West Winch Housing Access Road

Environmental Statement Chapter 14 Climate – Greenhouse Gases and Climate Resilience

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Tables

Glossary of Abbreviations and Defined Terms

Acronym	Definition
GHG	Greenhouse Gas
UNFCCC	United Nations Framework Convention on Climate Change
NPPF	National Planning Policy Framework
NCC	Norfolk County Council
RICS	Royal Institute of Royal Surveyors
IEMA	Institute of Environmental Management and Assessment
DESNZ	Department for Energy Security and Net Zero

1 Introduction

1.1.1 This chapter reports the outcome of the assessment of likely significant effects arising from the Proposed Scheme upon greenhouse gas (GHG) emissions. It assesses the potentially significant effects arising from GHG emissions from both activities and traffic associated with both the construction and operational stages.

1.1.2 GHG emissions as a result of the Proposed Scheme have been calculated throughout the Proposed Scheme lifespan (2027-2086) over the construction and operational phases.

1.1.3 The chapter describes the assessment methodology, the baseline conditions, the likely significant effects, any mitigation measures required, reduce any significant adverse effects, and the likely residual effects.

1.1.4 The magnitude of emissions has been contextualised against the UK Carbon Budgets, along with professional judgement informed by the IEMA 2022 guidance **(Ref 14.1)**, this has been used to determine the significance of emissions due to the Proposed Scheme.

1.1.5 For the purposes of this chapter, carbon dioxide equivalent (CO_2e) is used as the unit of measurement for GHG emissions, which considers the seven main GHGs as defined in the Kyoto Protocol, 1997, relative to the Global Warming Potential (GWP) of CO_2 **(Ref 14.2)**.

1.1.6 This chapter is intended to be read as part of the wider Environmental Statement (ES) Report.

1.1.7 The objective of this chapter is to provide a GHG assessment for the Proposed Scheme.

2 Legislative framework, Policy and Guidance

2.1.1 The applicable legislative framework, policy and guidance is summarised as follows:

2.2 Legislative Framework

- United Nations Framework Convention on Climate Change **(Ref 14.3).**
    - The UK is a member of the United Nations Framework Convention on Climate Change (UNFCCC) (**Ref 14.2**) which drives international action on climate change. The UK has pledged to reduce emissions under the Paris Agreement (**Ref 14.4**), as a part of a joint pledge by members of the European Union (EU). This provides an overarching commitment by the UK.
- The Paris Agreement (2015) **(Ref 14.4)**:
    - The Paris Agreement is a legally binding international treaty on Climate Change, which was adopted at COP 21. The Paris Agreement committed countries to maintain global temperatures to below 2˚C and pursue efforts to limit the increase to 1.5˚C.
- Directive 2014/52/EU on Assessment of The Effects of Certain Public and Private Projects on The Environment (The EIA Directive) **(Ref 14.5).**
    - The EIA Directive provides the overarching legislative framework for assessing the significance of impacts and effects from schemes on the environment. The Directive requires EIA to identify, describe and assess the direct and indirect significant effects of a project on the climate (Article 3). It also stipulates that the information to be included within the EIA report should include the 'impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions)' (Ref 14.5).
- The Climate Change Act 2008 (2050 Target Amendment) **(Ref 14.6)**
    - The 2019 amendment to the Climate Change Act 2008 established a legal requirement for reaching net zero GHG emissions in the UK economy by 2050, which is reflected in the

UK Net Zero Strategy **(Ref 14.7)**. The 2008 Act also created the Committee on Climate Change **(Ref 14.8)**, with a responsibility for:

- Setting five-year carbon budgets;
- Advising and scrutinising the UK Government's associated climate change adaptation programmes; and
- Producing a national adaptation plan for the UK Government to implement.

- Infrastructure Carbon Review **(Ref 14.9)**
  - In 2013, the UK government published the Infrastructure Carbon Review **(Ref 14.9)**, aiming to "*release the value of lower carbon solutions and to make carbon reduction part of the DNA of infrastructure in the UK*." Major infrastructure owners, operators and developers were invited to endorse, become signatories and make commitments under the review.
  - The review provided increased emphasis on 'capital carbon' (GHG emissions associated with raw materials, activities and transport for construction, repairs, replacement, refurbishment and de-construction of infrastructure) while acknowledging that 'operational carbon' (associated with energy consumption for the operation and use of infrastructure) will continue to dominate overall emissions to 2050 and beyond.
  - The Infrastructure Carbon Review **(Ref 14.9)** highlighted the importance of assessing GHG emissions early in the lifecycle of an infrastructure scheme when there is the greatest carbon reduction potential. This led to the publication of PAS 2080: 2016 'Carbon Management in Infrastructure.' **(Ref 14.10)**. The assessment presented in this chapter provides an assessment of the Proposed Scheme early in its lifecycle.

Policy

National

- **The National Planning Policy Framework (NPPF) (Ref 14.11)** sets out the core planning principle of supporting "*the transition to a low carbon future in a changing climate*…":
- **Chapter 9: Promoting Sustainable Transport (Ref 14.12)** - considers how people should be offered a choice of transportation modes, encouraging a movement away from the use of single private vehicles, the latter being understood to contribute to a significant proportion of total UK carbon emissions. For example, in 2021 transport comprised 26% of UK emissions.

2.2.1 This chapter has been prepared in accordance with the Government's National Planning Practice Guidance **(Ref 14.13)**.

- **Powering Up Britain (2023) (Ref 14.14)**
    - In 2021, the UK Government published the Build Back Greener Net Zero Strategy which set out the UK's plans for meeting net zero emissions by 2050, and the carbon budgets. The strategy was ruled unlawful by the High Court in July 2021, because it was deemed not to meet the legal obligations under the Climate Change Act,+ as there was not enough detail in the strategy on how the target would be met.
    - In 2023, The UK published 'Powering up Britain' which is a more detailed document detailing how carbon budgets will be achieved on a policy-by-policy basis and sets out how the Government will enhance the country's energy security and deliver the UK's net zero commitments.
    - Powering Up Britain includes:
        - Net Zero Growth Plan
        - Energy Security Plan

- Government's response to the Independent Review of Net Zero (the Skidmore Review)
- Government's response to the Climate Change Committee's 2022 progress report
- Carbon Budget Delivery Plan

Carbon Budget Delivery Plan and Carbon Budget 6 (Ref 14.15)

2.2.2 The Carbon Budget Delivery Plan details how the UK Government intend to meet Carbon Budgets 4 to 6 (to 2037), though proposals and policies, and their anticipated emissions reductions (where quantified) to 2037.

2.2.3 The Plan also details the expected performance against the Carbon Budgets and shows that for CB6 (965 MtCO2e) there is expected to be an overshoot of 32 MtCO2e currently.

2.2.4 The Plan also summarises the sector residual emissions for each carbon budget, shown for domestic transport in Table 2-1.

Table 2-1 Summary of sectoral residual emissions across carbon budgets for Domestic Transport ($MtCO_2e$)

Sector	CB4 5-yr (average pa)	CB5 5-yr (average pa)	CB6 5-yr (average pa)
Domestic transport	546 (109)	422 (84)	254 (51)

Local

King's Lynn and West Norfolk Local Plan (2016) (Ref 14.16)

2.2.5 The Site Allocations and Development Management Policies Plan (SADMP) sits alongside the Core Strategy and "allocates land to deliver the development requirements of the Core Strategy, such as housing, employment, recreation, green spaces, community and leisure uses. Additionally, it includes development management policies which apply across the Borough and these will be used when determining planning applications."

2.2.6 The SADMP details that proposals for developments within the Growth Area will need to:

- Be accompanied by a comprehensive strategic transportation plan for the area, which should expressly address the provision of and role in minimising car-based traffic of public transport.

2.2.7 It also states that:

- There is an opportunity to create a new distinct but integrated development and to apply best practice to make efficient use of resources and meet energy-efficiency and low-carbon targets.
- The development should seek to meet high standards of sustainable construction and design in terms of energy efficiency, water resources, recycled and reclaimed materials and renewable or low-carbon energy.

Norfolk County Council Climate Strategy (2023) (Ref 14.17)

2.2.8 This document sets out the strategic framework for NCC's approach to tackling climate change locally and building resilience to the effects of climate change. The strategy sets out seven focus areas:

- NCC Estate;
- Indirect emissions;
- County-wide emissions;
- Promoting a green economy;
- Adapting to climate change;
- Space for nature to recover and grow; and
- Engage and Collaborate.

North Runcton and West Winch Neighbourhood Plan 2016-2026 (2017) (Ref 14.18)

2.2.9 This plan sets out a vision which is designed to guide development in the area. *The plan states that:*

- *"Applications for new employment sector sites and buildings will therefore be favoured when they clearly demonstrate how they will achieve/support a low carbon footprint (in construction and operational stages) and in particular where they demonstrate a responsible approach to travel planning."*

Norfolk County Council's Environmental Policy (2019) (Ref 14.19)

2.2.10 The Environmental Policy is designed to guide the Council's future decision-making. The Plan uses the UK Government's Goals as the basis for framing this policy:

- Clean air for the population;
- Reducing the risk of harm from environmental hazards such as flooding and drought;
- Using resources from nature more sustainably and efficiently;
- Mitigating and adapting to climate change; and
- Minimising waste.

West Winch Parish Council Environment and Sustainability Policy (2021) (Ref 14.20)

2.2.11 The Policy sets out what the Parish Council will seek to do, including:

- promote the conservation and sustainable use of natural resources;
- minimise environmental pollution and waste in all its own activities and encourage the conservation, reuse, and appropriate recycling of resources;
- seek to eliminate the unnecessary use of energy;

- reduce car use by satisfying local needs using local resources and encouraging walking, cycling and public transport; and
- progressively build environmental concerns and sustainability into all its policies.

Guidance

2.2.12 The following guidance documents have been used during the preparation of this chapter:

- Design Manual for Roads and Bridges (DMRB) LA 114 Climate **(Ref 14.21)**;
- PAS 2080:2023 Carbon Management in Buildings and Infrastructure **(Ref 14.22)**;
- Royal Institute of Chartered Surveyors (RICS) Whole life carbon assessment for the built environment (2017) **(Ref 14.23)**;
- Transport Analysis Guidance: Unit A3 Environmental Impact Appraisal **(Ref 14.24)**; and
- Institute of Environmental Management and Assessment (IEMA) (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition **(Ref 14.25)**.

3 Consultation, Scope, Methodology and Significance Criteria

3.1 Consultation Undertaken to Date

3.1.1 No consultation was undertaken as part of this assessment.

3.2 Scope of the Assessment

3.2.1 The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Chapter 5: Approach to EIA**.

3.2.2 The Scoping Report (**Appendix 1.1**) GHG chapter follows the principles of BS EN 17472:2022: Sustainability of construction works **(Ref 14.26)** which breaks down a project into a series of stages (A1-C4) covering construction, operations and end of life for whole life carbon assessments.

3.2.3 This section provides an update to the scope of the assessment and re-iterates the evidence base for scoping out elements following further iterative assessment.

Elements scoped out of the assessment

3.2.4 The GHG scoping process follows the principles of PAS 2080:2023 Carbon Management in Buildings and Infrastructure which provides a breakdown of stages A1-C4 of whole life carbon assessments **(Ref 14.22)**. The stages shown in **Table 3-1** are not considered to give rise to likely significant effects as a result of the Proposed Scheme and have therefore not been considered within this assessment.

Table 3-1 Elements scoped out of the assessment

Element scoped out	Phase	Justification
Disposal of waste A5	Construction	Emissions from the disposal of waste materials are unlikely to be large, due to a large proportion of construction waste being inert.

Element scoped out	Phase	Justification
Maintenance B2	Operation	There is uncertainty around the maintenance requirements at this time and emissions for maintenance are not considered to be material to the assessment of GHG emissions for the Proposed Scheme.
Repair B3	Operation	Emissions for repair are not considered to be material to the assessment of GHG emissions for the Proposed Scheme.
Refurbishment B5	Operation	The Proposed Scheme is considered to require infrequent, if any, refurbishment, therefore subsequent emissions sources are not considered to be large.

Element scoped out	Phase	Justification
Decommissioning process C1	End of Life	Expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of emissions activity to determine their likely magnitude, even if they take place at all. As such these emissions sources will not be considered.
Transport and disposal of materials C2-4	End of Life	Expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of emissions activity to determine their likely magnitude, even if they take place at all. As such these emissions sources will not be considered.

Elements scoped into the assessment

Construction Phase

3.2.5 The elements which are considered to have the potential to give rise to likely significant effects during construction of the Proposed Scheme and have therefore been considered within this assessment are shown in Table 3-2.

Table 3-2 Elements scoped in for the assessment – Construction phase

Element scoped in	Phase	Justification
Product stage (manufacture and transport of raw materials to suppliers) A1-3	Construction	Raw materials required for the Proposed Scheme will result in embodied emissions and have the potential to be large.
Transport of materials to site A4	Construction	Construction stage emissions from fuel / energy consumption due to the delivery of material to site have the potential to be large.
Plant and equipment use during construction A5	Construction	Fuel / energy consumption of plant and equipment used during construction has the potential to generate large GHG emissions.
Transport of waste A5	Construction	Emissions from fuel / energy consumption due to the transport of waste materials, particularly fill, have the potential to be large.

Element scoped in	Phase	Justification
Land use, land use change and forestry A5	Construction	Loss of trees and habitats in construction stages have the potential to increase GHG emissions through the reduction of carbon sequestration.

Operation Phase

3.2.6 The following elements which are considered to have the potential to give rise to likely significant effects during operation of the Proposed Scheme and have therefore been considered within this assessment are shown in Table 3-3.

Table 3-3 Elements scoped in for the assessment – Operational phase

Element scoped in	Phase	Justification
Replacement B4	Operation	The replacement and resurfacing of the Proposed Scheme would release emissions, which have the potential to be large.
Operational energy use B6	Operation	Emissions from operational energy use within the Proposed Scheme (e.g. lighting) have the potential to be large.
Land use, land use change and forestry B8	Operation	The change in carbon sequestration due to the Proposed Scheme may be large, as there is expected to be a loss of trees.
End-user emissions (regional traffic flows) – traffic B8	Operation	Changes to regional traffic flows are expected and this has the potential to result in a large change in GHG emissions.

Extent of the Study Area

3.2.7 The GHG assessment is not restricted by geographical area but instead includes any increase or decrease in emissions as a result of the Proposed Scheme, wherever they occur. This includes:

- Construction emissions – from the Proposed Scheme footprint, but also related to the transport of materials to and from the Site and their manufacture (this may be distant from the Proposed Scheme location, for example emissions from the manufacture of steel); and
- Operational emissions – (increase or reduction) which result from the end-use of the Proposed Scheme. Such emissions include those for traffic using the Proposed Scheme as well as the surrounding regional road network to gain access – within which traffic flows may be affected.

Method of Baseline Data Collation

Desk Study

3.2.8 The GHG assessment has been undertaken through a desk study using baseline traffic data provided by the transport team for the assessment of baseline traffic emissions.

3.2.9 The baseline involves no construction activities; however it would include the replacement and operational lighting emissions associated with the current road network.

Site Visit and Surveys

3.2.10 For the purpose of this assessment, no site visits or surveys were required.

Assessment Methodology

3.2.11 The assessment approach has considered the likely magnitude of anticipated GHG emissions (or avoided emissions) of the Proposed Scheme in comparison with the baseline scenario without the Proposed Scheme.

3.2.12 Where data was available, GHG emissions have been quantified using the methodologies described below. Please refer to the assumption and limitations in **Section 9** for further information. Where data was unavailable, the impact on GHG emissions was assessed qualitatively using professional judgement and experience on schemes of a similar nature and scale.

Construction Phase

3.2.13 To quantify the embodied emissions of construction materials, materials data (for example the type and quantity of materials) was sourced from the Proposed Scheme design team. The quantity of materials was multiplied by appropriate emissions factors sourced from the Bath Inventory of Carbon and Energy (ICE) Version 3.0 **(Ref 14.27)**.

3.2.14 To estimate the emissions associated with transporting materials during construction, the expected mass of materials was multiplied by transport distance resulting in tonne kilometres. Where actual distances could not be provided by the design team, assumptions based on RICS guidance **(Ref 14.23)** have been used. The tonne kilometre values were then multiplied by an appropriate emission factor published by the Department for Energy Security and Net Zero (DESNZ) emission factors (**Ref 14.28)**.

3.2.15 Due to the unavailability of electricity and fuel data used during construction, to quantify the emissions associated with plant and equipment, emissions were calculated using the Proposed Scheme total construction cost value, taking into account inflation at 2015 levels using the Bank of England inflation calculator, and the carbon factor from RICS guidance (1400 kgCO_2e/£100k). By multiplying scheme cost with the RICS factor, the carbon emissions from site activities were determined.

3.2.16 For the assessment of biomass loss in construction, the habitats that are subject to change between the baseline and Proposed Scheme scenario were compared. To estimate the carbon stores lost through biomass loss, the habitat type and the hectares of individual habitats were considered along

with appropriate values for carbon storage using best practice taken from the scientific literature.

3.2.17 A habitat carbon calculator was used to assess the total carbon stock of the habitats in the baseline scenario. The calculator uses the following literature sources:

- Natural England, (2021), Carbon Storage and Sequestration by Habitat (2nd) (Natural England, 2021) (**Ref 14.29**); and
- Woodland Carbon Code, (2021), Woodland Carbon Code Calculator (V4 (Woodland Carbon Code, 2021)) (**Ref 14.30**).

3.2.18 For most habitat types, there is a wide range in the estimates of carbon storage per unit area in the literature. Following a review of available estimates combined with expert knowledge and professional judgement, the most appropriate values were identified. This approach was aligned with Natural England Carbon Storage and Sequestration by Habitat (2021), which uses the median value in calculations.

3.2.19 The carbon sequestration calculations in the construction phase assume all existing woodland is 50 years old at the opening year of the Proposed Scheme.

Operational Phase

3.2.20 End-user vehicle emissions were calculated in accordance with DMRB LA 114 Climate (2021) **(Ref 14.31)**. Emissions were quantified using TAG data from the Department of Transport **(Ref 14.32)**. This took into account different vehicle and fuel types, appropriate forecast fuel consumption parameters and applied appropriate emission factors accordingly. From this, emissions were quantified for each year over the lifetime of the Proposed Scheme (up to 2086).

3.2.21 In addition, emissions calculations for the use of materials required for the resurfacing of the Proposed Scheme have been calculated using industry standard replacement intervals.

3.2.22 Operational energy use, for example from lighting, has not yet been assessed due to data availability at this early design stage.

3.2.23 In addition, emissions calculations for the use of materials required for replacements for the Proposed Scheme have been calculated, using industry standard replacement intervals and information based on similar schemes.

3.2.24 A habitat carbon calculator was used to assess the total carbon stock of the habitats in the Do Nothing and Do Something scenario, using the methodology described in **Section 3.2.16.**

3.2.25 The carbon sequestration calculations in the operational phase assume all existing woodland is 50 years old at the opening year of the Proposed Scheme. Therefore, all retained woodland is assumed to be 110 years old and newly planted woodland is assumed to be 60 years old at the end of the scheme lifespan.

Significance Criteria

3.2.26 As climate change impacts are global in nature, it is not possible to link a specific project with a specific environmental impact. The recently published guidance from IEMA *Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance* sets out five distinct levels of significance based on the GHG emissions relative contribution towards achieving a science-based 1.5ºC aligned transition towards net zero by 2050 **(Ref 14.1)**.

3.2.27 The significance of GHG impacts has been assessed in line with the DMRB LA114 **(Ref 14.21)** and through comparing estimated GHG emissions arising from the Proposed Scheme and the respective UK carbon budgets **(Ref 14.33)** (**Table 3-4**), which have been set by the UK Government covering 2018 to 2032. The budgets are expressed in millions of tonnes of carbon dioxide equivalents ($MtCO_2e$).

3.2.28 As such the magnitude of emissions, in conjunction with guidance from IEMA and knowledge of similar schemes, have been used to inform the professional judgement of significance.

Table 3-4 National carbon budgets set by the Government ($MtCO_2e$)

Carbon Budget Period	UK Carbon Budget
Third: 2018-2022	2,544 $MtCO_2e$
Fourth: 2023-2027	1,950 $MtCO_2e$
Fifth: 2028-2032	1,725 $MtCO_2e$
Sixth: 2033-2037	965 $MtCO_2e$

Effect Significance

3.2.29 The following terms have been used to define the significance of the effects within this chapter:

- **Major adverse (significant):** the 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 and does not make a meaningful contribution to the UK's trajectory towards net zero;
- **Moderate adverse (significant):** the 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, falling short of fully contributing to the UK's trajectory towards net zero;
- **Minor adverse (not significant)**: the GHG impacts are fully consistent with applicable existing and emerging policy requirements and good practice design standards, fully in line with measures necessary to achieve the UK's trajectory towards net zero;
- **Negligible (not significant):** the GHG impacts are 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; and

- **Beneficial (significant):** the 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, substantially exceeding net zero requirements with a positive climate impact.

3.2.30 As set out in **Chapter 5: Approach to EIA**, effects that are classified as **moderate or above** are considered to be **significant**. Effects classified as below **moderate** are considered to be **not significant**.

4 Baseline Conditions

4.1.1 In the baseline (Do Minimum) scenario, GHG emissions occur constantly and widely as a result of human and natural activity including energy consumption (fuel, power), industrial processes, land use and land use change. The GHG assessment will only consider instances in which the Proposed Scheme results in additional or avoided emissions in comparison to the baseline scenario and its assumed evolution. The baseline conditions therefore focus on those emissions sources subject to change between the baseline scenario and the Proposed Scheme. In addition, transport emissions from 2021 within East of England, Norfolk, King's Lynn and West Norfolk and Nationally are presented in **Table 4-1** for context **(Ref 14.31)**.

Table 4-1 Transport Emissions for East of England, Norfolk, King's Lynn and West Norfolk and Nationally (kt CO_2)

Category	East of England	Norfolk	King's Lynn and West Norfolk	Nationally
Road Transport (A roads)	5,972	977	207	48,450

Category	East of England	Norfolk	King's Lynn and West Norfolk	Nationally
Road Transport (Motorways)	2,358	0	0	25,398
Road Transport (Minor roads)	3,711	616	133	36,254
Diesel Railways	176	10	1	1,680
Transport Other	272	133	13	1,943
Transport Total	12,489	1,736	354	113,725

4.1.2 Without the Proposed Scheme, construction would not take place, and as such during construction there are no baseline emissions. The future baseline scenario involves no construction activities and therefore the future construction baseline is also zero emissions.

4.1.3 The baseline for operational end users' emissions from the Proposed Scheme comprises the 'Do Nothing' scenario, under the existing conditions. This is a future baseline where the Proposed Scheme is not constructed, and emissions are generated by vehicles on the existing road network in the future.

4.1.4 The total baseline end-user emissions for the affected network are presented in **Table 4-2** for the year 2027 (the first operational year of the Proposed Scheme) and the future modelled year 2042. In addition, the average annual and total GHG emissions from 2027 to 2086 are presented for comparison with the 60-year operational period of the Proposed Scheme.

Table 4-2 Baseline operational stage emissions - traffic

Scenario	2027 (operational year)	2042 (future year)	Average per year (2027-2086)	Total (2027-2086)
Baseline (Do Minimum)	597,130	382,911	411,473	24,688,387

4.1.5 The baseline for operational emissions for the current energy use (e.g. lighting) comprises the 'Do Nothing' scenario. This is also the future baseline where the Proposed Scheme is not constructed, and emissions are assumed to be the same as they are at present.

4.1.6 **Table 4-3** shows the baseline emissions for the carbon storage in the Do Minimum scenario for the opening and final year of the 60 year modelled lifespan.

Table 4-3 Do Minimum (2027) and Do Minimum (2086) scenario for habitat carbon storage

Scenario	Total tCO_2e sequestered
Do Minimum (2027)	10,432
Do Minimum (2086)	11,179

5 Sensitive receptors

5.1.1 The impacts of GHGs relate to their contribution to global warming and climate change. These impacts are global and cumulative in nature, with every tonne of GHGs contributing to impacts on natural and human systems. GHG emissions result in the same global effects wherever and whenever they occur. Therefore, the sensitivity of different human and natural receptors is not considered in this assessment.

6 Assessment of Potential Effects, Mitigation and Residual Effects

6.1.1 This section details the preliminary assessment of predicted impacts and effects for the Proposed Scheme during both the construction and operational phases, pre-mitigation.

6.2 Construction Phase

6.2.1 The total estimated GHG emissions arising from the embodied carbon (manufacture and transport of raw materials to suppliers), transport of materials to site, transport of waste from site, construction plant use, and habitat loss have been quantified and are presented in **Table 6-1**, **Table 6-2 and Section 6.2.2,** and is approximately 29,916 utCO_2e.

Table 6-1 Construction emissions from materials and transport of materials, and transport of waste

Material	Embodied carbon A1-3 (tCO_2e)(Note 1)	Transport to site A4 (tCO_2e) (Note 1)	Transport of Waste from site A5 (tCO2e) (Note 1)	Total (tCO2e)
Steel	5,096	193	2	5,291
Asphalt	3,677	591	No data	4,268
Aggregate	3,164	676	No data	3,840
Concrete	1,242	79	3	1,324
Earthworks	492	183	628	1,304
Aluminium	290	2	<1	292
Clay pipe	508	8	No data	516
Plastic	112	2	No data	114
Timber	91	11	1	103

Material	Embodied carbon A1-3 (tCO_2e)(Note 1)	Transport to site A4 (tCO_2e) (Note 1)	Transport of Waste from site A5 (tCO2e) (Note 1)	Total (tCO2e)
Zinc			1	1
Stone	42	5		47
Cement Sand	17	1		18
Copper	1	<1		1
Total	**14,733**	**1,750**	**636**	**17,119**

Note 1 - All figures rounded to whole figures.

Table 6-2 Estimated Emissions for Construction Plant and Equipment (A5)

Total Scheme Cost	Emissions (tCO_2e) (Note 1)
£354,370,466	3,790

Note 1 - Figure rounded to whole figure

6.2.2 An increase in emissions due to the loss of habitats and loss of stored carbon during the construction phase would equate to 9,008 tCO_2e.

Potential Effects

6.2.3 Based on the results presented in Table 6-1, Table 6-2 and described in Section 6.2.2, the magnitude of GHG emissions from the embodied carbon of materials, transport of materials, transport of waste from site, plant and equipment use and habitat loss for the Proposed Scheme are predicted to be Moderate adverse (significant) during construction.

Mitigation

6.2.4 The magnitude of GHG emissions associated with the design and construction phase of the Proposed Scheme can be minimised by, amongst others:

- Design optimisation to reflect the carbon reduction hierarchy (detailed below and found in clause 4.3 of PAS 2080) **(Ref 14.22)**:
    - **Avoid:** align the outcomes of the project and/or programme of work with the net zero transition at the system level and evaluate the basic need at the asset and/or network level;
    - **Switch**: assess alternative solutions and then adopt one that reduces whole life emissions through alternative scope, design approach, materials, technologies for operational carbon reduction, among others, while satisfying the whole life performance requirements;
    - **Improve**: identify and adopt solutions and techniques that improve the use of resources and design life of an asset/network, including applying circular economy principles to assess materials/products in terms of their potential for reuse or recycling after end of life;
- Minimise any expected tree loss during the construction of the Proposed Scheme;
- During procurement the opportunity to use more sustainable materials with reduced embodied carbon emissions and materials/resources featuring recycled content (where safe and of sufficient integrity for engineering) should be considered (e.g. procuring steel with a higher than average recycled content (preferably between 70-100%) or specifying concrete with a higher portion of ground-granulated blast-furnace slag (GGBS) content); These choices should be supported with eco- and carbon labels or verified Environmental Product Declarations (EPD);
- Using more efficient construction plant and delivery vehicles, and/or those powered by electricity from alternative/lower carbon fuels; contractor to ensure high performance of plant and equipment through

strong record of, and ability to ensure correct maintenance and servicing of vehicle fleet to avoid polluting emissions;

- If possible, the contractor is to select and engage with material suppliers considering their policies and commitments to reduction of GHG emissions, including actions to reduce embodied emission in materials;
- Maximise the local sourcing of materials;
- Use of local waste management facilities;
- Re-use of materials onsite rather than taking offsite as a waste;
- The Construction Contractor should have training policies and management protocols in place to avoid idling of engines, spills of fuels (for example, when refuelling) and safe/environmentally sensitive driving techniques to maximise fuel saving;
- Designing, specifying and constructing the Proposed Scheme with a view to maximising the potential for reuse and recycling of materials / elements at the end-of-life-cycle stage; and
- Where possible consider the use of innovative construction methods to reduce plant use.

Residual Effects

6.2.5 As detailed above, the total GHG emissions arising from the embodied carbon, transportation of materials to site, transport of waste from site, construction plant use and habitat loss are estimated to be 29,916 tCO_2e, which represents 0.0015% of the fourth carbon budget. Due to high construction emissions, there is still likely to be **moderate adverse (significant)** residual GHG emissions after mitigation measures have been implemented. If the PAS 2080: 2023 Carbon Management Process is followed, and all of the mitigation measures detailed in Table 1.9 of the Carbon Management Plan are implemented as part of the scheme design and

contractor requirements, this has the potential to reduce the impact of the construction phase of the Proposed Scheme to **Minor Adverse (not significant)**.

6.3 Operational Phase

6.3.1 The total anticipated traffic GHG emissions are presented in **Table 6-3** for the year 2027 (the first year of operation for the Proposed Scheme) and the year 2042 (the future modelled year). In addition, the average annual and total GHG emissions based on a 60-year operational period of 2027-2086 are presented. The baseline figures (without the Proposed Scheme) are included for comparison. Please note that due to rounding the sum of the rows may not equal the totals.

Table 6-3 Total GHG emissions for traffic in the strategic and local road network (tCO_2e) (Note 1)

Scenario	2027 (operational year)	2042 (future year)	Average per year (2027-2086)	Total (2027-2086)
Baseline ("Do Minimum")	597,130	382,911	411,473	24,688,387
"Do Something"	597,528	383,430	411,976	24,718,581
Difference	398	519	503	30,194

Note 1 - All figures rounded to whole figures

6.3.2 The total regional traffic GHG emissions for the operational lifespan of the Proposed Scheme are 30,194 tCO_2e more than the baseline scenario.

6.3.3 Operational emissions due to the replacement of asphalt are presented in **Table 6-4**. The whole scheme lifespan is assumed to be 60 years, in line with DMRB LA114 guidance **(Ref 14.21)**.

Table 6-4 Operational Emissions (Note 1)

Item	Replacement frequency (years)	No of replacements	Material emissions (tCO_2e)	Transport emissions (tCO_2e)	Total (tCO_2e)
Asphalt - General Asphalt (Surface)	15	3	2,034	323	2,357
Asphalt - General Asphalt (Binder)	30	1	971	154	1,124
Asphalt - General Asphalt (Base)	60	0	No data	No data	No data
Total	**105**	**4**	**3,005**	**476**	**3,481**

Note 1 - All figures rounded to whole figures

6.3.4 The change in carbon sequestration as a result of the land use change in the operation of the Proposed Scheme leads to an increase in carbon sequestration, as shown in **Table 6-5**.

Table 6-5 Carbon sequestration across project lifespan

Scenario	Total tCO_2e sequestered for 60-year lifespan
Do Nothing (2086)	11179
Do Something (2086)	19553
Change	-8374

6.3.5 This equates to a reduction in project emissions of 8374 tCO_2e.

6.3.6 The operational energy use from lighting has not been quantified at this time due to data availability, however it should be noted this will cause an increase in CO_2e emissions as a result of the Proposed Scheme.

Potential Effects

6.3.7 Based on the results presented in **Table 6-6**, the magnitude of GHG emissions from the end user traffic as a result of the operation of the Proposed Scheme is predicted to have a **Moderate adverse** (significant) effect.

Mitigation

6.3.8 The magnitude of GHG emissions associated with the eventual operation of the Proposed Scheme can be minimised by, amongst others:

- Opportunities to sequester carbon through increased tree planting in addition to the current plans, which have been taken into account in this assessment; and
- Use road surface options with greater longevity, to reduce frequency of replacements throughout use phase.

Residual Effects

6.3.9 The net GHG emissions arising from land use change, end user traffic and replacement from the operation of the Proposed Scheme are estimated to be approximately 25,302 tCO_2e. Total emissions from the Proposed Scheme (construction and net operational emissions) are estimated to be 55,218 tCO_2e. There is still likely to be **moderate adverse** (significant) residual GHG emissions after mitigation measures have been implemented.

Assessment against Future Baseline

6.3.10 Compared to the future construction baseline scenario, there is an increase in emissions arising from embodied carbon materials, transport of materials to site, transport of waste from site, construction plant use and habitat loss by 29,916 tCO_2e.

6.3.11 Compared to the future operational baseline scenario, there is an increase in emissions arising from the whole operational stage (end user traffic, plant and equipment and land use change) by 25,302 tCO_2e over the 60-year lifespan of the Proposed Scheme.

6.3.12 The total estimated GHG emissions arising from the Proposed Scheme are presented in **Table 6-6**. They are presented for the construction phase (2025-2027) and the operational phase (2027-2086).

6.3.13 The Proposed Scheme GHG emissions have been put into context of the UK National Carbon Budgets.

Table 6-6 Project GHG emissions against relevant carbon budgets

Project Stage	**Estimated total carbon over carbon budget (tCO_2e) ("Do Something" scenario)**	**Net CO_2 project GHG emissions (tCO_2e) ("Do Something" – "Do Minimum" scenario)**	**Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO2e) (and as % of relevant carbon budget) Fourth (2023 - 2027)**	**Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO2e) (and as % of relevant carbon budget) Fifth (2028-2032)**	**Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO2e) (and as % of relevant carbon budget) Sixth (2033-2037)**
Construction (2025-2027)	29,916	29,916	29,916	No data	No data
Operation (2027-2086)	24,713,689	25,302	258	1413	1616

Project Stage	**Estimated total carbon over carbon budget (tCO_2e) ("Do Something" scenario)**	**Net CO_2 project GHG emissions (tCO_2e) ("Do Something" – "Do Minimum" scenario)**	**Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO2e) (and as % of relevant carbon budget) Fourth (2023 - 2027)**	**Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO2e) (and as % of relevant carbon budget) Fifth (2028-2032)**	**Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO2e) (and as % of relevant carbon budget) Sixth (2033-2037)**
Total	24,743,605	55,218	30,175	1413	1616
% of carbon budget	No data	No data	0.0015%	0.0001%	0.0002%

Note 1 - All figures rounded to whole figures.

6.3.14 By utilising the mitigation measures for the Proposed Scheme design, as well as during construction and operation, as per **Section 6.2.4** and **Section 6.3.8** the GHG emissions from the Proposed Scheme can be reduced and subsequently the impact on the climate.

7 Cumulative Effects

7.1.1 The impacts of GHGs relate to their contribution to global warming and climate change. These impacts are global and cumulative in nature, with every tonne of GHGs contributing to impacts on natural and human systems. GHG emissions result in the same global effects wherever and whenever they occur. It is the cumulative effect of all GHG-emitting human activities that cause climate change, and therefore the assessment of the GHGs due to the Proposed Scheme implicitly assesses the cumulative effect of GHG emissions. For the Proposed Scheme, the quantification of the emissions in the assessment of significance or effects inherently assesses the combined and cumulative impacts, and this includes comparing the GHG emissions against the carbon budgets.

8 Climate Resilience

8.1.1 The climate resilience assessment reports the likely significant effects arising for the Proposed Scheme in terms of its vulnerability to climate change, i.e., the climate change resilience and adaptation assessment. The assessment aligns with the requirements of EIA Regulations 2017 (**Ref: 14.34**), and the Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation from the Institute of Environmental Management and Assessment (IEMA) (**Ref: 14.35**).

8.1.2 The current climate baseline includes the climate trends over the past three decades (1991-2020) for temperature, precipitation (rain and snow), wind and storms, humidity and solar radiation obtained majorly from the Met Office records (**Ref: 14.36**). For future baseline, the UKCP18 (**Ref: 14.37**) projections have been used to analyse future changes in a range of climate variables that may affect the resilience of the Proposed Scheme to climate change. The future climate has been presented using the CRI tool (**Ref: 14.38**), for the 2030s (2020-2049), the 2050s (2040-2069) and 2080s (2070-2099) to identify the anticipated climate conditions under the worst-case scenario, i.e., RCP8.5. These projections are provided against the model

reference period of 1981-2010 and the current baseline of 1991-2020 (**Ref: 14.36**) as an indication of change from the reference period.

8.1.3 The baseline findings reveal that the Proposed Scheme is likely to experience hotter, drier summers and warmer, wetter winters with more extreme weather such as heatwave events and rising sea levels, which coincide with the Met Office key messaged of UKCP18.

8.1.4 In accordance with DMRB LA 114 methodology (**Ref: 14.35**), the 'likelihood-consequence' approach has been used to assess the significance of effects of climate change on the Proposed Scheme, while taking into account embedded mitigation obtained on consultation with the various topic specialists.

8.1.5 For the Proposed Scheme, none of the potential effects from risks related to climate change have been found to be 'significant'. Hence, no additional mitigation is required from the perspective of climate adaptation. However, regular repair and maintenance regimes are recommended for the receptors, particularly in the aftermath of extreme weather events.

9 Difficulties and Uncertainties

9.1.1 To ensure transparency within the EIA process, the following limitations and assumptions have been identified:

- This assessment has been completed based on current available information regarding the scale and nature of the Proposed Scheme. The type and quantities of materials and waste provided at this stage are indicative due to data constraints of working with preliminary designs.
- In EIA, there is currently no specific carbon emissions threshold, which, if exceeded, is considered significant. Professional judgement and current guidance have been used to derive findings in this assessment.

- For steel and copper the worldwide, Europe, or UK average emission factors have been used which includes average recycled content.
- Asphalt is assumed to have 7% binder content in it.
- As no emission factors are available in the data base for warm rolled asphalt, we followed the same assumptions as the National Highways tool, and assumed warm rolled asphalt has an emission factor 5% lower than the general asphalt value.
- In-situ concrete is assumed to be of 32/40 MPa grade.
- Reinforced concrete used in drainage systems is assumed to be of 'Concrete RC40/50 with CEM I cement' grade S
- The steel used in fencing is assumed to be galvanized steel.
- The signalled crossing is assumed to be made of 'Aluminium General, European Mix, Inc Imports'.
- The emission factor for limestone is only available for CO_2 only and not CO_2e, therefore for the purpose of this assessment it has been taken to be the equivalent of CO_2e.
- The plant and equipment emissions have been calculated using the RICS standard formula of 1,400 kgCO_2e / £100k, due to the lack of information on the plant and equipment use data.
- The opening year for the Proposed Scheme has been modelled from the year 2027.
- The design life of the Proposed Scheme is assumed to be 60 years in line with the DMRB LA114.
- The anticipated construction phase is assumed to occur between 2025 and 2027.
- The distances for the transportation of materials were based on RICS (2017) guidance, and the high-level information provided by the design

team – It was assumed a 50km distance for all materials, except for Steel, Aluminium, Timber and HDPE pipes for which the distance was assumed to be 300km.

- The distances for the transportation of waste were based on RICS (2017) guidance. For recycling a 50km distance was used and where landfill was used the average distance for the two closest sites was taken to be 74.65 km (Old landfill and Springfield Landfill Site).
- As the mode of transportation for materials and waste has not yet been defined, 'Road Freight: HGV. Unknown size. Average Load' vehicle was assumed.
- The modelled traffic data was provided by the transport team; and the BOQ, plant and equipment data, waste data, and information on material and waste transport distances was provided by the design team.
- All the on-site plantations and vegetation loss have been included in the assessment.
- The age of the existing woodland in the land use change calculations for the construction and operational phases was assumed to be 50 years old.
- There will be some uncertainty regarding traffic data as the model is based on traffic assumptions that project into the future.
- The emissions from replacement were calculated based on industry standard replacement frequencies for asphalt.
- Large emissions values have been rounded when reported, e.g., to the nearest 1000 tCO_2e.

10 Summary

10.1.1 IEMA guidance states “a project that follows a ‘business-as-usual’ or ‘do minimum’ approach and is not compatible with the UK’s net zero trajectory, or accepted aligned practice or area-based transition targets, results in a significant adverse effect”.

10.1.2 In the absence of agreed thresholds for what level of GHG emissions is considered significant in an EIA context, IEMA guidance and professional judgement including previous experience of road infrastructure schemes has been used to assess the magnitude of change based on schemes of a similar size and nature.

10.1.3 Based on professional judgement, the overall GHG emissions generated during the construction phase of the Proposed Scheme are anticipated to have a **Moderate Adverse (significant)** effect. If the PAS 2080: 2023 Carbon Management Process is followed, and all of the mitigation measures detailed in Table 1.9 of the Carbon Management Plan are implemented as part of the scheme design and contractor requirements, this has the potential to reduce the impact of the construction phase of the Proposed Scheme to **Minor Adverse (not significant)**. Emissions during the operation of the Proposed Scheme are anticipated to have a **Moderate Adverse (significant)** effect.

10.1.4 The mitigation outlined in **Table 10-1** is expected to reduce GHG emissions due to construction and operation of the Proposed Scheme. Whilst the application of the mitigation measures would reduce GHG emissions it would not alter the significance of effects, noting that IEMA guidance states that all GHG emissions are significant. Therefore, with the application of the above mitigation measures, the residual effect of GHG emissions during both construction and operation would remain **Moderate adverse (Significant).**

10.1.5 **Table 10-1** provides a summary of the findings of the assessment.

10.1.6 Key to table:

- + / - = Positive or Negative;

- P / T = Permanent or Temporary;
- D / I = Direct or Indirect;
- ST / MT / LT = Short Term (18 months or less), Medium Term (18 months – 10 years) or Long Term (greater than 10 years); and
- N/A = Not Applicable.

Table 10-1 Summary of GHG effects

Sensitive Receptor	Potential Effects	Additional Mitigation	Residual Effects	Monitoring
Construction phase GHG emissions	GHG emissions arising from the embodied carbon of materials (A1-3), transport of materials to site (A4), transport of waste from site (A5),construction plant equipment (A5), and land use loss (A5).	Construction emissions could be minimised through design optimisation to reflect the carbon reduction hierarchy as well as other measures detailed in **Section 6.2.4**.	Minor Adverse (not significant) T / D / LT	No monitoring is required.

Sensitive Receptor	Potential Effects	Additional Mitigation	Residual Effects	Monitoring
Operational phase GHG emissions	GHG emissions arising from end-user traffic emissions, land use change and replacement during the operation of the Proposed Scheme.	Operational emissions could be minimised by identifying opportunities to sequester carbon through increased tree planting Using low carbon road surface options, informed using the carbon reduction hierarchy. Using road surface options with greater longevity, to reduce frequency of replacements, as well as other measures detailed in **Section 6.3.8**.	Moderate Adverse (significant) T / D / LT	No monitoring is required.

14 References

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