West Winch Housing Access Road

Environmental Statement

Chapter 14: Climate-Greenhouse Gases and Climate Resilience Appendix 3: Carbon Management Plan

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1 Introduction

1.1.1 WSP have been commissioned by Norfolk County Council (NCC) to prepare an Outline Business Case (OBC) for the West Winch Housing Access Road (WWHAR) scheme.

1.1.2 The objective of the WWHAR scheme is to provide access to the proposed housing developments east of West Winch which have been identified within the Borough Council of King's Lynn and West Norfolk (BCKLWN) Local Plan as suitable for development for approximately 4,000 new dwellings.

1.1.3 The proposed scheme will include the development of a 3.5km new single access road, with a new roundabout junction between WWHAR and the A47 trunk road, providing access to the planned Hardwick Green development.

1.1.4 Additional works include: A new roundabout junction between the WWHAR and the A10 at the southern end of the WWHAR; Roundabout junctions on the WWHAR to provide access to the residential allocation area; Treatment of local roads which will be severed by the WWHAR, including a new road over bridge with shared footway and cycleway on Rectory Lane to cross over the proposed WWHAR and the permanent stopping up of Chequers Lane for vehicular traffic; A new foot/cycle bridge is to be constructed over Chequers Lane to maintain access to pedestrians over WWHAR; Modification and re-orientation of the Hardwick Interchange; Dualling of the A47 to the north of the existing highway alignment between the WWHAR and the A10/A47 Hardwick Interchange junction; Temporary working areas for road construction including haul routes and two sets of National Grid gas main diversion works including construction compounds and temporary access and working areas.

1.1.5 This Carbon Management Plan (CMP) forms an appendix of the OBC and should be read in conjunction with the OBC.

1.1.6 The purpose of the carbon management process is to manage and reduce Greenhouse Gas (GHG) emissions (GHG emissions are expressed in terms of carbon dioxide equivalents (CO_2e) according to their relative global

warming potential. For this reason, the shorthand 'carbon' may be used to refer to GHGs, although in this assessment the term 'GHG' has been adopted.) over the course of the project lifecycle. This can be achieved through taking actions that maximise emission reduction impacts (e.g., modal shift) and minimise impacts that increase emissions (i.e., embodied carbon). These actions must be informed by carbon assessments that provide an understanding of whole-life carbon impact.

1.1.7 Purpose of this document

1.1.8 This CMP has been prepared to detail the carbon management process recommended for the WWHAR scheme. In presenting the results of the carbon assessment and related actions to manage carbon outcomes, this document adheres to the principles in Revised PAS 2080:2023 Carbon Management in Buildings and Infrastructure (herein referred to as PAS2080).

1.1.9 The carbon management standard PAS2080:2023 defines carbon management as the "assessment, reduction and removal of greenhouse gas emissions during the planning, optioneering, design, delivery, operation, use, end of life (and beyond) of new, or the management of existing, assets, networks and/or systems".

1.1.10 This document has been prepared to guide the project team's planning and delivery of the Proposed Scheme, and their ability to manage carbon emissions throughout.

1.1.11 It is recommended that a carbon management process is adopted which aligns with the principles of PAS 2080:2023. It is recommended that this CMP is maintained and updated as the scheme and its carbon management evolve and should be updated iteratively at key stages of the project lifecycle. Ideally this process will be mandated at each stage of the project. Each iteration will provide the latest description of the status of carbon management measures (Table 1.1).

1.1.12 The baseline assessment presented in this document is the first whole life carbon assessment of the WWHAR scheme.

1.2 Document Management

1.2.1 Going forwards this document should be updated and maintained as WWHAR scheme and its carbon management evolve. The next recommended update should be made following the completion of Environmental Statement (ES).

1.2.2 Where carbon management actions and commitments have been actioned or completed, this will be recorded in future iterations of this report. The carbon emissions of the scheme will be reassessed following the implementation of any actions and this will be compared to the baseline assessment reported in V2.0 to assess any carbon reductions achieved.

1.2.3 It may be necessary to perform a re-baselining exercise if the data granularity or availability changes materially throughout the design development.

1.2.4 Table 1.1 documents the versions of the CMP to date.

Table 1-1 – Version control

Version Number	Date updated	Brief description of updates
1.0	22/09/2023	A Carbon Management Plan has been developed as part of the OBC for WWHAR in September 2023.
2.0	18/10/2023	The Carbon Management Plan was updated to include land use change data.

1.3 Carbon Management Process

1.3.1 This section sets out the process through which scheme-level carbon monitoring, reduction and mitigation will be managed.

The carbon management process for the WWHAR scheme will be aligned to the principles of PAS2080: 2023. Targets are recommended to be set relative to baseline values and outlining the frequency, methodology and process for measuring, quantifying, and reporting on the management of carbon throughout infrastructure planning and delivery.

1.1.1. Table 1.2 outlines the various activities within the carbon management process that will be applied on the scheme. The carbon management process is iterative, and the plan will be updated regularly throughout the project lifecycle.

Table 1-2 – Carbon Management Process (developed from PAS 2080:2023 guidance)

Clause	Description	Activities
Leadership	Asset owners/managers set objectives, targets and outcomes for the project/programme of works aligned with the decarbonization principles (Clause 4 of PAS 2080:2023). Map key collaborators/stakeholders for enabling whole-life carbon management. Set governance structure and principles.	It is recommended that the Carbon Management Process and any carbon reduction targets set for the scheme are integrated into Project Management and Delivery activities, and the roles and responsibilities for this are assigned. Overall responsibilities should sit with the Project Manager, although specific tasks should be delegated.
Integrate carbon management into decision-making	Asset owners/managers make alignment with net zero transition central to the scope and requirements of work. Identify activities and associated emissions/removals within control and influence across all work stages (as per Clause 4), and the necessary collaborations with value chain members and stakeholders that will enable whole life carbon reductions, and the network(s) and system(s) with which the project or programme of works interfaces. Integrate carbon management into the delivery processes to support system-level low-carbon outcomes. Prioritise implementation of carbon reduction opportunities within control and influence. Integrate the carbon implications of climate resilience (or lack of) in the carbon management at all levels. Prioritise nature-based solutions for reduced carbon and increased sequestration. Follow the carbon reduction hierarchy (Clause 4) across all work stages to identify potential opportunities to reduce whole life carbon emissions: Avoid – Switch – Improve.	At each stage of the project design and delivery, carbon management should be considered a part of normal project delivery and decision-making. The carbon reduction hierarchy shows that the highest carbon reduction potential is at the earliest stages of the project lifecycle. A low carbon design review or a workshop at each stage of the project is recommended as a minimum requirement.

Clause	Description	Activities
Whole-life carbon assessment principles	Quantification of whole-life carbon emissions with sufficient frequency to inform decision-making throughout the project lifecycle. Principles in PAS 2080 should be followed, such as defining the scope for quantification and use of a chosen study period (i.e., appraisal period)	The most recent assessment of Greenhouse Gas emissions has been presented in Section 1.7.
Target setting and baselines	Targets can be set for specific elements such as capital, operational, and/or whole-life carbon. Targets should relate to a desired outcome and use a fixed timescale by which that outcome is to be achieved. Where appropriate, targets should align with sector-level or local, national, and international carbon reduction targets.	Setting a project carbon target is recommended in Section 1.9 of this report. Recommendations are also set in line with PAS 2080:2023.
Monitoring & Reporting	KPIs to monitor carbon emissions. PAS2080 recommends these are at a minimum monitored during all infrastructure work stages or at key points where decisions are made that influence whole-life carbon reduction.	It is recommended that the carbon assessment be updated at regular stages of the project lifecycle. This should be used to determine whether the project is on track to meet any reduction target set and identify any carbon hotspots in the design and delivery of the project.
Procurement	Include carbon management process requirements (including objectives, targets and project outcomes) in contracts.	It is recommended that the project teamwork with suppliers and contractors to reduce carbon, and where possible these requirements are included in contracts.
Continual improvement	This should allow lessons to be learned from applying this carbon management process to improve the delivery of future programmes of work. Acknowledging that comprehensive carbon data or low carbon solutions will not be available at the outset, adopting continuous improvement allows the project team to begin carbon management while gradually improving.	Mitigation measures should be identified, implemented, and reviewed across the project lifecycle. This should be informed by the carbon assessments. Any carbon reductions achieved should be recorded at the end of each project stage as well as any mitigation measures which are unable to be implemented and why. This could be used to identify lessons learned at the end of the project.

Clause	Description	Activities
Leadership	Asset owners/managers set objectives, targets and outcomes for the project/programme of works aligned with the decarbonization principles (Clause 4 of PAS 2080:2023). Map key collaborators/stakeholders for enabling whole-life carbon management. Set governance structure and principles.	It is recommended that the Carbon Management Process and any carbon reduction targets set for the scheme are integrated into Project Management and Delivery activities, and the roles and responsibilities for this are assigned. Overall responsibilities should sit with the Project Manager, although specific tasks should be delegated.

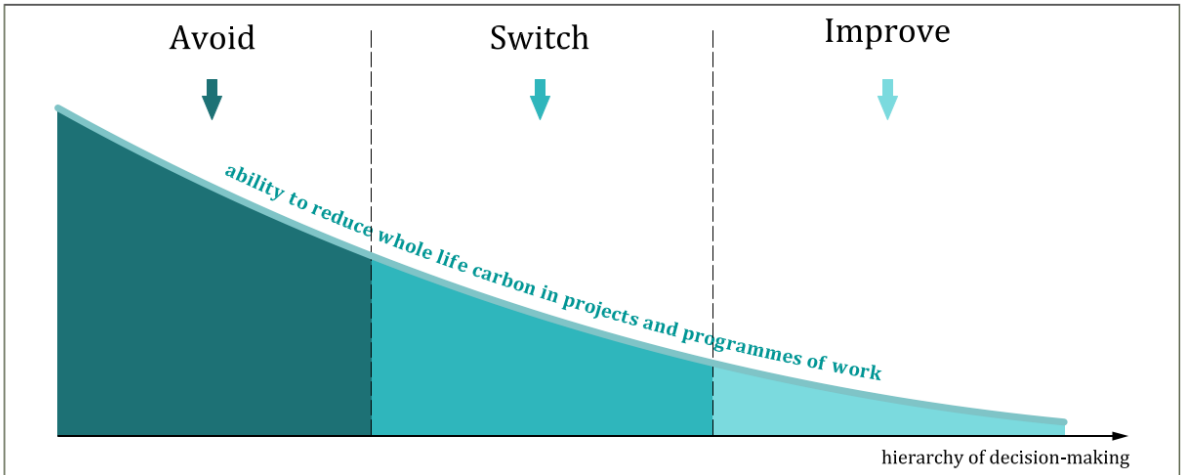
1.3.2 To optimise design and maximise carbon reduction benefits, PAS2080 guidance clearly defines a carbon reduction hierarchy (detailed in Figure 1.1) and found in clause 4.3 of PAS 2080:2023. It includes the following three steps -

- 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.

1.3.3 The greatest ability to influence whole life carbon reduction is at the “need” stage.

Figure 1-1 – Carbon reduction hierarchy: A key component of PAS 2080:2023 is the revised Carbon Reduction Hierarchy – Avoid > Switch > Improve.

The Carbon Reduction Hierarchy should be implemented at every work stage to achieve whole life carbon reductions.



***NOTE** This figure represents a simplified and streamlined version of the carbon reduction hierarchy presented in PAS 2080:2016 and the* Infrastructure carbon review *[1]. It has been updated to clarify its applicability and relevance to a wider range of projects and programmes within the built environment (i.e. to clarify that the carbon reduction hierarchy is not solely about new builds).*

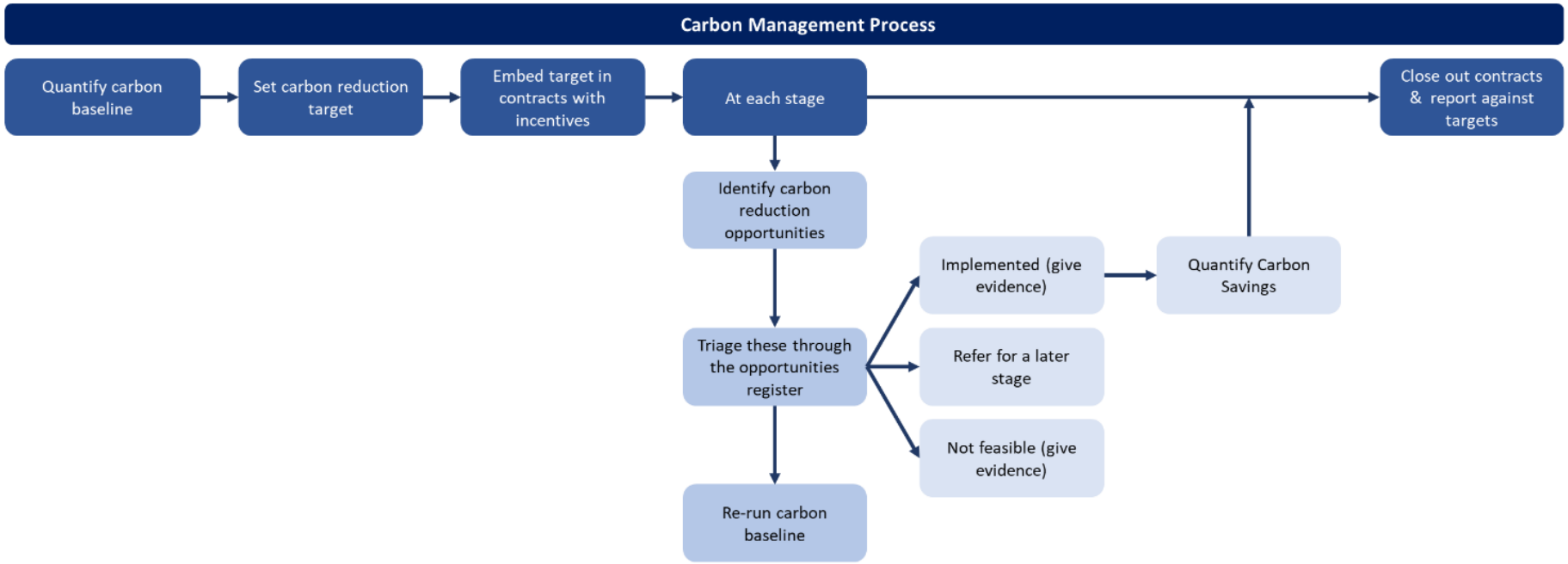
1.3.4 The carbon management process for WWHAR is detailed in the flowchart, in Figure 1.2.

1.3.5 The carbon management process for WWHAR involves the following steps –

- Carbon quantification at the baseline stage;
- Setting carbon reduction target;
- Embedding the target in contracts with incentives;
- At each stage, identifying carbon reduction opportunities and categorizing them based on feasibility to implement at the current stage, or referring them to a later stage, or identifying them as not feasible;
- Following this at each stage, the carbon assessment will be completed to identify the carbon savings achieved;

- The final stage involves closing out the contracts and reporting against the set targets.

Figure 1-2 – The Carbon Management Process of WWHAR

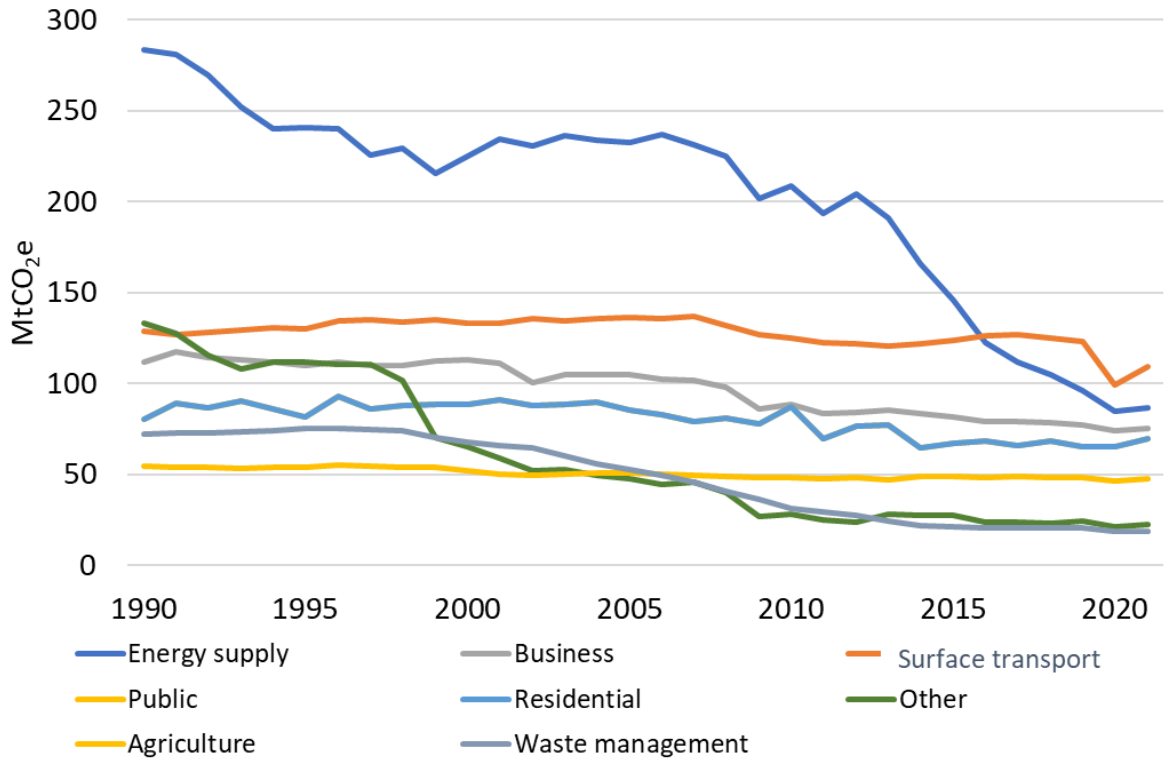


1.4 Emissions context

1.4.1 At a national level, in 2021, GHG emissions in the transport sector increased by an estimated 10% from 2020 levels, with it remaining the largest emitting sector in the UK, accounting for 26% of GHG emissions in 2021. This information is available online, on the Gov.uk Final UK greenhouse gas emissions national statistics webpage.

1.4.2 The transport sector is the largest source of UK emissions, and other than a dip due to changes in travel patterns due to COVID-19, transport emissions in the UK have remained relatively static, see Figure 1.3.

Figure 1-3 – UK Emissions by sector over time. Provisional figures for 2022 show a ~4% increase in CO_2e emissions from surface transport as they continue to rebound following COVID-19



1.4.3 The UK carbon budgets (Table 1.3) have been set by the UK Government covering 2018 to 2032. The budgets are expressed in millions of tonnes of carbon dioxide equivalents ($MtCO_2e$). The budgets can be used to contextualise the Proposed Scheme emissions.

Table 1-3 – UK carbon budget

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 $MtCO_2e$

1.4.4 In addition, the national and local transport emissions for 2021 are presented in Table 1.4 for context.

Table 1-4 – Transport emissions for East of England, Norfolk, King's Lynn and West Norfolk and Nationally for 2021 (kt CO_2e)

Category	East of England	Norfolk	King's Lynn and West Norfolk	Nationally
I. Road Transport (A roads)	5,972	977	207	48,450
J. Road Transport (Motorways)	2,358	0	0	25,398
K. Road Transport (Minor roads)	3,711	616	133	36,254
L. Diesel Railways	176	10	1	1,680
M. Transport Other	272	133	13	1,943
Transport Total	12,489	1,736	354	113,725

1.5 Carbon Baseline

Methodology

Construction Phase

1.5.1 Emissions calculations for the materials required for the construction phase of the scheme have been completed by multiplying quantities of material by the relevant emissions factors to give the estimated greenhouse gas emissions (tCO_2e). In this assessment the emission factors were selected from the Bath ICE V3 database.

1.5.2 The emissions from the transport of materials and waste were calculated using assumed local (50km) and national (300km) transport distances. The tonnage of the materials and waste transported was multiplied by the distance travelled and by an appropriate emissions factor, selected from the UK Government emissions factors.

1.5.3 In the absence of information on the types of fuels used to operate the construction plant, the emissions from plant and equipment use during construction (A5) have been estimated based on the total construction cost, using best practice methods from the Royal Institution of Chartered Surveyors (RICS) whole life carbon assessment for the built environment. The RICS metric is based on 2015 data, therefore in line with the guidance the total project cost has been adjusted for inflation to 2015 levels using the Bank of England inflation calculator. For this approach, the total project cost of £35,43,70,466.26 has been used.

1.5.4 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. A habitat carbon calculator was used to assess the total carbon stock of the habitats in the baseline scenario. The calculator uses literature from Natural England and the Woodland Carbon Code.

1.5.5 For most habitats, 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. The approach was aligned with Natural England Carbon Storage and Sequestration by Habitat (2021), which uses the median value in calculations.

1.5.6 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

1.5.7 End-user vehicle emissions were calculated in accordance with DMRB Volume 11, Section 3, Part 14 Climate; LA1148. Emissions were quantified using TAG data (v1.21 - May 23) from the Department of Transport. This took into account the vehicle type, fuel type, forecast fuel consumption parameters and the appropriate emission factors. The whole project lifespan is assumed to be 60 years, in line with DMRB LA114 guidance. From this, emissions were quantified for each year over the lifetime of the scheme (up to 2086).

1.5.8 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.

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

1.5.10 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 method described in Section 1.6.4.

1.5.11 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.

1.6 Results

1.6.1 The current baseline estimated whole-life impact is 55,218 tCO2e over 60 years. A breakdown of the key impacts that make up this whole-life impact (referenced against BS EN 17472 modules) is provided in Table 1.5. Please note that due to rounding, the sum of the rows may not equal the total.

Table 1-5 – Baseline carbon breakdown

Construction emissions	**tCO2e**
Materials (Product Stage A1-A3)	14,733
Transport to the site (A4)	1,750
Transport of waste (A5)	636
Plant and equipment use during construction (A5)	3,790
Land use change (A5)	9,008
Operational emissions (Use Stage)	**tCO_2e**
Replacement (Resurfacing) (B4)	3,481
Land use change (B8)	-8,374
End user traffic emissions (B8)	30,194
Total emissions	**55,218**

Note: All figures rounded to whole figures

1.7 Emission hotspots

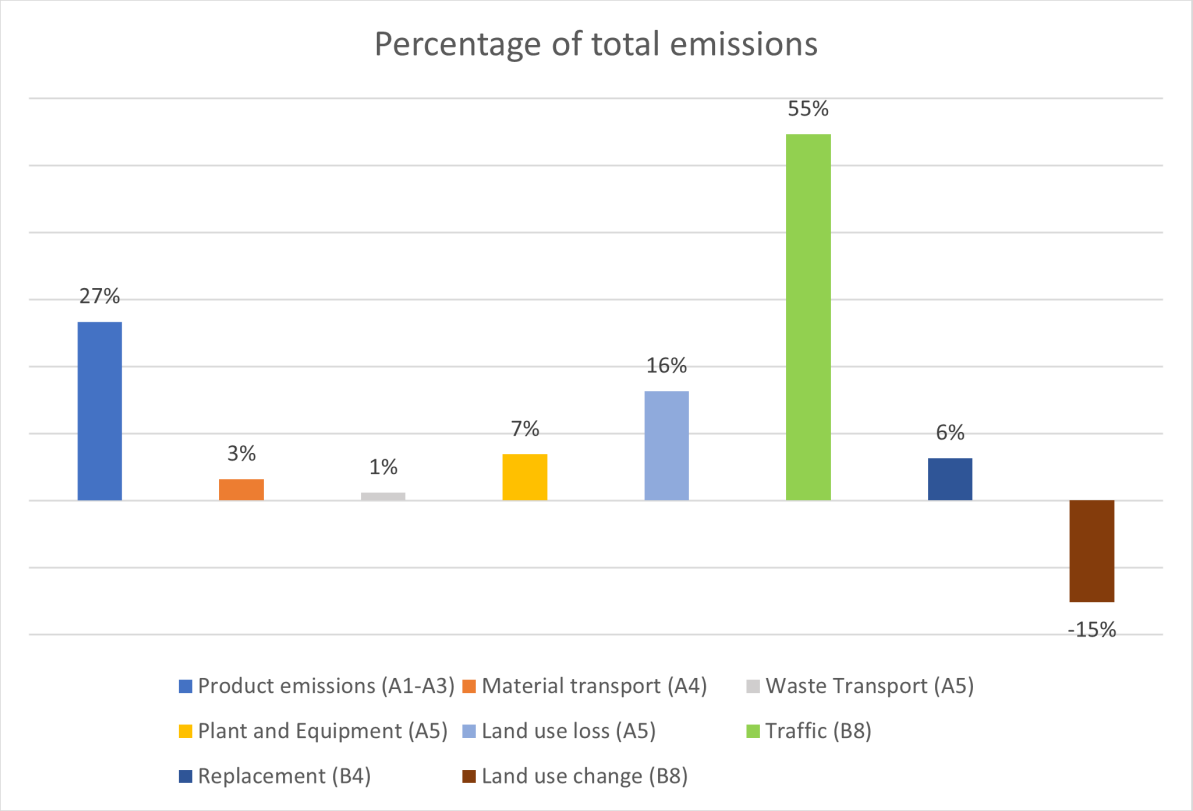
Hotspot per BS EN 17472 module

1.7.1 Figure 1.4 presents the emission hotspots (priority areas for carbon reduction) for the construction and operational stages.

1.7.2 The traffic module (B8) is the highest contributor (55%) to the total carbon emissions of WWHAR. It is followed by materials emissions (A1-A3) with 27% of total emissions. The third most carbon intensive module is land use change and habitat loss (A5) with 16% share. Plant and Equipment (A5), Replacement (B4), Material Transport to Site (A4) and Transport of Waste (A5) contribute 7%, 5%, 3% and 1% respectively.

1.7.3 There is also an emission reduction in module B8 land use change, with the increase in carbon sequestration accounting for a 15% reduction.

Figure 1-4 – Percentage of total emissions contributed by each module (BS EN 17472)

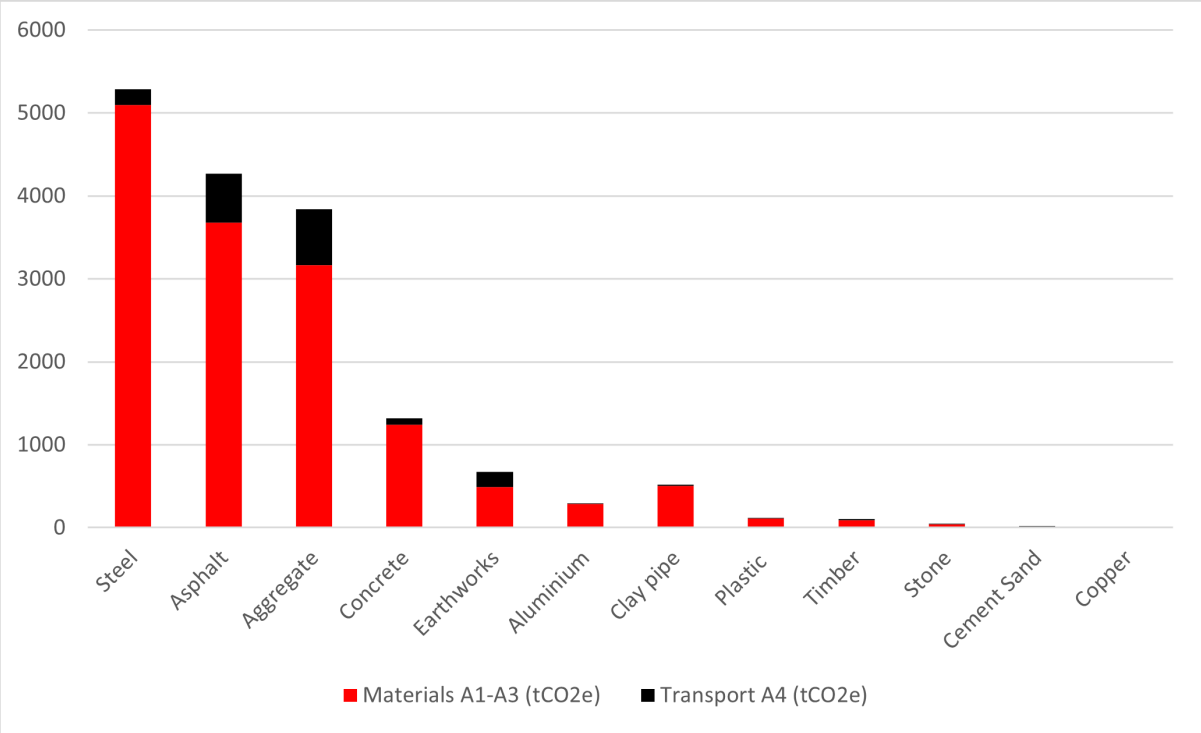


Materials and transport hotspots

1.7.4 Emission hotspots of materials, including their embodied carbon, and transport of materials are summarised in Figure 1.5, which depicts the total impact in tCO_2e of each material.

1.7.5 The emissions from manufacturing and transport of materials show that the most intensive carbon hotspot for WWHAR is steel with a contribution of 5,288 tCO2e (32%) to A1-A4.

Figure 1-5 – Emissions from materials and transport of materials



1.7.6 The emissions hotspots from materials and the transport of materials are presented in Table 1.6.

Table 1-6 – Materials and transport of materials hotspots

Hot Spot	Description	Carbon Impact (tCO_2e)	Key Hotspot (yes/no)
Steel	32%	5,288	Yes
Asphalt	26%	4,268	Yes
Aggregate	23%	3,840	Yes
Concrete	8%	1,321	No
Earthworks	4%	675	No

Hot Spot	Description	Carbon Impact (tCO_2e)	Key Hotspot (yes/no)
Aluminium	2%	292	No
Clay pipe	3%	516	No
Plastic	1%	114	No
Timber	1%	102	No
Stone	0%	47	No
Cement Sand	0%	18	No
Copper	0%	1	No

Limitations and assumptions

1.7.7 To ensure transparency within the CMP, 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, and traffic data provided at this stage are indicative due to data constraints of working with specimen design;
- For steel and copper the worldwide, Europe, or UK average emission factors have been used which includes average recycled content.
- The emission factor for limestone is only available for CO2 only and not CO2e, therefore for the purpose of this assessment it has been taken to be the equivalent of CO2e.
- 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.
- 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 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 emissions from replacement were calculated based on industry standard replacement frequencies for asphalt.
- It was assumed that the distance of materials to site was 50km 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.
- 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.

1.8 Target setting process

1.8.1 The PAS 2080 guidance document recommends setting a target which covers an overall carbon budget for the Proposed Scheme.

1.8.2 The carbon budget should reflect both the Before Use and Use stages as considered in the PAS 2080: 2023, covering the construction and operational phases of the project lifecycle.

1.8.3 It is recommended that project carbon budgets/targets align with sectoral and national decarbonisation trajectories, and local policies.

The Climate Change Act 2008 (2050 Target Amendment)

1.8.4 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. The 2008 Act also created the Committee on Climate Change, 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.

The Paris Agreement (2015)

1.8.5 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.

Powering Up Britain (2023)

1.8.6 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.

1.8.7 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

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

1.8.9 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.

1.8.10 The Plan also summarises the sector residual emissions for each carbon budget, shown for domestic transport in Table 1.7.

Table 1-7 – 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)

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

1.8.11 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."

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

1.8.13 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.

- 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)

1.8.14 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
- Engage and Collaborate

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

1.8.15 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)

1.8.16 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
- Minimising waste

West Winch Parish Council Environment and Sustainability Policy (2021)

1.8.17 The Policy sets out what the Paris 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
- progressively build environmental concerns and sustainability into all its policies

1.8.18 Setting an early project carbon budget or carbon reduction target will help to inform decision-making in the early stages of the project. It will also guide carbon management decisions and improve carbon reduction opportunities across the project lifecycle.

1.8.19 Identifying carbon reduction opportunities for the scheme is a vital step to developing a suitable carbon reduction target.

1.8.20 The following steps detail the opportunities identification process:

- Step 1 – Carbon reduction workshop with key stakeholders to discuss the carbon hotspots in the baseline and discuss opportunities (including feasibility).
- Step 2 – Record the opportunities in the ‘Recommended Mitigation Measures’, see Section 1.17. Opportunities should be recorded as ‘Committed to and required’, ‘To be encouraged’, ‘To be investigated further’, and ‘Not to be taken forward’.
- Step 3 – For any ‘Committed to and required’ opportunities, assess the carbon reductions which will be achieved through implementation. The

estimated carbon saving in terms of percentage saving from the baseline will be recorded.

- Step 4 – Agree the scheme carbon reduction target if setting one, using the estimated potential carbon saving as a guide for an appropriate carbon reduction target. The target can be recorded in Section 1. 16.

1.8.21 A record of any opportunities identified, should be created to transparently record the process. This can be recorded in Section 1.17.

1.9 Scheme Carbon Reduction Target

Construction (A1-5)

1.9.1 Any carbon reduction target should be measured against the baseline established in Section 1.16 of this Carbon Management Plan. Reductions in GHG emissions are expected to be achieved using available mitigation measures outlined in Section 1.17.

1.9.2 Using an appropriate target range (e.g. 20-30% reduction) at this stage is the best approach as the current baseline is subject to change and will have some inherent inaccuracy due to the availability of data at this stage. The carbon reduction target should not be fixed to this calculation as it is an indicative estimate only.

Operational (Use Stage B1-B8)

1.9.3 Replacement (B4) due to resurfacing accounts for 6% of the total scheme emissions over its entire lifespan of 60 years. Choosing a material with greater longevity which would reduce the frequency of replacement of that material and choosing a lower embodied carbon material would reduce these emissions. If the scheme sets a carbon reduction target, it is recommended that replacement is covered by the target.

1.9.4 User traffic emissions' (B8) contribution is the largest to the total scheme emissions which is 55%. However, given the uncertainty of current TAG data and the impacts of the national Government ban on ICEV sales from 2030 and PHEVs from 2035, it is not prudent and is too difficult to set a realistic

target for reducing user emissions at this stage. If a carbon reduction target is set for the scheme, it should be clear whether traffic emissions are covered by it.

Scheme Carbon Reduction Target

1.9.5 A carbon reduction target for the Proposed Scheme should be recorded in this section of the CMP, once agreed by NCC.

1.9.6 During the following scheme development stage, this carbon reduction target should be reviewed. A final target should be proposed based on the baseline, which could be updated to include more accurate data or incorporated construction and installation processes. It is recommended that any carbon reduction targets set for the scheme align with the UK 2050 Net Zero target, Powering Up Britain, and the Paris Agreement.

1.9.7 Consideration of an appropriate carbon reduction target will continue to be monitored with each iteration of this Carbon Management Plan and the key design stages of the Scheme.

1.10 Recommended Mitigation Measures

1.10.1 Mitigation actions and carbon reduction measures have been summarised based on the outcomes of the workshop in Table 1.8.

1.10.2 As a general recommendation, carbon emissions can be reduced by following the carbon reduction hierarchy detailed in PAS 2080. The new PAS 2080:2023 introduces an updated carbon hierarchy to reduce carbon emissions (shown in Figure 1.1 and found in clause 4 of PAS 2080: 2023).

1.10.3 Throughout the project design and delivery these opportunities should be considered, their status updated, and any additional carbon reduction opportunities should be added.

1.10.4 Each opportunity should be assigned a status:

- Committed to and required
- To be encouraged

- To be investigated further
- Not to be taken forward

Table 1-8 – Carbon management opportunities and recommended mitigation actions

Module	Opportunity detail	Rank	Recommended Timescale for Completion	Responsibility	Status
Construction Process (A1-A5)	Consider the benefits of offline vs online dualling (offline has benefits for traffic, whereas online may have benefits for reuse of materials)	Ambition – High impact, but not as feasible	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further
Construction Process (A1-A5)	Investigate the time of the year for the construction activities to avoid redoing of work	Low hanging fruit – Lower impact but feasible	To be considered along the entire project life cycle	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further
Construction Process (A1-A5)	Consider removing the footbridge and using an at grade crossing	Best bets – High impact and high feasibility	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer	To be investigated further
Materials (A1-A3)	Consider eliminating the use of Ordinary Portland Cement (OPC)	Ambition – High impact, but not as feasible	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Materials (A1-A3)	Consider using a lower carbon concrete mix during construction of the scheme	Best bets – High impact and high feasibility	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Materials (A1-A3)	Consider using Reclaimed Asphalt Pavement (RAP) asphalt as a lower carbon substitute	Best bets – High impact and high feasibility	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Materials (A1-A3)	Consider alternative pavements choices (e.g. using a lower carbon subbase, or considering fully flexible vs composite pavements)	Best bets – High impact and high feasibility	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further

Module	Opportunity detail	Rank	Recommended Timescale for Completion	Responsibility	Status
Materials (A1-A3)	Consider using options like foam mixed or cold mix asphalt for base and pavements	Best bets – High impact and high feasibility	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Materials and Transport of Materials (A1-A4)	Looking into the feasibility of reusing cut earthworks on another site locally and achieve cut-fill balance efficiency	Best bets – High impact and high feasibility	To be incorporated into the design at the detailed design stage. To be considered along the entire project life cycle.	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further
Materials and Transport of Materials (A1-A4)	Investigate the potential of reusing material on-site through using soil stabilisation	Best bets – High impact and high feasibility	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Transportation (A4)	Investigate the potential to use locally sourced materials for construction	Ambition – High impact, but not as feasible	To also be confirmed prior to construction. To be considered along the entire project life cycle	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Transportation (A4)	Investigate the potential carbon benefits from reduced transportation if borrow pitting is used	Ambition – High impact, but not as feasible	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further
Transportation (A4)	Consider the transporting materials in bulk via barge to reduce the land transportation distances	Best bets – High impact and high feasibility	To also be confirmed prior to construction. Or To be considered along the entire project life cycle	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Plant and Equipment (A5)	Look into the feasibility of using HVO fuel for on-site plant and equipment	Best bets – High impact and high feasibility	To also be confirmed prior to construction. Or To be considered along the entire project life cycle	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further

Module	Opportunity detail	Rank	Recommended Timescale for Completion	Responsibility	Status
Construction Process (A5)	Consider using rainwater harvesting for site compounds	Low hanging fruit – Lower impact but feasible	To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further
Plant and Equipment (A5)	Investigate the potential to use electric fleet/plant and a mains connection on site	Low hanging fruit – Lower impact but feasible	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further
Operational Energy Use (B6)	Investigate the potential to use LED lights	Low hanging fruit – Lower impact but feasible	To be incorporated into the design at the detailed design stage.	Asset Owner/Manager / Principal Designer / Principal Contractor / Material Suppliers	To be investigated further
Traffic (B8)	Look into the feasibility of making the traffic on the road move more efficiently.	Ambition – High impact, but not as feasible	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further
Land Use and Sequestration (B8)	Investigate the potential to increase the BNG to more than 10%	Low priority – Low impact and low feasibility	To be incorporated into the design at the detailed design stage. To also be confirmed prior to construction.	Asset Owner/Manager / Principal Designer / Principal Contractor	To be investigated further

1.11 Carbon Risk Register

Table 1-9 – Summary of risks to projects as a result of outcomes of this GHG assessment

Risk	Probability	Impact	Risk Rating	Mitigation
Project encounters challenges through the planning process due to increasing carbon emissions	4	4	16 (High)	The CMP has identified potential mitigation measures which could be incorporated to mitigate any further emissions

1.11.1 Table 1.9 provides a summary of the challenges the project may face through the planning process because of increasing emissions.

1.11.2 Table 1.10 presents the live risk register, which is a continuous process with new risks identified by specialists as the scheme progresses. The top-rated risks from the project risk register were assessed for their potential impact on GHG emissions.

1.11.3 Risks are quantified in two ways, by assessing the likelihood (or probability) of them occurring and the severity of impact on the project. Impact and probability of each risk are scored using a 5-scale point system from 1 (very low/unlikely) to 5 (very high/probable). These scores are multiplied by each other to determine total risk score, which ranges from 0-25.

1.11.4 The current highest scoring risks from the Project Risk Register are summarised in Table 1.10. The probability score is taken from the Project Risk Register, the impact score is the potential impact on the GHG emissions from the Proposed Scheme. This resulted in a new risk rating for the impact

on GHG emissions from the Proposed Scheme. These scores will be updated at each CMP update as the scheme progresses.

Table 1-10 – Top Risks from current register. The band for a 'high' score is between 15-25, a medium score is between 8-12, and a low score is between 1-6.

Risk	Overall Project Risk Rating	Impact on carbon	Probability	Impact	GHG Risk Rating
It may not be possible to obtain 10% biodiversity net gain within scheme boundary. It would require off-site compensation. Additional land needs to be agreed with landowner prior to securing planning consent	High	If 10% BNG is not achieved, it will affect the carbon sequestration potential of the site, resulting in higher operational carbon emissions.	5	2	Medium (10)
Conflicting priorities between NCC and NH regarding road use. NH are proposing a change in signalling from the proposed plan, which could result in more traffic in the local area. May be able to develop appropriate solution, but may not be practically acceptable to NH.	High	An increase in traffic in the local area will increase the carbon emissions associated with the scheme and contradict the aims of local climate change plans, such as the West Winch Parish Council Environment and Sustainability Policy	3	5	High (15)
Cost plan and assumed delivery method are based on the gas main diversion being completed in line with the programme. There is a risk this may be delayed, which could result in increased construction cost and programme prolongation.	High	Increased construction cost could result in cost reductions elsewhere, which might prevent the feasibility of using lower carbon options due to budget. If the project construction is prolonged, this will extend the duration of disruption in the local area. There will be more traffic due to diversions and roadworks which could lead to an increase in carbon emissions in local area	4	1	Low (5)
Changes to the Scope instructed by the Project manager, not covered by specific risks, resulting in inadequate project development, design or otherwise, leading to changes	High	Any changes to the Scope which have not been accounted for in the carbon calculations could affect the overall construction and operational carbon emissions of the scheme.	4	3	Medium (12)

Risk	Overall Project Risk Rating	Impact on carbon	Probability	Impact	GHG Risk Rating
The cost plan allowance for land acquisition is based upon a detailed calculation from NCC's specialist land acquisition contractor NPS, which in a worst-case scenario, there could be a 15% increase in the cost of land acquisition over and above the land budget.	High	Increased construction cost could result in savings elsewhere, which might prevent the feasibility of using lower carbon options due to budget.	5	1	Low (5)
Project requires the acquisition of common land. Replacement land has been identified but it may not be suitable under common land law. Process takes at least 12 months and must take place post planning. Uncertainty as to the extent of common land may necessitate additional consultation and increase land acquisition costs.	High	Increased construction cost could result in cost reductions elsewhere, which might prevent the feasibility of using lower carbon options due to budget.	5	1	Low (5)
WWHAR planning determination may be impacted by the outcome of updates to the Local Plan. If the housing numbers differ from assumed numbers, then the benefits assumed in business case around land value uplift may not be realised.	High	A difference in housing numbers will affect the carbon calculations and projections of the scheme due to changes in road-users and predicted traffic, affecting the operational carbon emissions of the scheme.	5	4	High (20)
The new structure may settle post construction, resulting in the potential for movement between old and new structures. Would result in ongoing monitoring and maintenance, such as rewater-proofing and filling cracks, and traffic management delays	High	Repairs will require more materials to be used than accounted for in the calculations, resulting in increased material and transport of material emissions than predicted. Traffic management delays will increase the congestion of the surrounding area and carbon emissions.	4	3	Medium (12)

Risk	Overall Project Risk Rating	Impact on carbon	Probability	Impact	GHG Risk Rating
DfT may not award the full pot of MRN funding that is needed, because of policy driven investment decisions and competition with other schemes, it could delay the project until alternative funding streams become available.	High	If project is not built, or is smaller than planned, then emissions would be reduced. This would have a beneficial impact for carbon.	4	0	No risk to carbon
The Planning Inspector may reject the Local Plan assumptions around delivery timeframe, with specific concerns around housing developing being brought forward to fit this timeframe. The project is dependent on outcomes built into the Local Plan to support population growth and traffic modelling assumptions that in turn feed into the BCR.	High	Should the Local Plan not be approved, this may have impacts for the viability of this project. Should the project not go ahead, there will be no net increase in carbon emissions. This would have a beneficial impact for carbon.	4	0	No risk to carbon
NH may not accept the current design ahead of planning application, which may lead to statutory consultee objection to the planning application.	High	If project is not built, or is smaller than planned, then emissions would be reduced. This would have a beneficial impact for carbon.	5	0	No risk to carbon

1.12 Roles and Responsibilities

1.12.1 It is the responsibility of all within the project team to deliver this carbon management plan and any carbon reduction target set. As best practice, the appointment of an assigned Carbon Co-ordinator should be explored to take ownership of the coordination and delivery of this plan in line with PAS 2080: 2023.

1.12.2 In addition to the carbon co-ordinator, it is recommended that key stakeholders are identified to cover the following areas (these are PAS 2080 aligned):

- **Leadership and governance** - working with the Carbon co-ordinator to embed carbon management into the Scheme processes, whilst liaising with key project leaders and external stakeholders where necessary. The Carbon Coordinator should report the carbon baseline and savings updates to these key stakeholders for wider dissemination if necessary.
- **Scheme design (detailed design)** – Design experts will be required for feasibility assessments to ensure suitable opportunities are considered. Additionally, they should ensure that the opportunities committed to are included in the Scheme design.
- **Procurement team** – To ensure the carbon reduction targets are cascaded across the value chain, and suitable suppliers are selected who can support the scheme carbon requirements.

1.12.3 Carbon management action owners are referenced in the table above as a guide to those who should have responsibility for reviewing and implementing (where feasible) the opportunities for carbon reduction.

Value chain engagement

1.12.4 Early value chain engagement is recommended, including early contractor involvement in the detailed design to discuss low carbon solutions to reduce embodied carbon in a cost-effective manner, and to explore the feasibility of

carbon actions referenced in Section 1.10. This should be ongoing to ensure collaboration and sharing of best practice for the successful delivery of this carbon management plan.

Skills

1.12.5 It is recognised that a degree of upskilling may be required across the parties involved in delivery of the detailed design and construction of the Proposed Scheme. Required skill levels will vary subject to roles and responsibilities.

1.12.6 Gaps in skills or capabilities should be identified based on the actions in Section 1.17. If appointed, the identification of these gaps would be owned by the Carbon Coordinator, who works with the stakeholders in each area.