanded Wixams Rail Station, the road network. The high-level use categories were aligned with the following categories for emissions factors identified in RICS guidance²²: leisure park; food & beverage retail; resort hotel; retail mall/shopping centre; other industrial/utilities/specialist uses; depot/open storage; mixed use city block.

A4 Transport to Project Site

9.1.12. Traffic model flow data from the transport assessment (**Chapter 5: Traffic and Transport (Volume 1)**) for construction traffic has been used to determine GHG emissions associated with construction transport, in accordance with DMRB Volume 11, Section 3, Part 14 Climate; LA114¹⁹, based on the following information from the traffic modelling data:

- Road network Link IDs;
- Daily traffic flows;
- Proportion of Heavy Duty Vehicles (HDVs); and
- Vehicle speed.

9.1.13. From this, construction related transport emissions were quantified over the construction period from 2026 to 2031, using TAG data from the Department for Transport²⁰.

A5 Plant and Equipment Use and Waste Management

9.1.14. GHG emissions for plant and equipment energy/fuel usage and the management of construction waste arisings was estimated using the RICS assumption²³. This assumption is based on the estimated construction cost (adjusted for inflation) of the Proposed Development:

- Construction cost (£) X RICS Assumption (1,400 kgCO₂e/£100k of construction cost) (tCO₂/£) = Emissions (tCO₂e)

OPERATIONAL PHASE

9.1.15. The quantification of operational GHG emissions covers the following emission sources with reference to PAS 2080 lifecycle stages²¹:

- B2-B5 Maintenance, repair, replacement, and refurbishment;
- B6 Operational energy use;
- B7 Operational water use; and
- B8/D End-user emissions (transport by road).

9.1.16. The following operational categories were also scoped in for the assessment but given the stage of the Proposed Development there was insufficient information to quantify the associated GHG

emissions, so qualitative assessment has been used to evaluate potential impacts from emissions for these aspects:

- B1 Operation/Use (use of refrigerants, consumables etc.); and
- B8/D End-user emissions (transport by rail or air travel).

9.1.17. Land use, land use change and forestry (B1 Operational Phase) was scoped out of the assessment as the reduction in carbon sequestration over the lifetime of the Proposed Development due to the land use change is not expected to be significant.

B2-B5 – Maintenance (B2), Repair (B3), Replacement (B4) and Refurbishment (B5)

9.1.18. Quantitative data for the operational categories B2-B5 is not available at the current design stage, therefore the GHG emissions for these elements have been estimated based on a proportion of the embodied carbon emissions determined for the Construction Phase (A1-A3) and the indicative built development footprint.

B2 – Maintenance

9.1.19. RICS guidance²⁴ for determining module B2 impacts in the UK has been used to estimate GHG emissions associated with maintenance activities, applying an area-based emissions factor to the overall built development footprint for each phase of the Proposed Development.

- Built development footprint (m²) X RICS emissions factor (0.01 tCO₂e/m²) = Emissions (tCO₂e).

B3 – Repair

9.1.20. RICS guidance²⁴ for determining module B3 impacts in the UK has been used to estimate GHG emissions associated with repair activities, assumed to be a proportion of the emissions determined for the Construction Phase embodied carbon (A1-A3) and maintenance activities (B2).

- 10% of A1-A3 embodied carbon (tCO₂e) + 25% of B2 maintenance (tCO₂) = Emissions (tCO₂e).

B4 – Replacement and B5 – Refurbishment

9.1.21. To address the gap in information available at this stage of the design for emissions arising from replacement and refurbishment activities a factor has been applied to the emissions determined for the embodied carbon during the Construction Phase (A1-A3). This is based on a study of whole life carbon for different building types by RIBA²⁵ identifying the relationship between operational carbon emissions (including, but not limited to replacement and refurbishment aspects) and embodied carbon emissions. Emissions estimated for replacement and refurbishment for each phase of the Proposed Development are calculated as follows:

- A1-A3 embodied carbon (tCO₂e) X % factor for operational emissions = Emissions (tCO₂e).

9.1.22. This is potentially an overestimate for these operational categories as it may encompass emissions other than those directly related to replacement and refurbishment.

B6 – Operational Energy Use

9.1.23. A cautious worst case for the assessment assumes that grid electricity supplies will be used to meet the power demand for the Proposed Development, natural gas network supplies will be used to meet heating requirements and there will be a potential requirement for use of diesel fuel in back-up generators in case of emergency for power outages.

- 9.1.24. Emissions associated with operational electricity supplied from the grid are based on the indicative power demand from the WSP Utilities Team for each phase of the Proposed Development (31,000 kW assumed for the Primary Phase and 17,000 kW assumed for the Build Out scenario, without electrification of heating), and forecast emissions factors for UK grid average electricity supply. An average annual emissions factor for UK grid average electricity supply has been determined covering the minimum operational period of the Proposed Development (2031 to 2090), based on BEIS forecasts of UK grid average emissions factors (Consumption-based, Commercial/Public sector²⁶).
- Proposed Development power demand (MWh) X Average of UK grid electricity emissions factor for 2031-2090 (tCO₂e/MWh) = Emissions (tCO₂e).
- 9.1.25. Emissions associated with natural gas are based on the indicative gas use for heating requirements from the WSP Utilities Team for each phase of the Proposed Development (330 MWh daily demand assumed for the Primary Phase and 220 MWh daily demand assumed for the Build Out scenario, without electrification of heating), and the most recent UK Government emissions factor for natural gas supplies²⁷.
- Proposed Development gas use (MWh) X UK natural gas emissions factor (tCO₂e/MWh) = Emissions (tCO₂e).
- 9.1.26. To determine GHG emissions for a cautious worstcase scenario the potential requirement for back-up power in the form of diesel generators is considered. Fuel use and generator capacity has been based on an assumption for a temporary emergency requirement to meet 30% of the total electrical power demand for a limited period of 24 hours. Emissions resulting from the use of back-up power diesel generators for each phase of the Proposed Development are calculated based on estimated use of diesel fuel and the most recent UK Government emissions factor (Fuels, Diesel - average biofuel blend)²⁷.
- Amount of diesel fuel (l) X Emissions factor (tCO₂e/l) = Emissions (tCO₂e).

B7 – Operational Water Use

- 9.1.27. Emissions associated with operational water use are based on forecast for water consumption from the WSP Utilities Team for each phase of the Proposed Development (6 million litres per day assumed for the Primary Phase and 3 million litres per day assumed for the Build Out scenario), and the most recent UK Government emissions factor for water supply²⁷.
- Amount of water (l) X Emissions factor (tCO₂e/l) = Emissions (tCO₂e).

B8/D – End-user Emissions (transport by road)

- 9.1.28. Traffic model flow data from the transport assessment (**Chapter 5: Traffic and Transport (Volume 1)**) has been used to determine GHG emissions associated with road transport during the

²⁶ HM Government, Department for Business, Energy & Industrial Strategy (2023) *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*. Available at: <https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal> [Accessed: 22 May 2025].

²⁷ HM Government (2023) *Greenhouse gas reporting: conversion factors 2023*. Available at: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023> [Accessed: 22 May 2025].

Operational Phase, in accordance with DMRB Volume 11, Section 3, Part 14 Climate; LA114¹⁹, based on the following information from the traffic modelling data:

- Road network Link IDs;
- Daily traffic flows;
- Proportion of Heavy Duty Vehicles (HDVs); and
- Vehicle speed.

9.1.29. Emissions were quantified using TAG data from the Department for Transport²⁰. This took into account the proportions of the vehicle types, fuel type, forecast fuel consumption parameters and emission factors. From this, emissions were quantified for each year over the minimum 60-year operational period of the Proposed Development. The assessment was completed using the Core Scenario from the transport assessment.

B8/D – End-user Emissions (air travel)

9.1.30. To address what may be considered a cautious worstcase for impacts arising from the Proposed Development associated with air travel, the quantitative estimate of indirect GHG emissions related to air travel covers the following three scenarios (for the Primary Phase, from 2031 onwards and the assumed increase in visitor numbers for the 2051 Build Out scenario, assumed to be from 2051 onwards):

- *Low-range* – visitor flights originating from European countries only.
- *Medium-range* – visitor flights originating from European and ‘Rest of the World’ countries.
- *High-range* – visitor flights originating from ‘Rest of the World’ countries only.

9.1.31. Assumptions for visitor numbers are in-line with information on international visitors used in the transport assessment (**Chapter 5: Traffic and Transport (Volume 1)**):

- Total number of international visitors:
 - 2031 Primary Phase = 2,550,000 visitors per year (30% of 8.5M total visitors).
 - 2051 Build Out scenario = 5,760,000 visitors per year (48% of 12M total visitors).
- Assume that 22% of international visitors will use air travel for the sole purpose of visiting the Proposed Development (based on an assumption for the transport assessment that 22% of international visitors will travel directly to the Proposed Development from a UK airport).

9.1.32. The following additional assumptions have been used to estimate air travel GHG emissions for each scenario:

- GHG emissions factors:
 - *Low-range*: using an average ‘European’ emissions factor of 175 kgCO₂ per visitor return flight to the UK, based on ICAO data²⁸ for a selection of six European countries (Belgium, France, Germany, Italy, Netherlands, Spain).

²⁸ ICAO Carbon Emissions Calculator tool (ICEC). Available at: <https://www.icao.int/environmental-protection/Carbonoffset/Pages/default.aspx> [Accessed: 22 May 2025].

- **Medium-range:** using a combined emissions factor of 304 kgCO₂ per visitor return flight to the UK, based on the 'European' and 'Rest of the World' emissions factors and assuming 85% of flights originate from 'Europe' and 15% of flights originate from the 'Rest of the World'.
- **High-range:** using an average 'Rest of the World' emissions factor of 1,033 kgCO₂ per visitor return flight to the UK, based on ICAO data²⁸ for a selection of seven non-European countries (Australia, Brazil, China, India, Japan, South Africa, USA).
- Assume an additional 10% for GHG emissions for international visitors travelling to the UK by air, who will combine a visit to the Proposed Development with trips to other visitor attractions.

9.1.33. For each of the three scenarios annual air travel emissions are estimated for each phase of the Proposed Development:

- Annual international visitors (number per phase) x Adjustment for direct trips (22%) x Adjustment for indirect trips (110%) x Scenario emissions factor (tCO₂/return trip) = Emissions (tCO₂/yr).

9.2 SIGNIFICANCE OF EFFECT CRITERIA

- 9.2.1. Any magnitude of emitted or avoided GHG emissions makes a cumulative contribution to climate change (adverse or beneficial respectively).
- 9.2.2. Significance of GHG impacts is assessed in line with IEMA Guidance¹⁸; a development's emissions should be based on its net impact over its lifetime, which may be beneficial, adverse, or negligible. The evaluation of significance should not just focus on GHG emissions, or the magnitude of those emissions, but whether the Proposed Development contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2051.
- 9.2.3. **Figure 9-1** from the IEMA guidance illustrates how the significance of a project's whole life GHG emissions can be determined and how these align with the UK's net zero compatible trajectory.

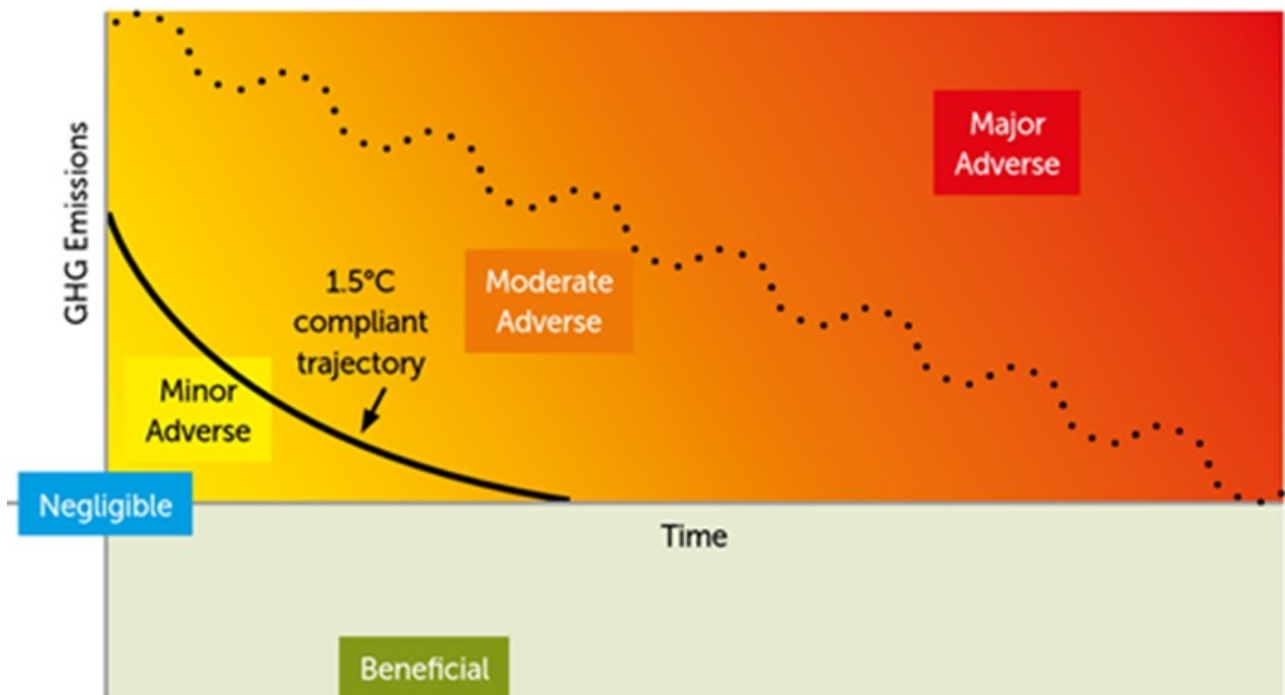


Figure 9-1 - Different Levels of Significance Plotted Against the UK's Net Zero Compatible Trajectory

9.2.4. The levels of significance as defined in the IEMA guidance are outlined below:

- **Major adverse:** the project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
- **Moderate adverse:** the project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
- **Minor adverse:** the project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
- **Negligible:** the project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
- **Beneficial:** the project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

9.2.5. As per the IEMA guidance, major or moderate adverse effects and beneficial effects are considered significant; minor adverse and negligible effects are considered to be not significant.

9.2.6. Contextualising the GHG emissions from a proposed development helps to determine whether it supports or undermines the UK's trajectory towards net zero. IEMA guidance further suggests that:

"It is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact".

9.2.7. The estimated GHG emissions arising from the Proposed Development have been compared to the UK Carbon Budgets²⁹, shown in **Table 9-1**, and the annual GHG emissions sources reported for BBC in 2021³⁰, shown in **Table 9-2**.

9.2.8. To contextualise the forecast carbon emissions of the Proposed Development, acquired data will be compared to relevant sectoral, local, and national carbon budgets and targets, including UK Carbon Budgets, shown in **Table 9-1**.

²⁹ HM Government (2023) *Carbon Budget Delivery Plan*. Available at: <https://assets.publishing.service.gov.uk/media/6424b2d760a35e000c0cb135/carbon-budget-delivery-plan.pdf> [Accessed: 22 May 2025].

³⁰ HM Government, Department for Business, Energy & Industrial Strategy (2023) *2005 to 2021 UK local and regional greenhouse gas emissions – data tables (ODS)*. Available at: <https://www.gov.uk/government/statistics/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics-2005-to-2021> [Accessed: 22 May 2025].

Table 9-1 - GHG UK Carbon Budgets

Carbon Budget Period	UK Carbon Budget (MtCO ₂ e)
Fourth: 2023-2027	1,950
Fifth: 2028-2032	1,725
Sixth: 2033-2037	965

Table 9-2 - GHG Emissions Sources (2021) for Bedford and the UK

Emissions Sources	Bedford Borough (ktCO ₂ e)	UK (ktCO ₂ e)
Industry Electricity	36.3	17,109
Industry Gas	41.4	20,037
Large Industrial Installations	7.5	29,268
Industry 'Other'	35.3	17,927
Industry Total	120.6	84,341
Commercial Electricity	31.1	10,964
Commercial Gas	17.1	6,239
Commercial 'Other'	0.7	223
Commercial Total	48.8	17,426
Public Sector Electricity	17.2	5,380
Public Sector Gas	22.9	10,580
Public Sector 'Other'	0.1	63
Public Sector Total	40.3	16,024
Domestic Electricity	60.5	22,245
Domestic Gas	167.6	63,613
Domestic 'Other'	21.8	11,064
Domestic Total	250.0	96,921
Road Transport (A Roads)	186.9	48,450
Road Transport (Motorways)	0	25,397
Road Transport (Minor Roads)	76.1	36,254
Diesel Railways	16.9	1,680

Emissions Sources	Bedford Borough (ktCO ₂ e)	UK (ktCO ₂ e)
Transport 'Other'	6.9	1,943
Transport Total	286.7	113,725
Landfill	40.7	13,618
Waste Management 'Other'	13.1	5,196
Waste Management Total	53.8	18,814
Other Total (LULUCF and agriculture)	59.6	51,795
Grand Total*	<u>859.7</u>	<u>399,046</u>

**Note: emissions have been rounded, so rounding errors may occur*

10 CLIMATE CHANGE RESILIENCE

10.1 SIGNIFICANCE CRITERIA

- 10.1.1. In line with the IEMA Guidance on climate change resilience and adaptation³¹, a 'likelihood-consequence' approach has been adopted to measure the significance of effects of future climate change on the Proposed Development.

10.2 SENSITIVE RECEPTORS

- 10.2.1. Sensitive receptors are elements of the Proposed Development that are likely to be affected by future changes in climate. The assessment of climate resilience has identified potential impacts associated with the projected changes in climate variables on each of the sensitive receptors during the Operation Phase of the Proposed Development.

10.3 LIKELIHOOD-CONSEQUENCE OF IMPACT

- 10.3.1. Consequence and likelihood are qualitatively assessed using the descriptions in **Table 10-1** and **Table 10-2**. These descriptions have been developed using professional judgement, informed by relevant guidance such as the IEMA guidance on climate change resilience and adaptation³¹. It should be noted that the IEMA guidance definitions of consequence have been developed for large scale infrastructure specifically, and therefore, the description of the measure of consequence will have regard to the Proposed Development.

Table 10-1 - Likelihood Definitions

Measure of Likelihood	Description
Very high	The event occurs multiple times during the lifetime of the project; e.g., approximately annually.
High	The event occurs several times during the lifetime of the project; e.g., approximately once every five years.
Medium	The event occurs limited times during the lifetime of the project; e.g., approximately once every 15 years.
Low	The event occurs occasionally during the lifetime of the project; e.g., once in 60 years.
Very low	The event may occur once during the lifetime of the project.

³¹ Institute of Environmental Management and Assessment (IEMA) (2020) *Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation*. Available at: <https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020> [Accessed: 22 May 2025].

Table 10-2 - Consequence Definitions

Measure of Consequence	Description
Negligible	No facility/infrastructure damage, minimal adverse effects on health, safety, and the environment. Facility doesn't shut down. No financial loss.
Minor adverse	Localised facility/infrastructure disruption. No permanent damage, minor restoration work required: Facility closure lasting less than one day. Slight adverse health or environmental effects. Repairs cost 2% of facility reconstruction cost.
Moderate adverse	Limited facility/infrastructure damage with damage recoverable by maintenance or minor repair. Disruption lasting more than one but less than three days. Adverse effects on health and/or the environment. Repairs cost 25% of facility reconstruction cost.
Large adverse	Extensive facility/infrastructure damage. Disruption lasting more than three but less than ten days. Early renewal of 50-90% of infrastructure Severe health effects and/or fatalities. Significant effect on the environment, requiring remediation. Repairs cost 50% of facility reconstruction cost.
Very large adverse	Permanent damage. Disruption lasting more than ten days. Early renewal of facility/infrastructure >90%. Severe health effects and/or fatalities. Repairs cost 50% of facility reconstruction cost.

10.4 SIGNIFICANCE OF EFFECT

- 10.4.1. The significance of effects is determined by considering the likelihood of the climate event to occur and the consequence of its potential impacts associated with changes in climate variables, on the Proposed Development components as depicted in **Table 10-3**. The assessment of consequence and likelihood (and therefore significance) take embedded mitigation into account as an assumed part of the design.

Table 10-3 - Significance Matrix Rating

Likelihood	Consequence of Hazard Occurring				
	Negligible	Minor Adverse	Moderate Adverse	Large Adverse	Very Large Adverse
Very High	Not significant	Significant	Significant	Significant	Significant
High	Not significant	Significant	Significant	Significant	Significant
Medium	Not significant	Not significant	Significant	Significant	Significant
Low	Not significant	Not significant	Not significant	Significant	Significant
Very Low	Not significant	Not significant	Not significant	Significant	Significant

11 MAJOR ACCIDENTS AND DISASTERS

- 11.1.1. By definition, a major accident and/or disaster would have a major Significant effect on the environment (including human health, welfare and/or the environment). Accordingly, any risks that could result in a major event without suitable mitigation, management or regulatory controls in place will be assessed as Significant in the context of EIA.

12 POPULATION AND HUMAN HEALTH

12.1 SIGNIFICANCE CRITERIA

SENSITIVE RECEPTORS

- 12.1.1. The sensitivity of receptors considered in this assessment have been defined as high, medium, low, or negligible. In the context of Population and Human Health, the level of sensitivity depends upon the baseline conditions.
- 12.1.2. Specific values in terms of sensitivity are not attributed to Population and Human Health resources/receptors due to their diverse nature and scale. The assessment takes account of the qualitative 'sensitivity' of each receptor. The receptor sensitivity is assessed on a case-by-case basis, using professional judgement. Quantitative data on the relevant health baseline of receptors is presented wherever available and the sensitivity is determined by comparison to regional and national data. Broad definitions of the receptor sensitivities are given in **Table 12-1**.

Table 12-1 - Broad definitions of sensitivity for Population and Human Health receptors

Sensitivity of Receptor	Population Human Health
High	High levels of deprivation (including pockets of deprivation); reliance on resources shared (between the population and the project); existing wide inequalities between the most and least healthy; health outcomes which are substantially worse than regional or national comparators; a community whose outlook is predominantly anxiety or concern; people who are prevented from undertaking daily activities; dependants; people with very poor health status; and/or people with a very low capacity to adapt.
Medium	Moderate levels of deprivation; few alternatives to shared resources; existing widening inequalities between the most and least healthy; health outcomes which are in line with, or only marginally different to, regional or national comparators; a community whose outlook is predominantly uncertainty with some concern; people who are somewhat limited from undertaking daily activities; people providing or requiring a lot of care; people with poor health status; and/or people with a limited capacity to adapt.
Low	Low levels of deprivation; many alternatives to shared resources; existing narrowing inequalities between the most and least healthy; health outcomes which are similar to regional or national comparators; a community whose outlook is predominantly ambivalence with some concern; people who are slightly limited from undertaking daily activities; people providing or requiring some care; people with fair health status; and/or people with a high capacity to adapt.

Sensitivity of Receptor	Population Human Health
Negligible	There is no human health problem.

12.1.3. The extent to which the receptors experience inequalities in health outcomes is also considered in determining receptor sensitivity. Vulnerable population groups include those with higher levels of social deprivation or relatively poor health status. Examples of vulnerable groups and specific points of interest near to the Site are as follows:

- **Age-related groups, such as children and older people:** Wixams retirement village is located approximately 2km from the Site. As the retirement village is catered for over 55 year-olds, this has been considered in the assessment of sensitivity.
- **People suffering with long-term illnesses and disabilities** e.g. dementia, autism and epilepsy: Woburn Court Community Health Centre is located 270m north-west of the Site. Residents with long-term health issues or disabilities that require access to this facility have therefore been considered in our assessment of sensitivity.
- **Sex:** Different sexes can face disproportionate health impacts due to biological differences and varying societal roles.
- **Ethnic minority groups:** Ethnic minority groups can face disproportionate health impacts due to a combination of factors including socioeconomic inequalities and limited access to healthcare services; and
- **Income-related groups and socio-economically disadvantaged groups:** Whilst socio-economically disadvantaged groups such as those on lower incomes or the unemployed are not a protected group identified by the Equality Act (which the other vulnerable population groups listed above are), evidence suggests that this group can disproportionately experience poorer health outcomes, and so have the potential to be impacted more acutely by changes to health determinants. They have been included for this reason.

12.1.4. For example, if the air quality baseline found existing poor air quality levels, high numbers of people suffering with long-term illnesses or high number of children, the sensitivity of the population (including vulnerable groups) to the health effect would be high.

MAGNITUDE OF IMPACT

12.1.5. This entails consideration of the size of the effect on receptors (people), including vulnerable groups, in the context of the area in which effects would be experienced.

12.1.6. This assessment draws upon and summarises, where relevant, the evidence and analysis presented in other technical assessments, highlighting any effects which are relevant to human health. To do this, this assessment establishes pathways to health effects – these determine the relationships between the Proposed Development and potential health impacts on the population and are assessed through a high-level literature review for each health determinant.

12.1.7. Magnitude is assessed as high, medium, low or negligible. The classification of magnitude of impact on receptors takes account of such factors as:

- The spatial scale at which the effect is assessed.

- The frequency of the effect.
- The degree of change relative to existing environmental conditions.
- The reversibility of the effect.
- The duration over which the effect occurs; and
- The strength of evidence over the health pathway.

12.1.8. The assessment of the magnitude of potential impacts aims to quantify the magnitude of impacts wherever possible. Where quantification has not been possible, qualitative assessments (professional judgement) have been made and justified.

SIGNIFICANCE OF EFFECT

12.1.9. **Table 12-2** shows how the magnitude of impact and sensitivity of receptor combine to determine the scale of the effect. The combination of less sensitive and lower magnitude impacts result in minor or negligible effects. Conversely, a more sensitive receptor with a higher magnitude of impact can result in a moderate or major effect. Effects classified as moderate or major are significant. Effects that are deemed significant have been highlighted in bold.

Table 12-2 - Effect significance matrix

		Magnitude			
		High	Medium	Low	Negligible
Sensitivity	High	Major	Major/moderate	Moderate/minor	Minor/negligible
	Medium	Major/moderate	Moderate	Minor	Minor/negligible
	Low	Moderate/minor	Minor	Minor	Negligible
	Negligible	Minor/negligible	Minor/negligible	Negligible	Negligible

12.1.10. Effects are grouped into two categories:

- Beneficial — these are effects which are deemed to have a positive effect on the receptor and/or study area; and
- Adverse — these are effects that are deemed to have a negative effect on the receptor and/or study area.

12.1.11. Effects can be either temporary or permanent; and, direct or indirect. Generally, impacts during the Construction Phase of the Proposed Development are considered temporary, and impacts during the Operational Phase of the Proposed Development are considered permanent.

12.1.12. Embedded mitigation refers to measures built into the project design from the start to prevent or reduce adverse environmental impacts. Secondary mitigation involves additional actions taken after the project design is finalised to further reduce or offset impacts not fully addressed by embedded measures. Embedded mitigation is referred to and included in the assessment of effects. If the effect does not require secondary mitigation (or none is possible), the residual effect will remain the same.

If, however, secondary mitigation is required, an assessment of the post mitigation residual effect is provided. Embedded and secondary mitigation measures can also represent enhancements of positive effects where actions are taken to improve or amplify the beneficial outcomes of the Proposed Development what would naturally occur.



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