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TABLES

7 CLIMATE

7.1 Introduction

7.1.1 Climate change is the alteration of enduring weather conditions as a result of interactions between the earth's atmosphere and its various physical, chemical and biological processes.

7.1.2 The latest climate science data from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6)[1] show that the decade 2011–2020 was approximately 1°C warmer than in 1850–1900. Since 1901, sea level has risen by approximately 20cm.

7.1.3 The AR6 Working Group 1 report on the physical science basis[2] concludes that it is "unequivocal" that greenhouse gas (GHG) emissions associated with human activities are responsible for the "widespread and rapid" climate changes observed today. Many human activities emit GHGs which trap heat within the atmosphere; other activities, such as deforestation, limit the capacity of natural systems to sequester GHGs. The consequence is anthropogenic climate change: unprecedented overall warming leading to the rapid destabilisation of the prevailing climate.

7.1.4 Countries have committed to reduce their GHG emissions through the Paris Agreement[3]. This is a legally binding international treaty which commits Parties to the United Nations Framework Convention on Climate Change (UNFCCC) to objectives to reduce GHG emissions, with the view to limiting the global average temperature rise to well below 2˚C above pre-industrial levels, whilst "pursuing efforts to limit the temperature increase to 1.5˚C". The Agreement is revisited five-yearly to allow Parties to the Convention to evaluate and enhance the level of ambition of their climate action plans, known as nationally determined contributions (NDCs).

7.1.5 This is translated into UK policy through the Climate Change Act 2008 (amended 2019)[4]. This Act, in 2008, set a target of reducing GHG emissions by at least 80% by 2050, relative to the baseline year of 1990. The Act further established the Climate Change Committee (CCC) as an independent, statutory body, to advise the UK and devolved governments on emission reduction targets and report to Parliament on progress. The CCC is further tasked with the production of the UK Climate Change Risk Assessment, followed by a National Adaptation Programme to address those risks every five years.

7.1.6 In 2019, the emission targets set out in the Climate Change Act 2008 were made more ambitious by the Climate Change Act 2008 (2050 Target Amendment) Order 2019 thereby making the UK the first major global economy to commit to a net zero target requiring a net reduction of emissions by 100% relative to 1990 levels by 2050.

[1] https://www.ipcc.ch/report/ar6/syr/

[2] https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf

[3] https://unfccc.int/sites/default/files/english_paris_agreement.pdf

[4] https://www.legislation.gov.uk/ukdsi/2019/9780111187654

It therefore constitutes a legally binding commitment to end the UK's contribution to climate change by 2050.

7.1.7 The Climate Change Committee is an independent statutory body established under the Climate Change Act (2008) to advise the UK government and Devolved Administrations on reducing GHG emissions and preparing for climate change. The CCC undertakes an annual assessment of GHG emissions to determine whether the UK is on course to meet its target carbon budget. These budgets are presently set as follows (**Table 7.1**):

Table 7.1 UK Carbon Budgets

Carbon budget	Carbon budget level ($MMtCO_2e$)	% reduction below base year
1st (2008 – 12)	3,018	23
2nd (2013 – 17)	2,782	29
3rd (2018 – 22)	2,544	35
4th (2023 – 27)	1,950	50
5th (2028 – 32)	1,725 (1,765 including international shipping)	57
6th (2033 – 37)	965 (including international aviation and shipping)	78

7.1.8 In its most recent budget report (released in December 2020), the CCC recommended that the UK set a Sixth Carbon Budget which requires a reduction of emissions of 78% by 2035, relative to 1990 levels (63% reduction from 2019). This represents a world-leading commitment which is consistent with the over-arching objectives of the Paris Agreement.

7.1.9 It is a requirement of the EIA Regulations that a project's direct and indirect impact on the climate must be considered.

7.1.10 This chapter reports the outcome of the assessment of likely significant effects arising from the Proposed Development upon the climate during construction, operation and decommissioning. Whilst decommissioning has been scoped out other environmental factor chapters within this draft Environmental Statement, in line with relevant guidance, this chapter assesses the whole lifecycle of the Proposed Development and therefore decommissioning has been included.

7.1.11 This chapter (and its associated figures and appendices) is intended to be read as part of the wider draft Environmental Statement, with particular reference to **Volume**

2, Chapter 2: Description of the Proposed Development and **Chapter 11: Traffic and Transport.**

7.2 Consultation, Scope and Study Area

Consultation undertaken to date

7.2.1 **Table 7.2** provides a summary of the consultation activities undertaken in support of the preparation of this assessment.

Table 7.2 Summary of consultation undertaken

Consultee	Key matters raised	Actions in response to consultee comments
Planning and Environment Decisions Wales	Planning and Environment Decisions Wales had no further comments to make on the Climate EIA scoping chapter; however, they highlighted the importance of including decommissioning as part of the Environmental Statement.	GHG emissions from the decommissioning phase, previously scoped out, have been included within the GHG assessment.
Natural Resources Wales	Natural Resources Wales disagreed that Major Accidents and Disasters should be scoped out, particularly the risk of "*major losses of containment of CO_2 and how significant adverse environmental effects would be prevented or mitigated, including details of emergency preparedness*".	A Major Accidents and Disasters chapter has been included in the draft Environmental Statement (**Volume 2, Chapter 13: Major Accidents and Disasters**) and comprises a risk assessment that covers the major loss of CO_2. The risk assessment concludes the level of risk to be as low as reasonably practicable and therefore it has not been necessary to assess the GHG emission of this scenario in this chapter.

Scope of the assessment

7.2.2 The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Volume 2, Chapter 4: Approach to EIA**.

7.2.3 This section provides an update to the scope of the assessment and updates the evidence base for scoping out matters following further iterative assessment.

Matters scoped out of further assessment

7.2.4 presents matters that are scoped out of further assessment, together with appropriate justification. No change has occurred since EIA scoping.

Table 7.3 Receptor/matters scoped out of further assessment

Matter	Phase	Justification	Change since EIA Scoping?
Climate change risk	Construction	A review of 'worst-case' (RCP 8.5) climate projections from the UK Climate Projections (UKCP18)[5] was undertaken as part of the EIA scoping process. This indicated no significant impact from temperature increase, and due to distance from coast and approximate elevation of 100m above sea level, sea level rise is not expected to impact the Site during construction or operational life. Expected increase in winter rainfall may increase flood risk, but a stand-alone Flood Consequences Assessment will be submitted in support of the DNS application.	No. The Planning and Environment Decisions Wales Scoping Direction agreed that climate change risk should be scoped out of further assessment.

7.2.5 The Scoping Report did not include a breakdown of emissions sources to be included or excluded for the GHG Assessment. In line with the GHG Protocol and IEMA guidance, a materiality threshold of 1% may be set whereby emissions that are expected to contribute to less than 1% of the overall emissions inventory may be excluded from the assessment. Those emission sources that are not considered to have sufficient magnitude and are therefore scoped out are detailed in

Table 7.4 Emissions sources scoped out of further assessment

Phase	Life cycle stage	Emissions source	Justification	Change since EIA Scoping?
Construction	A5	Land use change	Any vegetation removals will be compensated for as part of the landscape and habitat strategic proposal and the habitat creation and management plan.	Not detailed in this level of granularity at EIA scoping stage.
Operation	B2-B5	Repair and maintenance	The Proposed Development is designed to be maintained rather than repaired, therefore repair emission sources are not considered to be material. Maintenance associated with the Proposed Development is not considered a material emissions source as only a small amount will be additional to the maintenance that already takes place at the	

[5] https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf

Phase	Life cycle stage	Emissions source	Justification	Change since EIA Scoping?
			existing cement works and which is part of the existing baseline (e.g., vehicle emissions from technicians driving to Site).	
	B6	Electricity consumption	The Proposed Development is partly an energy generation development (CHP) to provide its own energy source. Emissions from the CHP are scoped into the assessment (see **Table 7.5**) Electricity consumption from the National Grid is not expected to change significantly between the current operations and the Proposed Development. Furthermore, electricity consumption will be on a renewables tariff, and therefore will generate no market-based scope 2 emissions.	
	B7	Water consumption and waste water treatment	Emissions from water consumption, treatment and waste generated from the operation of the Proposed Development have been scoped out of assessment as these are not considered to be a material change from the baseline scenario.	
	B8	Waste		

7.2.6 The CO_2 transport pipeline and final storage of the captured carbon outside of the Site boundary is outside the scope of this assessment as it is covered by separate consents and is not part of the Proposed Development, as described in **Volume 2, Chapter 1: Introduction.** There is no cumulative assessment included for this climate change topic, in line with the IEMA Guidance, and as explained further in **Volume 2, Chapter 15: Cumulative Assessment**.

Receptors/matters scoped into further assessment

7.2.7 presents the emissions sources that are scoped into further assessment, together with appropriate justification.

Table 7.5 Emissions sources scoped into further assessment

Phase	Life cycle stage	Emissions source	Justification	Change since EIA Scoping?
Construction	A1-A3	Embodied emissions of construction materials	The embodied carbon of construction materials (e.g., steel and concrete) are expected to be significant.	Not detailed in this level of granularity at EIA scoping stage.
	A4	Transport of materials to Site	Inclusion of other construction emissions will allow a robust assessment of overall construction phase emissions.	
	A5	Fuel consumption during construction		
		Waste		
		Construction worker transport		
Operation	B1	Process emissions from cement manufacture	The emissions from cement manufacture are anticipated to be significant.	
		Emissions savings from Carbon Capture and Storage (CCS) process	GHG emissions projected to be captured by the CCS process are considered in this assessment. The opportunity to reduce emission from the cement production process is the primary driver for the Proposed Development.	
	B6	Fuel consumption (coal, solid recovered fuel and natural gas) for operations at the Site.	Whilst the only change in fuel consumption between the current operations and the Proposed Development is in natural gas use, the emissions from combustion of all fuels will be part of the CCS process and therefore emissions from all fuel sources will change as part of the Proposed Development.	
	B7-B8	Embodied emissions from solvent and chemical use	Solvents and chemicals are required for the CCS process.	

Phase	Life cycle stage	Emissions source	Justification	Change since EIA Scoping?
		Biomass	Biomass combustion is a part of the Proposed Development. It is considered an 'out of scopes' emission source by the GHG Protocol, and is reported here to account for the emissions savings from the carbon capture of these emissions.	
Decommissioning	C1-4	Activities associated with end of life	The Planning and Environment Decisions Wales Scoping Direction highlighted the importance of inclusion of the impact of the decommissioning phase for the climate chapter. The decommissioning effects are anticipated to be similar to, but not exceed those associated with the construction phase.	Yes – this was originally scoped out due to uncertainties in decommissioning processes after 25-year operational life.

Extent of the Study Area

7.2.8 The sensitive receptor for GHG emissions is the global climate, which is considered highly sensitive to GHG fluctuations. The Proposed Development can potentially affect the climate by the addition and avoidance or removal of GHG emissions in comparison to the baseline and future baseline scenarios.

7.2.9 The individual components of the development can be summarised as follows:

- A Combined Heat and Power (CHP) plant with 15 MWe (minimum) and 83MW (minimum) thermal of installed capacity, to produce electricity and heat to power the carbon capture equipment;
- A Post Combustion Carbon Capture and Compression (PCCCC) plant, to extract CO_2 from waste gases and compress it for transport and storage; and
- Various temporary and permanent enabling development to support and facilitate the Proposed Development.

7.2.10 A full description of the main components of the Proposed Development is presented in **Volume 2, Chapter 2: Description of the Purpose and Nature of the Proposed Development, Table 2.1**.

7.2.11 The scope of the GHG assessment includes the GHG emissions directly from construction, operational and decommissioning activities undertaken within the footprint of the Proposed Development, including:

- Fuel consumption for the Site (construction and operation); and
- Process emissions from cement manufacture (operation).

7.2.12 It will also extend to include emissions which will occur outside the Site boundary, but related to the activities of the Proposed Development, including those from:

- Upstream emissions associated with fuel consumption;
- Extraction, manufacture, and transportation of materials to the Site; and
- The management of any wastes arising from construction processes.

7.2.13 The GHG assessment will also consider those GHG emissions that have been avoided due to the CCS process; this is the primary purpose of the Proposed Development.

7.3 Approach and methodology

Applicable guidance

7.3.1 The assessment of the GHG emissions arising from the Proposed Development will be carried out in accordance with:

- The Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (2004)[6]
- The Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022)[7]
- British Standards Institution (2023) PAS 2080 – Carbon management in infrastructure[8]; and
- Royal Institute of Chartered Surveyors (RICS) Whole life carbon assessment for the built environment (2023)[9]

7.3.2 The RICS 2023 lifecycle stages have been adopted as a way of classifying emissions sources.

Data sources to inform the EIA baseline characterisation

7.3.3 Data has been provided by the Applicant to inform both the baseline characterisation and impact assessment, as detailed in **Section 7.3.6**. Emissions from materials were quantified using OneClick LCA (a lifecycle assessment tool for calculating building and infrastructure whole life carbon emissions), relevant Environmental Product Declarations, the Inventory of Carbon and Energy (ICE; University of Bath, 2019)[10] and the UK *Government Conversion Factors for UK Company Reporting* (Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, 2023)[11] to use the most accurate densities and emission factors as possible.

Surveys to inform the EIA baseline characterisation

7.3.4 No surveys or site visits have been undertaken to inform the assessment.

Assessment methodology

7.3.5 The assessment establishes present and future baseline GHG emissions. It quantifies applicable Kyoto Protocol GHGs as measured in tonnes of CO_2 equivalence (tCO_2e), where equivalence means having the same warming effect as CO_2 over 100 years. The six original Kyoto Protocol gas groups are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and perfluorocarbons (PFCs); nitrogen trifluoride (NF_3), a chemical released in

[6] https://ghgprotocol.org/corporate-standard

[7] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010056/TR010056-001649-Climate%20Emergency%20Planning%20and%20Policy%20-%20Appendix%20A%20-%20IEMA%20Guide-%20Assessing%20Greenhouse%20Gas%20Emissions%20and%20Evaluating%20their%20Significance,%20Version%202,%20Feb%202022.pdf

[8] https://www.bsigroup.com/en-GB/standards/pas-2080/

[9] https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment

[10] https://opennetzero.org/dataset/inventory-of-carbon-and-energy-ice-database

[11] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023

certain high-tech industries, was added in 2013. The global warming potential (GWP) of each is presented in **Table 7.6**.

Table 7.6 Kyoto Protocol GHGs and their global warming potential (values from the IPCC's Fifth Assessment Report: AR5[12])

Greenhouse gas/group	Chemical formula	GWP (CO_2e)
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265
Hydrofluorocarbons	HFCs	Depends on specific gas
Sulphur hexafluoride	SF_6	23,900
Perfluorocarbons	PFCs	Depends on specific gas
Nitrogen Trifluoride	NF_3	16,100

7.3.6 Data associated with the activities contributing to the construction and operation of the Proposed Development have been provided by the Applicant. This comprises benchmarks of $kgCO_2$ per tonne of clinker produced, anticipated consumption of fuels and pre-calculated emissions data that have been used as part of the Phase-2 CCUS cluster sequencing funding process for the project, as described in **Volume 2, Chapter 2: Description of the Purpose and Nature of the Proposed Development** of this draft Environmental Statement.

7.3.7 As this assessment represents a forecast of emissions and some specific activity data may not yet be known, secondary activity data (such as estimates, extrapolations, benchmarks, and proxy data such as distance travelled) have been used, applying professional judgment. Emissions have then been quantified by applying the most relevant emission factors.

7.3.8 An emission factor is a representative value that relates to the quantity of a pollutant released into the atmosphere with an activity associated with the release of that pollutant. Emission factors are available from government publications, independent agencies, and scientific research journals; however, the quality and accuracy of such factors can vary significantly. Factors can differ depending on the research body

[12] https://www.ipcc.ch/assessment-report/ar5/

and/or underlying methodologies applied. It is, therefore, good practice to apply emission factors only from reputable sources.

Reportable emissions

7.3.9 GHG emissions from the combustion of biomass is considered 'outside of scopes' by the GHG Protocol Corporate Accounting and Reporting Standard[13] because the direct impact of these fuels has been determined to be a net '0' (since the fuel source itself absorbs an equivalent amount of CO_2 during the growth phase as the amount of CO_2 released through combustion). These emissions are reported as a separate line item to account for the carbon savings from the CCS of biomass emissions.

Baseline scenario assessment methodology

7.3.10 In the future baseline 'do-nothing' scenario, without the Proposed Development, annual GHG emissions are assumed to be the same as at the current Site. These emissions are from the industrial processes associated with the Site, such as the directly from the cement manufacture, energy consumption and transport. Limestone is transported from the nearby Cefn Mawr Quarry to the current facilities at Padeswood Cement Works, processed on-site and the resultant cement is transported to customers via road or rail. Emissions from these transport activities are not included as part of this assessment as the Proposed Development does not involve a change to them.

7.3.11 The GHG assessment only considers those emissions that are additional, or have been avoided, compared to the baseline conditions, as a result of the Proposed Development. As such, the baseline conditions focus on those activities and sources which are subject to change between the baseline conditions and the Proposed Development. These are detailed in **Table 7.7**.

Table 7.7 Baseline assessment emissions sources

Life Cycle Module	Emission source	Description
B1	Use (clinker production)	Clinker production produces CO_2 emissions from the calcination of limestone.
B6	Energy use – fuel consumption	Fossil fuel and non-biofuel combustion for cement kiln for clinker production
	Reportable emissions – biomass	*Carbon accounting of emissions from the combustion of biomass.*

7.3.12 The principal sources of GHG emissions are the production of clinker, generated from the calcination of limestone, plus emissions from fuels used to provide process heat.

[13] https://ghgprotocol.org/corporate-standard

It is understood that 817,000 tonnes of clinker is produced per year, at 542 $kgCO_2e$ per tonne of clinker.

7.3.13 On-site fuel use includes emissions associated with the combustion of coal for the kiln, other solid recovered fuel produced from recovered waste and from sustainable biofuels.

Proposed Development scenario assessment methodology – Construction

7.3.14 The GHG assessment of construction emissions has calculated the lifecycle emissions for the building materials and systems, accounting for their embodied emissions, as well as the emissions during construction.

7.3.15 provides an indication of the key emissions sources which are anticipated during the construction phase of the Proposed Development (2025-2028).

Table 7.8 Anticipated key emissions sources during the construction phase of the Proposed Development (2025-2028)

Life cycle module	Emissions source	Description
Product stage (A1 – A3)	Raw material extraction	Embodied emissions associated with the production of material used for the construction of the Proposed Development
	Precursor product processing	
	Product manufacture	
	Packaging	
	Transport to factory gate	
Construction process stage (A4 – A5)	Transport to Site	Emissions associated with the transport of equipment and materials to the Site
	Construction activities	Emissions associated with pre-construction demolition, the consumption of fuels on-site for the purposes of construction of the Proposed Development and transportation of construction workers
	Waste	Emissions associated with the disposal of waste generated on-site

A1 – A3: Product stage emissions

7.3.16 The quantity of materials for the Proposed Development is based on the Proposed Development design and summarised in **Volume 4, Technical Appendix 7.1**.

7.3.17 Material quantities were based on data provided by the Applicant. However, conversions between mass, volume and area have been calculated where

appropriate to allow the application of specific emissions factors. In addition, some material types, build ups, weights and dimensions were based on publicly available information, where required.

7.3.18 Emissions from materials were quantified using OneClick LCA (a lifecycle assessment tool for calculating building and infrastructure whole life carbon emissions), relevant Environmental Product Declarations, the Inventory of Carbon and Energy (ICE; University of Bath, 2019)[14] and the *UK Government Conversion Factors for UK Company Reporting* (Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, 2023)[15] to use the most accurate densities and emission factors as possible.

A4 – A5: Construction process stage

7.3.19 *Transport of materials to site and transport of construction waste from Site:* The quantification of transport emissions uses the tonne-kilometre (t.km) unit, equivalent to the transport of one tonne over one kilometre. Transport distances have been estimated using RICS 2023 guidance[16].

7.3.20 *Construction activities:* To estimate emissions associated with construction plant use, the Applicant provided data on anticipated plant required. The following assumptions have also been applied:

- Plant has an assumed delivery distance of 50km;
- Typical weight and fuel efficiency of plant was derived using publicly available data;
- All plant will operate for five days per week, ten hours a day, over a period of 65 weeks (approximately half of the construction period to account for plant arriving and leaving the Site)
- All plant will operate at 50% capacity.

7.3.21 To estimate emissions associated with worker transportation, it was estimated that an average of 310 workers would travel to Site each day over a 37-month construction period with 60% of workers travelling via single occupancy car and 40% of workers travelling via car share or bus. These assumptions were taken from the Construction Traffic Flow Report associated with the Proposed Development. The following assumptions were also applied:

- Construction workers would travel a one-way journey distance of 20km if travelling via car – this incorporates the distance from the key surrounding areas (e.g., Chester and Wrexham);
- Construction workers would travel a one-way journey distance of 24km if travelling via bus – this is based on the length of the local T8 bus route near to the Site on the A5118; and

[14] https://opennetzero.org/dataset/inventory-of-carbon-and-energy-ice-database

[15] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023

[16] https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment

- For construction workers that travel to Site via vehicle, it was assumed that 20% travel via car and 80% travel via van, as a conservative assumption based upon results of the Construction Traffic Flow Report.

7.3.22 To calculate emissions from pre-construction demolition (to include the demolition of Padeswood Hall, Padeswood Hall Farm and other nearby outbuildings and garages), OneClick LCA software and the LETI Climate Design Guide 2020[17] were used. The OneClick model applied the indicative floor area and height of Padeswood Hall to the typical single dwelling category in OneClick LCA. In the absence of other information, the remaining pre-construction demolition emissions associated with the Padeswood Hall Farm, nearby outbuildings and garages were estimated by assuming the emissions would equate to the emissions associated with the demolition of Padeswood Hall.

Proposed Development scenario assessment methodology – Operation

7.3.23 **Table 7.9** provides an indication of the key emissions sources which are anticipated during the operational phase of the Proposed Development (2029 – 2050).

Table 7.9 Annual operational emissions sources from the Proposed Development

Life Cycle Module	Emission source	Description
B1 Use	Clinker production	Clinker production produces CO_2 emissions from the calcination of limestone
B6 Operational Energy Use	Fuel consumption	Fossil fuel and non-biofuel combustion for cement kiln for clinker production
	Fuel upstream emissions	Well-to-tank emissions (only for natural gas, which is an additional fuel included for the Proposed Development)
B8 Other operational processes	Solvent used for carbon capture process	Embodied emissions from solvent used on carbon capture process
	Reportable emissions – biomass	*Carbon accounting of emissions from the combustion of biomass*

B1: Use (Cement production and carbon captured through Carbon Capture process)

7.3.24 As confirmed with the Applicant, the rate of clinker production following the implementation of the Proposed Development is expected to remain consistent with

[17] https://www.leti.uk/_files/ugd/252d09_3b0f2acf2bb24c019f5ed9173fc5d9f4.pdf

the baseline tonnes at 817,000 tonnes of clinker per year, with 542 kgCO_2e/tonne clinker pre-CCS emissions.

7.3.25 The Proposed Development is designed to capture up to 95% of CO_2 on an hourly design basis from clinker production and the operation of the combined heat and power plant; allowing for startups, shutdown and periods when the CCS process is not operational due to outages, the annual capture rate is assumed for the purpose of this assessment to be 92.2%. The final capture performance of the plant is subject to confirmation through the detailed design and environmental permitting process, which will follow the planning application.

B6: Operational energy and carbon captured through Carbon Capture process

7.3.26 The Proposed Development will use the baseline equivalent fuel consumption for biomass, waste fuels and coal consumption.

7.3.27 However, the Proposed Development will include a natural gas-fired CHP plant and CCS facilities. Natural gas consumption associated with the CHP plant for CCS will be an additional emissions source, and will include upstream emissions, known as Well-To-Tank (WTT) emissions also.

7.3.28 The CCS process is designed to capture up to 95% of CO_2 emissions from the use of the CHP, 92.2% when adjusted for outages as described in **7.3.25** above.

B8: Other operational processes

7.3.29 Carbon capture involves the use of additional chemicals, the main ones being MHI KS21 amine solvent and sodium hydroxide. KS21 is comprised of several different amines, and so the embodied emissions of alamine[18] have been used as a proxy for the embodied emissions.

Proposed Development scenario assessment methodology – Decommissioning

7.3.30 provides an indication of the key emissions sources which are anticipated during the end-of-life phase of the Proposed Development.

Table 7.10 Anticipated key emission sources during the decommissioning phase

Life cycle boundary	Emissions source	Description
Decommissioning (C1 – 4)	Activities associated with end of life	Emissions associated with deconstruction, transport, waste processing and disposal of materials from the Proposed Development at end-of-life

[18] Alamine is an amine of high-molecular weight, or mixture of such amines

7.3.31 Using RICS 2023 guidance[19], it was assumed that demolition fuel use would equate to 50% of the fuel required for construction of the Proposed Development.

7.3.32 No activity data was available for end-of-life activities. Using waste disposal emissions factors derived from DESNZ (2023)[20], it was assumed that 80% of steel would be recycled at end-of-life, and 20% would go to landfill. All aggregates and cabling would go to landfill at end of life. A landfill to recycling ratio of 70:30 was applied for all other construction materials. Given that decommissioning will occur at least 25 years in the future (assumed for purposes of this assessment), and the clear direction of policy on waste, this assumption is highly robust.

Significance criteria

7.3.33 Impact assessments normally assess to what degree the Proposed Development will affect the baseline environment of the Study Area. In the case of GHG emissions, any emissions will have a long-term, irreversible negative effect on the global climate, which is considered highly receptive to any emissions of GHGs. A specific source of GHG emissions cannot be linked to impacts at a specific location but will contribute to the global impact of climate change.

7.3.34 This GHG assessment will therefore evaluate the significance of emissions based upon guidance from IEMA's *Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance* (2022)[21], which provides a framework for determining significance against the goals of the Paris Agreement (i.e., a science-based 1.5°C trajectory: **Table 7.11**).

7.3.35 IEMA guidance states that a project's significance in terms of GHG emissions should be based upon lifecycle emissions. Significance should not therefore be determined purely on the magnitude of GHG emissions, but whether a project contributes to reducing GHG emissions consistent with a trajectory towards net zero by 2050.

Table 7.11 IEMA's *Guidance to Assessing GHG Significance* (2022)[22] Framework for assessment of significant effects

Significance	Level	Criteria
Significant	Major adverse	Project adopts a business-as-usual approach, not compatible with the national Net Zero trajectory, or aligned with the goals of the Paris Agreement (i.e., a science-based 1.5°C trajectory). GHG impacts are not mitigated or reduced in line with local or national policy for projects of this type.

[19] https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment

[20] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023

[21] https://www.iema.net/preview-document/assessing-greenhouse-gas-emissions-and-evaluating-their-significance

[22] https://www.iema.net/preview-document/assessing-greenhouse-gas-emissions-and-evaluating-their-significance

Significance	Level	Criteria
	Moderate adverse	Project's GHG impacts are partially mitigated, and may partially meet up-to-date policy; however, emissions are still not compatible with the national Net Zero trajectory, or aligned with the goals of the Paris Agreement.
Not significant	Minor adverse	Project may have residual emissions, but the project is compatible with the goals of the Paris Agreement, complying with up-to-date policy and good practice.
	Negligible	Project has minimal residual emissions and goes substantially beyond the goals of the Paris Agreement, complying with up-to-date policy and best practice.
Significant	Beneficial	Project causes GHG emissions to be avoided or removed from the atmosphere, substantially exceeding the goals of the Paris Agreement with a positive climate impact.

7.3.36 The UK's GHG inventory and corresponding five-year carbon budgets provide a framework to measure the amount of GHG emissions the UK is legally permitted to emit per five-year period to stay aligned with the goals of the Paris Agreement. The determination of significance will therefore reference the appropriate budget period in which the emissions arise.

7.3.37 The UK is currently in the 4th carbon budget period, which runs from 2023-27. The construction program for the Proposed Development falls within this 4th carbon budget. The operational phase emissions have been compared to the appropriate and available carbon budgets within the design life of the Proposed Development. These comprise the 5th and 6th carbon budgets, which span 2028-2032 and 2033-2037 respectively.

7.3.38 The UK carbon budgets are used for context, given that this project is of national significance. In addition, the project's emissions are compared against those of the Local Authority area to understand the local implications of the Proposed Development.

7.3.39 Based on 2021 data published by the UK Government[23] (the latest available data at the time of writing), the Flintshire Local Authority area emits 0.48% of the total UK emissions (based upon Flintshire Local Authority emissions of 1,899 $ktCO_2e$ and national emissions of 399,046 $ktCO_2e$). The Flintshire Local Authority area carbon budget has therefore been based upon 0.48% of the national Carbon Budget and displayed in **Table 7.12**.

Table 7.12 UK and Flintshire Local Authority area carbon budgets

[23] https://www.gov.uk/government/collections/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics

Carbon budget	Carbon budget level ($MMtCO_2e$)	Flintshire LA area proportional emissions budget ($ktCO_2e$)
1st (2008 – 12)	3,018	14,361
2nd (2013 – 17)	2,782	13,238
3rd (2018 – 22)	2,544	12,106
4th (2023 – 27)	1,950	9,279
5th (2028 – 32)	1,725	8,209
6th (2033 – 37)	965	4,592

7.4 Baseline conditions

Sensitive receptors

7.4.1 The sensitive receptor for GHG emissions is the global climate, which is considered highly sensitive to GHG fluctuations.

Current baseline

7.4.2 The current baseline conditions of the Site include the existing GHG emissions, prior to the construction and operation of the Proposed Development. Only those emissions sources that are likely to change between the existing operational cement works and the Proposed Development have been assessed, and these are displayed in **Table 7.13**.

7.4.3 The principal source of CO_2e is from clinker production, and is estimated to emit 442.7 $ktCO_2e$ per year. Other significant sources of CO_2e emissions include fuel consumption for energy, such as the combustion of coal and solid recovered fuels. The total annual emissions from clinker production and fuel consumption of the existing cement works is 650.1 $ktCO_2e$ per year, approximately one third of the total greenhouse gas emissions for all of Flintshire reported in 2021 (1,899 $ktCO_2e$).

Table 7.13 Annual emissions from the existing operational cement works that are likely to change with the Proposed Development

Life Cycle Module	Description	Annual emissions ($ktCO_2e$)	Proportion of total operation emissions
B1	Use (clinker production)	442.7	68%
B6 Energy Use	Coal	80.0	12%
	Solid Recovered Fuels	127.4	20%
Total		**650.1**	
	Reportable emissions (outside of scopes) – biomass	68.6	

Note: this does not include indirect fuel and energy-related emissions (outside of scopes 1 and 2).

Future baseline

7.4.4 The future baseline is a 'business as usual' scenario whereby the Proposed Development is not implemented. Annual emissions from the Site would be expected to remain at similar levels in the absence of the Proposed Development. A large majority of emissions are from the production of cement, and assuming no changes to the process of cement manufacture in the coming years or changes to volume of cement produced, this will remain consistent year-on-year.

Table 7.14 Anticipated emissions from the existing operational cement works over the next 25 years (those emissions sources that are likely to change with the Proposed Development)

Life Cycle Module	Description	Total emissions over 25 years ($ktCO_2e$)	Proportion of total operation emissions
B1	Use (clinker production)	11,069	68%
B6 Energy Use	Coal	1,999	12%
	Solid Recovered Fuels	3,184	20%
Total		**16,251**	
	Reportable emissions (outside of scopes) – biomass	*1,714*	

Note: this does not include indirect fuel and energy-related emissions (outside of scopes 1 and 2).

7.5 Relevant legislation and planning policy

7.5.1 The following legislation and planning policy have been used during the preparation of this assessment:

- The Paris Agreement, 2015[24]
- The Climate Change Act, 2008 (amended 2019)[25]
- The Climate Change Committee Carbon Budgets[26]
- UK Net Zero Strategy: Build Back Greener, 2021[27].
- Environment (Wales) Act, 2016[28]
- Welsh Wellbeing of Future Generations Act 2015[29]

[24] https://unfccc.int/sites/default/files/english_paris_agreement.pdf

[25] https://www.legislation.gov.uk/ukdsi/2019/9780111187654

[26] https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

[27] https://assets.publishing.service.gov.uk/media/6194dfa4d3bf7f0555071b1b/net-zero-strategy-beis.pdf

[28] https://www.legislation.gov.uk/anaw/2016/3/contents/enacted

[29] https://www.legislation.gov.uk/anaw/2015/2/contents

- Planning Policy Wales, 2024[30]
- Future Wales: the national plan 2040, 2021[31]
- Flintshire County Council Climate Change Strategy 2022 – 2030[32]

7.6 Assessment of potential effects and additional mitigation

7.6.1 In this section the GHG impacts are assessed for each phase of the Proposed Development (construction, operation and decommissioning). It is important to understand the impacts at each phase and identify hotspots to facilitate mitigation efforts. However, the net impact of the Proposed Development must be considered across the entire lifecycle of the project due to the long-term and cumulative nature of GHG emissions across the lifetime of the Proposed Development. Therefore, the net impact of the Proposed Development is assessed, considering the benefit of the CCS process.

Construction phase

7.6.2 Within this section, the GHG emissions arising from construction of the Proposed Development are identified and assessed within each applicable lifecycle stage (**Table 7.15**).

Table 7.15 Estimated GHG emissions for site construction (2025 – 2028)

Life Cycle Module	Description	Total emissions (tCO_2e)	% of total construction GHG
A1 – A3	Embodied carbon of construction materials	65,167	85
A4	Transport of materials to project	2,554	3
A5	Construction phase emissions including commuting, fuel and waste	8,543	11
Total construction emissions		**76,265**	**100%**

Significance

7.6.3 Total emissions of 76,265 tCO_2e from the construction phase comprise 0.004% of the UK's national carbon budget, and 0.82% of the Flintshire Local Authority area's proportioned emissions budget. Given emissions should be considered cumulatively across the entire life cycle of the Proposed Development (IEMA, 2022), and

[30] https://www.gov.wales/sites/default/files/publications/2024-02/planning-policy-wales-edition-12_1.pdf
[31] https://www.gov.wales/future-wales-national-plan-2040-0
[32] https://www.flintshire.gov.uk/en/PDFFiles/Climate-Change/Climate-Change-Strategy-2022-2030.pdf

considering these emissions relate solely the construction phase (and are not repeated year on year), these emissions constitute a minor adverse impact (not significant) on the climate. Furthermore, these activities facilitate the emissions savings that are achieved in the operational phase.

Additional Mitigation

7.6.4 It is unavoidable that the construction of new developments results in GHG emissions. This is mainly due to the embodied energy associated with resources and materials used and the energy required for light, heat and power for construction plant and equipment. The appropriate selection of raw materials alongside careful and conservative consumption of energy should be the priority to mitigate against excessive GHG emissions.

7.6.5 An Outline Construction Environmental Management Plan (OCEMP) (as provided in **Volume 4, Technical Appendix 2.1**) has been developed and submitted for consideration alongside this draft Environmental Statement to contain standard environmental protection measures. A number of measures are recommended to mitigate GHG emissions as part of the design and construction process, as listed below:

- Reviewing design proposals with the view of implementing the carbon hierarchy:
  - Build nothing – challenge the root cause of the need; explore alternative approaches to achieve the desired outcome;
  - Build less – maximise the use of existing assets; optimise asset operation and management to reduce the extent of new construction required;
  - Build clever – design in the use of low carbon materials; streamline delivery processes; minimise resource consumption; and
  - Build efficiently – embrace new construction technologies; eliminate waste.
- Maximise the specification of materials with an environmental product declaration with the aim of reducing embodied carbon emissions;
- Where technical specifications allow, maximise the recycled content of construction materials such as concrete and steel;
- The use of locally sourced and/or produced materials. Where wood is to be integrated within the design, source from certified managed/sustainable forests (FSC/UKWAS or similar). The use of recycled aggregates, where appropriate, for foundations, subbases, hard-standings and pavement materials;
- Actions to meet the waste hierarchy in accordance with the principles of the Government's Resources and Waste Strategy 2018[33]. Promoting the recycling of materials by segregating construction waste to be re-used and recycled where reasonably practical;
- Implement measures to decrease fuel use by maximising energy efficiencies, for example to ensure all vehicles switch off engines when stationary and

[33] https://www.gov.uk/government/publications/resources-and-waste-strategy-for-england

ensure construction vehicles are well maintained and conform to current emissions standards;

- Welfare facilities to be connected to mains electricity to restrict use of on-site diesel generators, except for short term supplies. Where possible, a proportion of imported energy to be sourced from renewable energy sources;
- Promoting the use of sustainable fuels in construction vehicles, where possible make use of electric vehicles to reduce fuel consumption;
- On-site mobile and non-mobile plant should conform to the latest emissions standards, with mobile vehicles conforming to EURO 6 standards as a minimum. All plant should investigate the option of using HVO fuels or electric versions where possible; and
- Liaising with construction staff to minimise GHG emissions associated with commute to Site, including provision of staff minibuses, and promoting of lower carbon modes of travel such as car sharing options and use of public transport.

7.6.6 Considering the construction phase only, there are residual emissions after mitigation is considered, but the project is compatible with the goals of the Paris Agreement (see **Paragraph 7.1.4**), complying with up-to-date policy and good practice.

Operation

7.6.7 Within this section, the GHG emissions arising from the operation of the Proposed Development are identified and assessed. **Table 7.16** details the residual emissions that are not captured by the Carbon Capture Plant. Note the change in units from tCO_2e to $ktCO_2e$ for the operation of the Proposed Development. The WTT emissions from the coal and SRF have been omitted as these would be the same for the future baseline and for the Proposed Development.

7.6.8 To estimate total lifecycle emissions, clinker production is assumed to remain constant and the annual emissions have been multiplied by the assumed operational lifespan of the Proposed Development (at least 25 years). The capture rate has been assumed at 92.2% throughout the whole life of the Carbon Capture Plant.

Table 7.16 Estimated annual residual GHG emissions for operation of Proposed Development (2028 – 2053)

Life Cycle Module	Description	Annual emissions ($ktCO_2e$)	Total emissions over 25 years ($ktCO_2e$)	Proportion of total operation emissions
B1 – Use	Clinker production	34.5	863	41%
B6 – Energy consumption	Coal	6.2	156	7%
	Solid Recovered Fuels	9.9	248	12%
	Natural gas	10.9	273	13%
	Natural gas WTT	23.1	578	27%

Life Cycle Module	Description	Annual emissions ($ktCO_2e$)	Total emissions over 25 years ($ktCO_2e$)	Proportion of total operation emissions
B8: Other operational processes	Embodied carbon of solvent and chemicals used for carbon capture	0.24	6	<1%
Total		**85.0**	**2,124**	
	Reportable emissions-biomass	5.3	134	
Annual operation emissions (incl. biomass)		**90.3**	**2,258**	

7.6.9 **Table 7.17** details the net effect of the operation of the Proposed Development, compared to those emissions expected from the future baseline.

Table 7.17 Estimated net emissions from the operation of the Proposed Development

Life Cycle Module	Description	Future baseline ($ktCO_2e$)	Proposed Development ($ktCO_2e$)	Net emissions from Proposed Development
B1 – Use	Clinker production	11,069	863	-10,205
B6 – Energy consumption	Coal	1,999	156	-1,843
	Solid Recovered Fuels	3,184	248	-2,936
	Natural gas	0	273	273
	Natural gas WTT	0	578	578
B8: Other operational processes	Embodied carbon of solvent and chemicals used for carbon capture	0	6	6
Total		**16,251**	**2,124**	**-14,127**
Outside of scopes	*Reportable emissions-biomass*	1,714	134	-1,581
Total operation emissions (incl. biomass)				**-15,708**

Significance

7.6.10 Annually, the operation of the Proposed Development would lead to GHG savings of 565 $ktCO_2e$, which represents a reduction of 8% of annual UK emissions from the manufacture of cement (annual emissions of 6,915.5 $ktCO_2e$ based upon 2020 data).

7.6.11 The Proposed Development causes GHG emissions to be avoided compared to the future baseline, substantially exceeding the goals of the Paris Agreement with a positive climate impact. It therefore has a significant beneficial effect.

Mitigation

7.6.12 The GHG emissions from the operation of the Proposed Development result in a decrease in GHG emissions of approximately 576 $ktCO_2e$ per annum against the future baseline scenario, approximately 30% of all of Flintshire's emissions reported for 2021. Therefore, no additional mitigation or monitoring is required.

Decommissioning (2053)

7.6.13 Within this section, the GHG emissions arising from decommissioning of the Proposed Development are identified, aligned with standard practice for Life Cycle Assessments. These emissions are subject to a very high level of uncertainty, as the decommissioning conditions cannot be predicted ~25 years into the future with any confidence (including the lack of knowledge as to whether the plant would actually be decommissioned at that time or remain operational).

Table 7.18 Estimated GHG emissions for site decommissioning (2053)

Description	Total emissions (tCO_2e)	Proportion of total decommissioning emissions
End of life (C1-4)	7,477	100.0%

Significance

Total emissions of 7,477 tCO_2e from the decommissioning phase (estimated 2053) do not fall within a specified and quantified carbon budget (**Table 7.12)** however, it can be assumed that carbon budgets for 2053 would be much smaller than they are currently. The estimated decommissioning emissions presented here are very conservative, given the direction towards net zero carbon in construction for 2050[34], and are an order of magnitude smaller than those predicted for construction. Therefore, whilst emissions should be considered cumulatively across the entire life cycle of the Proposed Development (IEMA, 2022), considering solely the decommissioning phase, these emissions are likely to constitute a negligible adverse impact on the climate. There are minimal residual emissions, but the project is

[34] https://assets.publishing.service.gov.uk/media/631222898fa8f54234c6a508/20220901-Carbon-Net-Zero-Guidance-Note.pdf

compatible with the goals of the Paris Agreement, complying with up-to-date policy and good practice.

Mitigation

7.6.14 GHG emissions from decommissioning can be mitigated using similar principles to those in construction, as detailed below:

- Actions to meet the waste hierarchy in accordance with the principles of the Welsh government's Towards Zero Waste policy[35]. Promoting the recycling of materials by segregating construction waste to be re-used and recycled where reasonably practical;
- Implement measures to decrease fuel use by maximising energy efficiencies, for example to ensure all vehicles switch off engines when stationary and ensure construction vehicles are well maintained and conform to current emissions standards;
- Welfare facilities to be connected to mains electricity to restrict use of on-site diesel generators, except for short term supplies. Where possible, a proportion of imported energy to be sourced from renewable energy sources;
- Promoting the use of sustainable fuels in construction vehicles, where possible make use of electric vehicles to reduce fuel consumption;
- On-site mobile and non-mobile plant should conform to the latest emissions standards, with mobile vehicles conforming to EURO 6 standards as a minimum. All plant should investigate the option of using HVO fuels or electric versions where possible; and
- Liaising with construction staff to minimise GHG emissions associated with commute to Site, including provision of staff minibuses, and promoting of lower carbon modes of travel such as car sharing options and use of public transport.

Net effect of the Proposed Development (assessment against future baseline)

7.6.15 As shown in **Table 7.19**, the estimated lifecycle emissions from the construction, operation and decommissioning of the Proposed Development, assessed over 25 years, are 2,124 $ktCO_2e$. Compared against the lifetime emissions of the existing operational cement works assessed over 25 years of 16,251 $ktCO_2e$, and including emissions from biomass[36], these equate to a net decrease of 15,624 $ktCO_2e$.

Table 7.19 Net lifecycle emissions from the Proposed Development during construction, operation and end-of-life

[35] https://www.gov.wales/sites/default/files/publications/2019-05/towards-zero-waste-our-waste-strategy.pdf

[36] The combustion of biomass is considered an 'out of scopes' emission source by the GHG Protocol, as the emissions do not come from a fossil carbon source. However, they are reported on in **Table 7.18**, as the carbon from the biomass will be captured as part of the CCS process, and thus contribute to overall GHG emissions savings.

Life Cycle Module	Description	GHG emissions over the project lifetime (2028 – 2053) ($ktCO_2e$)		
		Future Baseline	Proposed Development	Net emissions from Proposed Development
A1-3	Embodied carbon of construction materials	0	65.2	65.2
A4	Transport of materials to project	0	2.6	2.6
A5	Construction phase emissions including commuting, fuel and waste	0	8.5	8.5
Construction total		**0**	**76.3**	**76.3**
B1	Clinker production	11,069	863	-10,205
B6	Coal	1,999	156	-1,843
	Solid Recovered Fuels	3,184	248	-2,936
	Natural gas	0	273	273
	Natural gas WTT	0	578	578
B8	Embodied carbon of solvent and chemicals used for carbon capture	0	6	6
Operation total		**16,251**	**2,124**	**-14,127**
C1-4	End of life	0	7.5	7.5
End of life total		**0**	**7.5**	**7.5**
Lifecycle total		**16,251**	**2,208**	**-14,044**
Outside of scopes	*Reportable emissions-biomass*	*1,714*	*134*	*-1,581*
Total lifecycle emissions (incl. biomass)				**-15,624**

7.6.16 **Table 7.20** displays these emissions in the context of the UK national, and Flintshire Local Authority proportioned[37], carbon budgets. The construction period falls within the 4th carbon budget period, with operation in the 5th and 6th carbon budget periods.

[37] Based on 2021 data published by the UK Government (the latest available data at the time of writing), the Flintshire Local Authority area emits 0.48% of the total UK emissions (based upon Flintshire Local Authority emissions of 1,899 $ktCO_2e$ and national emissions of 399,046 $ktCO_2e$). The Flintshire Local Authority area carbon budget has therefore been based upon 0.48% of the national Carbon Budget.

The construction emissions comprise 0.0004% of the national carbon budget for this period, and 0.8% of those proportioned for the Flintshire Local Authority area. The GHG emissions savings from operation of the Proposed Development comprise 0.18% and 0.33% of the 5th and 6th national carbon budgets respectively. Although these values are low, considering the national scope of the carbon budgets, they still represent an important contribution to carbon savings nationally. On a local level, the emissions savings represent 38% and 68% of the Flintshire Local Authority proportioned carbon budgets, which is a sizeable contribution to carbon savings in the local area.

7.6.17 In summary, the lifecycle of the Proposed Development results in a significant beneficial impact on the climate.

Table 7.20 Project emissions in the context of UK carbon budgets

Carbon budget	National carbon budget level ($MMtCO_2e$)	Flintshire LA area proportional emissions budget ($ktCO_2e$)	Project emissions ($ktCO_2e$)	% of national carbon budget	% of Flintshire LA area
1st (2008 – 12)	3,018	14,361			
2nd (2013 – 17)	2,782	13,238			
3rd (2018 – 22)	2,544	12,106			
4th (2023 – 27)	1,950	9,279	76	0.004%	0.8%
5th (2028 – 32)	1,725	8,209	-3,142	-0.18%	-38.3%
6th (2033 – 37)	965	4,592	-3,142	-0.33%	-68.4%

7.7 Opportunities for environmental enhancement

7.7.1 From a GHG emissions perspective, the very nature of the Proposed Development offers an enhancement to the original environment. Reducing carbon dioxide emissions from the cement manufacture process is the primary purpose of the Proposed Development.

7.8 Difficulties and uncertainties

7.8.1 The accuracy of a GHG assessment depends on the quality of the data provided. Primary data should always be used where available; however, the fact that this assessment represents a forecast of emissions from a future scenario means that all data is extrapolated, estimated or benchmarked. Assessments such as this, based

largely on secondary data, should only be viewed as an estimate of GHG emissions impact, and actual lifecycle emissions may vary.

7.8.2 To mitigate against this, a conservative approach has been adopted, whereby the most reasonable worst-case scenario has been assumed.

7.9 Assessment summary

7.9.1 **Table 7.21** provides a summary of the findings of the assessment.

Table 7.21 Summary of GHG effects

Receptor	Potential Effects	Additional (Secondary and Tertiary) Mitigation	Residual Effects	Monitoring
Construction Phase				
Contribution to global warming and climate change impacting on natural and human systems	GHG emissions generated through construction phase of the Proposed Development (76.3 $ktCO_2e$).	Design and construction mitigation measures incorporating the carbon reduction hierarchy and good low-carbon practice.	Construction emissions equate to 0.004% of the national carbon budget for 2023-2027 (and 0.8% of those proportioned to Flintshire Local Authority area) (**Table 7.11**) **Minor adverse (not significant)** **P / D / LT**	There are no proposed monitoring arrangements for the residual effects of the construction phase.
Operational Phase				
Contribution to global warming and climate change impacting on natural and human systems	GHG emissions savings through operation of the Proposed Development (15,624 $ktCO_2e$). The annual emissions savings is projected to be 565 $ktCO_2e$, approximately equivalent to 34% of Flintshire Local Authority area's proportional emissions reported in 2021, and represents an 8% reduction	No additional mitigation required.	**Beneficial (significant)** **P / D / LT**	GHG emissions will be monitored as part of the UK Emissions Trading System reporting requirements. No further climate impact monitoring will be undertaken.

Receptor	Potential Effects	Additional (Secondary and Tertiary) Mitigation	Residual Effects	Monitoring
	in annual UK emissions from the manufacture of cement (based upon 2020 data).			
Decommissioning Phase				
Contribution to global warming and climate change impacting on natural and human systems	GHG emissions generated through decommissioning phase of the Proposed Development (7.5 $ktCO_2e$)	Decommissioning mitigation measures incorporating the carbon reduction hierarchy.	The UK carbon budget has not been published for the year of decommissioning; however, the emissions are expected to be negligible compared to the national and Flintshire Local Authority area's proportional emissions budget. **Negligible adverse (not significant)** **P / D / LT**	There are no proposed monitoring arrangements for the residual effects of the decommissioning phase.

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

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