Industrie Cartarie Tronchetti

CUNDALL

Industrie Cartarie Tronchetti (ICT) UK Limited & Grag Hill Estates Ltd (CHEL)

Paper Mill Facility, Plot C, Airfields, Northern Gateway

Environmental Statement
Part 2 – Air Quality, Odour & Dust Technical Paper 8

Revision P04 24 November 2021

Revision Record

Revision Reference	Date of Revision	Nature of Revision	Author	Checked By
P01	20th September 2021	Issue	J. Carrington	G. Hodgkiss
P02	26th October 2021	NRW consultation comments addressed	J. Carrington	G. Hodgkiss
P03	28th October 2021	Spawforths comments addressed	J. Carrington	G. Hodgkiss
P04	24th November 2021	To include combustion plant only results for increased height of main stack, to inform permit application.	J. Carrington	G. Hodgkiss

Report Author	Jenny Carrington
Report Date	23rd November 2021
Project No.	1022988
Document Ref.	P04
Revision	Final Issue P04

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1. Introduction

1.1. This Technical Paper has been prepared by Cundall on behalf of Industrie Cartarie Tronchetti (ICT) UK Limited and Crag Hill Estates Ltd (CHEL).

1.2. The Paper describes the baseline conditions at the Application Site and surroundings; the assessment methodology; the anticipated significant environmental effects associated with construction and operational phases; and the outline mitigation measures required to prevent, reduce, or offset any significant adverse effects.

1.3. Any development proposal involving significant changes in the nature and location of emissions to air has the potential to impact on local air quality. Any changes to traffic volumes, speed and composition, and/or installation of new industrial and/or combustion plant, have the potential to impact emissions to air, and thus ambient air quality, at nearby receptors. There is also the potential for odour nuisance with odourous processes taking place on-site and in the wide surrounding area.

1.4. This assessment included the determination of:

- the air quality assessment study area;
- the existing baseline conditions and constraints;
- and the effects on local air quality emissions, dust and odour nuisance during the construction and operation phase on sensitive human and ecological receptors.

1.5. The air quality assessment has focused on the impacts of the following air pollutants

- Nitrogen dioxide (NO_2);
- Oxides of Nitrogen (NO_x);
- Particulate Matter of aerodynamic diameter ≤10µm (PM_{10});
- Particulate Matter of aerodynamic diameter ≤2.5µm ($PM_{2.5}$);
- Dust (as deposited dust); and
- Odour nuisance

1.6. The effects are assessed in the context of relevant national, regional and local air quality legislation, polices and guidance.

1.7. Where the potential for impacts is identified, mitigation measures are proposed, as required, in order to reduce the effect of the Proposed Development to negligible, as far as reasonably practicable.

1.8. In order to assess the potential impacts associated with the ICT Paper Mill Facility Application Proposals, it is necessary to consider the wider Outline proposals on the Airfields (former RAF Sealand) (Northern Gateway) Site and the remaining part of the Former Corus Garden City Site (Northern Gateway) site, which the Council have already resolved to grant Outline Planning Permission. The two developments will be constructed and begin operations within a similar timeframe, and therefore the incremental changes due to the ICT Proposed Development and the overall development (including the above proposals) are presented here. Other cumulative impacts are also addressed under the Cumulative Effects section.

1.9. This Technical Paper is supported by the Appendices provided in Section 13.

2. Documents Consulted

Key Legislation

2.1. This report has considered the following key air quality legislation, summarised in Table 8.1.

Legislation	Description
EU Ambient Air Quality Directive 2008/50/EC[2]	Establishes the requirements of Member States in terms of improvements required to air quality. Sets standards for a variety of pollutants for human-health and the environment.
The Air Quality Standards Regulations 2010[3]	Transposes formalised EU Limit Values set out in directive 2008/50/EC to UK law.
The Clean Air Quality Strategy 2019	The Clean Air Strategy sets out the case for action and demonstrates the government's determination to improve air quality. In some cases, the goals are even more ambitious than EU requirements to reduce people's exposure to toxic pollutants like nitrogen oxides, ammonia, particulate matter, non-methane volatile organic compounds and sulphur dioxide.
Environment Act 1995, Part IV[4]	Defines the requirements for Local Air Quality Management (LAQM).
Environment Protection Act 1990, Amended by the Pollution Prevention and Control Act 1999[5]	Part III provides statutory nuisance provisions for nuisance dust. Nuisance complaints about dust would need to be investigated by the Local Authority. In practice, dust deposition is generally managed appropriately by suitable on-site practices and mitigation, avoiding the determination of statutory nuisance and/or prosecution or enforcement notices.

Table 8.1: Legislation

2.2. The air quality EU limit values and UK Air Quality Objectives (AQOs) which apply to this assessment are shown in Table 8.2. Some pollutants have long-term (annual mean) objectives due to the chronic way they affect human health or the natural environment and others have short-term (1-hour, 24-hour mean) objectives due to the acute way they affect human health of the natural environment.

2.3. Previous research carried out on behalf of Defra identified that exceedances of the NO_2 1-hour mean are unlikely to occur where the annual mean is below 60 µg/m^3. This assumption

[2] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
[3] HMSO (2010). Statutory Instrument 2010 No. 1001, The Air Quality Standards Regulations 2010, London: HMSO
[4] Environment Act 1995, Chapter 25, Part IV Air Quality
[5] Environmental Protection Act 1990, Chapter 43, Part III Statutory Nuisances and Clean Air https://www.legislation.gov.uk/ukpga/1990/43/part/III

is still considered valid; therefore, Defra's Technical Guidance document, LAQM.TG(16)[6] confirms that this figure can be referenced where 1-hour mean monitoring data are not available (typically if monitoring NO_2 using passive diffusion tubes).

Pollutant	Averaging Period	Objective Threshold / EU Limit Value (µg/m³)
Nitrogen Dioxide (NO_2)	Annual mean	40
	1-hour mean	200 Not to be exceeded more than 18 times per year (equivalent to the 99.79th percentile of 1-hour mean values)
Particulate Matter (PM_{10})	Annual mean	40
	24-hour mean	50 Not to be exceeded more than 35 times per year (equivalent to the 90.4th percentile of 24-hour mean values)
Particulate Matter ($PM_{2.5}$)	Annual mean	25

Table 8.2: UK Air Quality Objectives (AQOs)

2.4. The air quality standards for the protection of vegetation used in the study are derived from the Air Quality Standards (Wales) Regulations 2010. These are set out in Table 8.3.

Pollutant	Averaging period	Air Quality Standard
NOx	Annual mean	30 µg/m³

Table 8.3: UK Air Quality Standards for the Protection of Vegetation

Dust Nuisance

2.5. Dust is the generic term to describe particulate matter in the size range 1–75µm in diameter, as defined in British Standard document BS 6069 (Part Two). Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Under provisions in the Environmental Protection Act 1990[7], dust nuisance is defined as a statutory nuisance

2.6. There are currently no standards or guidelines for dust nuisance in the UK. Complaints about excessive dust deposition would have to be investigated by the local authority and any complaint upheld for a statutory nuisance to occur. In practice, dust deposition if generally

[6] Defra (2021) Local Air Quality Management Technical Guidance TG(16) April 2021 https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf
[7] Environmental Protection Act 1990, Chapter 43, Part III Statutory Nuisances and Clean Air

managed effectively by the use of suitable on-site practices and mitigation during activities with the potential to generate dust, such as demolition and construction activities.

Odour Nuisance

2.7. Odour is a mix of volatile chemical compounds or single compounds that trigger an olfactory reaction, generally at very low concentrations. Any odour, whether pleasant or unpleasant, can result in a loss of amenity. Odour can be considered a statutory nuisance if it is perceived sufficiently often enough above a threshold level.

2.8. Odour can be an important issue in planning, should proposals be submitted for a potentially odourous development near to sensitive receptors, or conversely, proposals for a sensitive development near but to a potentially odourous source. There is no statutory limit in the UK for ambient odour concentrations, for either single or a mix of compounds. Guidance limits and custom standards have been used in some circumstances to advise on planning decisions.

Planning Policy and Guidance

2.9. Consideration of the strategic location and design of new developments is of key importance in the land-use planning process and can provide a means of improving air quality. Air quality considerations as part of development applications may become material in determining planning applications. Relevant planning policy and guidance at the national, regional and local levels considered as part of the Air Quality, Odour and Dust assessment are summarised in Tables 8.4, 8.5 and 8.6.

Policy / Guidance	Description
Clean Air Strategy (2019)[8]	Defra published a Clean Air Strategy in January 2019, setting out a wide range of actions for UK Government to reduce pollutant emissions and improve air quality. The actions are grouped into four main emission sources: Transport, Domestic, Farming and Industry
UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations. Detailed Plan. Defra / Department of Transport (DfT) (2017)[9]	Produced in response to a UK Supreme Court Ruling, the plan sets out how the UK will achieve compliance with EU Limit Values for nitrogen dioxide (NO_2) in the shortest possible time. The plan outlined infrastructure initiatives and grants and the requirements for Local Authorities to produce local action plans, with the aim of reducing NO_2 concentrations below the objective as soon as practically possible.
Environment Agency (EA) H4 Horizontal Guidance[10]	The guidance sets a range of odour criteria and benchmark levels to assess the offensiveness of odours at the boundary of the site.
Industrial Emissions Directive (2010)[11]	The EU's Industrial Emissions Directive (IED) takes an integrated approach to controlling pollution to air, water and land, and sets challenging industry standards for the most polluting industries. The IED aims to prevent and reduce harmful industrial emissions, while promoting the use of techniques that reduce pollutant emissions and that are energy and resource efficient. The UK EU Withdrawal Act 2018 maintains established environmental principles and ensures that existing EU environmental law will continue to have effect in UK law, including the IED and BAT Conclusion Implementing Decision made under it.

Table 8.4: National Policy and Guidance

[8] Department for Environment, Food and Rural Affairs (2019) Clean Air Strategy 2019 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

[9] Department for Environment, Food and Rural Affairs / Department for Transport (2017) UK plan for tackling roadside nitrogen dioxide concentrations, July 2017 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633269/air-quality-plan-overview.pdf

[10] Environment Agency (2011), H4 Odour Management

[11] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010,

Policy / Guidance	Description
Planning Policy Wales[12]	Planning Policy Wales (PPW) was originally published by the Welsh Government in 2002 and sets the context for planning in Wales, under which Local Planning Authorities prepare their statutory Development Plans. It is the principal and authoritative source of national planning policy. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars and policy clarification letters. Updates to national planning policy are issued for consultation and then incorporated into the latest version of PPW. Planning Policy Wales (Edition 11) is the latest version of PPW, issued in February 2021 Air Quality is mentioned several times throughout the document and in particular in section 6.7 Air Quality and Soundscape, which outlines a framework for addressing air quality, including the following items for consideration during the panning phase. "6.76 - *In proposing new development, planning authorities and developers must, therefore:* *• address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;* *• not create areas of poor air quality or inappropriate soundscape; and* *• seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes"* "6.78 - *Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose, and could include those related to:* *• traffic management and road safety;* *• ensuring progress towards a shift to low or zero emissions means of road transport, such as electrical charging points;* *• supporting low or zero emissions public transport;* *• providing active travel infrastructure; and* *• incorporating green infrastructure, where it can improve air quality by removing air pollution and aiding its dispersal, reduce real or perceived noise levels by absorbing and scattering noise and introducing natural sounds to soften man-made noise, provide areas of relative tranquility, and reduce exposure by putting a buffer between sources of pollution and receptors".*
Future Wales: The National Plan 2040[13]	The National Plan 2040 is Wales' national development framework, which sets the direction for development in Wales to 2040. Future Wales is a spatial plan, which means it sets a direction for where we should be investing in infrastructure and development for the greater good of Wales and its people. It refers to Planning Policy Wales which contains the planning policy framework for addressing air quality.
Planning Policy Wales Technical Note (TAN) 18: Transport[14]	"2.1.2 …*when preparing development plans and considering planning applications, planning authorities should take into account statutory air quality objectives, together with the results of air quality reviews and assessments and any Air Quality Management Area Action Plans that may have been prepared.*"

[12] Welsh Government (2021) Planning Policy Wales, Edition 11, February 2021, https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf
[13] Welsh Government (2021) Future Wales: The National Plan 2040, 24th February 2021, https://gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf
[14] Welsh Assembly Government (2007) Planning Policy Wales, Technical Advice Note, 18: TRANSPORT, March 2007, https://gov.wales/sites/default/files/publications/2018-09/tan18-transport.pdf

Policy / Guidance	Description
Flintshire Unitary Development Plan (FUDP)[15]	Planning in Wales is based on a Plan – led system whereby development plans are prepared by each local planning authority in order to provide for the economic, social and environmental needs of the County. Development plans contain a framework of policies and proposals which seek to regulate and control the development and use of land, and to provide the basis for consistent and transparent decision making on individual planning applications The Flintshire Unitary Development Plan (FUDP) is the adopted development plan for the period 2000-2015. Although the plan became time expired in 2015, it remains the adopted development plan for the County. The aim of the FUDP is to provide a framework for marking rational and consistent decisions on planning applications and to guide development to appropriate locations. Policy EWP 12 Pollution states that: "*new development which would create an additional risk of pollution or hazard will be permitted only where:* *a) it would not create or increase risk to the general public outside the boundaries of the site; and* *b) it would not impose significant restrictions on the use or development of surrounding land."* *"19.55 …to ensure that the planning and pollution control regimes are implemented in a complementary fashion, the Council will pay regard to the expert advice of the Environment Agency, which, in addition to the Council, has particular responsibility for enforcement of standards of pollution control. In considering the acceptability of a proposal the Council will, where appropriate, require the submission of an environmental statement*."
Flintshire Local Development Plan 2015-2030[16]	The submission version of the emerging Local Development Plan is now subject of an independent examination by a Government appointed Inspector. The expectation is that this plan will be adopted in 2022. The following strategic policy from the submission version is of relevance to air quality: Strategic Policy STR 14 – Climate Change and Environmental Protection *The Council will seek to mitigate the effects of climate change and ensure appropriate environmental protection in the County through:* *i. Ensuring new development is sustainably located and designed so as to reduce the need for travel by private car;…..* *vi. Ensuring that new development has regard to the protection of the environment in terms of air, noise and light pollution, unstable and contaminated land and former landfill sites*;

Table 8.5: Regional and Local Policy and Guidance

[15] Flintshire County Council, https://www.flintshire.gov.uk/en/Resident/Planning/Development-plans--policies.aspx
[16] Flintshire County Council (2017) Flintshire Local Development Plan 2015-2030, Preferred Strategy Consultation Document, Preferred Strategy Main Document, November 2017, https://www.flintshire.gov.uk/en/PDFFiles/Planning/Key-Stage-Documents-Policy/LDP-KSD-PS1-Preferred-Strategy.pdf

Policy / Guidance	Description
Other Relevant Policy and Guidance	
Defra Local Air Quality Management (LAQM) Policy Guidance (2016)[17] and Technical Guidance (2021)[6]	The guidance issued under Part IV of the Environment Act 1995 is designed to help local authorities with their LAQM duties. The guidance sets out the general approach to use and detailed technical guidance to guide local authorities through the Review and Assessment process.
Defra Odour Guidance for Local Authorities[18]	The guidance notes that 5ou$_E$/m^3 would be a 'faint' odour whilst 10ou$_E$/m^3 would be considered a 'distinct' odour. Generally, an average person would be able to recognise the source of an odour at about 3ou$_E$/m^3 although this can depend on the relative offensiveness of the odour
EPUK/IAQM Land Use Planning & Development Control (2017)[19]	This guidance has been produced to ensure that air quality is adequately considered in the land use planning and development control processes by relevant officers within local authorities, developers, and consultants involved in the preparation of development proposals and planning applications. This document is best practice guidance and has no formal or legal status.
Environmental Protection UK (EPUK) / IAQM Assessment of Dust from Demolition and Construction (2016)[20]	The document provides guidance for developers, their consultants and environmental health practitioners on how to undertake a construction impact assessment (including demolition and earthworks). The guidance provides a method for assigning a magnitude of risk (high, medium or low) and identifies appropriate mitigation measures.
EPUK / IAQM Guidance on the assessment of odour for planning (2018)[21]	The guidance provides information on various assessment methods to be used to undertake odour assessments for planning, as well advice on determining the significance of a proposed facility based on sensitivity of nearby receptors and the odour impact.
Covid-19: Supplementary Guidance, Local Air Quality Management Reporting in 2021[22]	The guidance had been informed by responses from an impact survey received following the release of the interim statement on Covid-19 impacts to the LAQM regime. The guidance is to be read in conjunction with LAQM.TG16
IAQM (2019) A guide to the assessment of air quality impacts on designated nature conservation sites[23]	Provides guidance on the assessment of the air quality impacts of development on designated nature conservation sites, habitats and species
Environment Agency (2021) Air Emissions Risk Assessment for Your Environmental Permit[24]	How to complete an air emissions risk assessment, including how to calculate the impact of your emissions and the standards you must meet.

[17] Defra (2016) Local Air Quality Management Policy Guidance (PG16) https://laqm.defra.gov.uk/documents/LAQM-PG16-April-16-v1.pdf

[18] Defra, Odour Guidance for Local Authorities, March 2010, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/645286/pb13554-local-auth-guidance-100326.pdf

[19] Environmental Protection UK/IAQM (2017) Land-Use Planning & Development Control: Planning for Air Quality, January 2017 https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

[20] IAQM (2016) Guidance on the assessment of dust from demolition and construction, Version 1.1 http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf

[21] Institute of Air Quality Management (IAQM) (2018). Guidance on the assessment of odour for planning – version 1.1, www.iaqm.co.uk/text/guidance/ odour-guidance-2018

[22] Department for Environment, Food and Rural Affairs (Defra) / Greater London Authority (2021). Covid-19: Supplementary Guidance, Local Air Quality Management Reporting in 2021, April 2021, Version 1.0, https://laqm.defra.gov.uk/supporting-guidance.html

[23] Institute of Air Quality Management (IAQM) A guide to the assessment of the air quality impacts on designated nature conservation sites, version 1.1, May 2020, https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf

[24] Environment Agency and Department for Environment, Food and Rural Affairs (Defra) (2021), Guidance – Air emissions risk assessment for your environmental permit, last updated 19th May 2021, https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

Policy / Guidance	Description
National Resources Wales, How to comply with your permit[25]	Guidance documents supplement Sector Guidance Notes, Technical Guidance Notes and Regulatory Guidance Notes for assistance with EPR Regulations

Table 8.6: Other Relevant Policy and Guidance

[25] Natural Resources Wales (2014) How to comply with your environmental permit, October 2014, https://naturalresources.wales/permits-and-permissions/environmental-permits/guidance-to-help-you-comply-with-your-environmental-permit/?lang=en

3. Consultations

3.1. In the case of this Application, we have not undertaken a detailed Screening or Scoping Opinion Request to the Council. On this basis, Spawforths has sought to confirm with the Council by letter the information to be provided in the Environmental Statement, in accordance with Part 4 (13) of the EIA Regulations, to ensure the scope of the technical chapters and the methodology for assessing the significance of effects is robust. To enable the Council to consider this, Spawforths enclosed the following plans and information:

- A Location Plan identifying "The Land";
- A description of the nature and purpose of the development, including a Character Area Plan;
- Topic/Technical Chapters of the ES based on the issues to be assessed;
- Methodology for the Assessment of Significant Effects in accordance with EIA Regulations;
- The cumulative impacts to be considered.

3.2. The Council subsequently confirmed that they accepted this approach and methodology including the range of environmental issues against which the proposals should be assessed as part of the Environmental Impact Assessment process; a copy of the Council letter confirming this is attached at Appendix 14 of the Part 1 Report of this ES.

3.3. Whilst a Scoping Opinion was not requested, consultation was undertaken with Flintshire County Council and NRW.

3.4. Environmental Health were consulted in 2019 regarding ICT proposals on an adjacent site which stalled. Environmental Health were also consulted again in July 2021, associated with this planning application and regarding additional scope for odour assessment.

3.5. Consultation relevant to air quality, odour and dust is summarized in Table 8.7.

Theme / Issue	Date	Consultee	Method	Summary of Discussion	Outcome / Output
Environmental Permitting	17-09-19	Natural Resources Wales (Permitting Regulation team)	Meeting	A pre-application meeting was held with RPS Group, ICT UK Ltd and NRW on the 17th September 2019 to discuss the scope and requirements of the Environmental Installation Permit, which included discussions regarding odour emissions emanating from the proposed waste water treatment plant on site.	NRW confirmed the proxy data is suitable for use to inform a H1 screening assessment of the proposed paper mill discharge to the River Dee.
Scope of Air Quality Assessment	October 2019	David Jones, Environmental Health Officer (Air Quality) at Flintshire County Council	Email / Telephone	The following scope of assessment was agreed: • Undertaking a screening assessment of road links supplied by the Transport Consultant using DMRB HA207/07 Methodology and emission factors obtained from Defra Emission Factor Toolkit V9.0, with sensitivity modelling undertaken using the Air Quality Consultants CURED emission factors; • Combined road traffic impacts for all three phases of the Proposed Development will be evaluated for the agreed scenario year; • Transport emission factors will be used for the relevant years being assessed; • The baseline air quality will be established for the Application Site using the Defra mapped background factors, with 2017 mapped background concentrations used for the model verification, baseline and opening years; • Undertaking a construction dust risk assessment following the latest IAQM Construction Dust guidance; we will assess the combined impacts from all three phases to assess worst-case construction phase impacts; • Examining impacts on human and ecological receptors, using the latest IAQM/EPUK guidance to assess significance; and • Where appropriate, recommending appropriate mitigation measures in line with IAQM/EPUK guidance and local policy.	Based on the information provided by ICT UK Ltd, it is understood that there are unlikely to be any odour emissions from the wastewater treatment plant. However, following concerns addressed during permit scoping discussions with NRW, odour will be assessed within the Technical Paper.

Theme / Issue	Date	Consultee	Method	Summary of Discussion	Outcome / Output
Updated Scope of Air Quality Assessment	July and August 2021	David Jones, Environmental Health Officer (Air Quality) at Flintshire County Council	Email and pre-app meeting	The following scope was proposed for agreement: • A review of legislation, national, regional and local policy and planning guidance related to air quality. • Examination of project plans, online maps and aerial photographs. • Baseline assessment of existing air quality in the area using findings the Local Authority review and assessment process and data available from the Defra Local Air Quality Management website. • Screening for the need for detailed assessment of operational impacts in accordance with note the land-use planning guidance published by Environmental Protection UK (EPUK)/Institute of Air Quality Management (IAQM). Where appropriate to the development proposals and based on public information readily available at the time, the screening assessment will consider: ○ road traffic emissions ○ combustion plant emissions ○ emergency generator emissions, ○ existing and possible future air quality concentrations at the development site and surrounding area. • Construction dust risk assessment following the latest Institute of Air Quality Management (IAQM) guidance; • Qualitative risk-based Source-Pathway-Receptor assessment for odour in accordance with IAQM guidance; • Where appropriate, recommending appropriate mitigation measures in line with IAQM/EPUK guidance and Local policy; and • Preparation of an air quality and odour technical report as part of the Environmental Statement.	Confirmation at the meeting that the scope appeared acceptable. David Jones was not present at the meeting.

Theme / Issue	Date	Consultee	Method	Summary of Discussion	Outcome / Output
Request for additional information regarding protected sites	October 2021	Tristan Williams, Development Planning Advisor, Natural Resources Wales	Letter	Request for further information regarding protected sites. With reference to air quality, the following comments were made: *"The plant ("cogeneration systems") will produce a total of 24 MW of on-site generated electricity. We have the following comments on the Environmental Statement Part 2 – Air Quality, Odour & Dust Technical Paper 8.* *Critical levels* *The Environmental Statement Part 2 – Air Quality, Odour & Dust Technical Paper 8 has assessed the effects of long-term NOx at ecological receptors, using the 30ug/l Air Quality Objective (AQO). The report concludes that the maximum change in air quality, relative to the Air Quality Objective, is at the River Dee and Bala Lake SAC, where the process contribution is 1% of the AQO. We agree that this would not be considered to be significant alone, however, in light of the Wealden judgement1, we advise that (even when the Process Contribution is less than 1%), consideration of other relevant projects may be required to ascertain whether there are possible in-combination effects. We advise that you liaise with the LPA regarding other relevant projects that should be considered in the in-combination assessment.* *Critical loads* *The Air Quality, Odour & Dust Technical Paper 8 does not include an assessment of any long-term effects of Nitrogen or acid deposition on ecological receptors. This should be provided to inform any HRA.* *The applicants should be aware of the Wealden ruling (link below):* *In light of the Wealden judgement, (CO/3943/2016 Wealden District Council v Secretary of State For Communities And Local Government, link:* *http://www.bailii.org/ew/cases/EWHC/Admin/2017/351.html), we advise that (even when the Process Contribution is less than 1%), consideration of other relevant projects may be required to ascertain whether there are possible in-combination effects".*	The impacts of the operation of the Application Site on relevant habitats and ecological designations has been assessed and screened out as insignificant. The modelled data at ecological receptor points is summarised in Table 8.68 and could be used, if still necessary, to assess the in-combination effects on European Habitats arising from the on-site combustion plant and emissions from the surrounding area. These results will be used to inform a Habitats Risk Assessment along with the emissions contributions from surrounding consented development, as yet to be agreed with Flintshire County Council.

Table 8.7: Summary of Consultations and Discussions

4. Methodology and Approach

4.1. An air quality assessment of the impacts of the local area's emissions on the Proposed Development itself has been undertaken in accordance with EPUK/IAQM guidance[19]. The assessment has evaluated the exposure that residents or users might experience, taking into account the following:

- The background and future baseline air quality, and whether this will be likely to approach, or exceed, the threshold values set by the air quality objectives;
- The presence and location of AQMAs as an indicator of local hotspots where the air quality objective thresholds may be exceeded;
- The presence of any heavily trafficked roads, with emissions that could give rise to significantly higher concentrations of pollutants (in particular NO_2), that would cause unacceptably high exposure for users of the new development; and
- The presence of sources of odour and/or dust that may affect amenity of future users of the Proposed Development.

4.2. The current/baseline conditions have been established qualitatively by reviewing relevant air quality information that is readily available from relevant local authorities, including Review and Assessment Reports and historic monitoring data. These data have been evaluated to understand current/baseline pollutant concentrations at receptors within the study area, and the risk that any changes in air quality may cause exceedances of AQOs at these locations.

4.3. The methodology of the assessment is detailed in full in Appendices 8.1 to 8.5.

Receptors

4.4. Receptors and their sensitivity to air quality, odour and dust are defined in Table 8.8.

Designation	Receptors
Very High	Residential care homes, schools and childcare settings (where highly sensitive receptors are likely to present for continuously extended time periods)
High	Residential sites Commercial sites of high sensitivity, including museums and long stay car parks or car showrooms (people or property would be expected to be present continuously for extended time periods)
Medium	Commercial sites of moderate sensitivity Parks and places of worship (people or property would not be expected to be present continuously)
Low	Commercial sites of low sensitivity Farmland, footpaths, short-term car parks and roads. (people or property would only be expected to be present for limited time periods)
Negligible	Commercial and industrial sites not deemed sensitive

Table 8.8: Receptor Sensitivity

4.5. The importance of receptors is defined in terms of significance also relates to local, regional, national and international context. With regards to air quality, whilst impacts at a local level (i.e. individual properties) are of interest, as these impacts relate to the attainment of UK and European air quality standards these receptors are also of interest from national and international perspective. In addition, there are designated ecological receptors that are nationally and internationally protected sites. Receptor importance on this basis is detailed in Table 8.9.

Designation	Development Receptors
International	All locations where members of the public are present (including Internationally designated sensitive ecological receptors: SAC)
National	All locations where members of the public are present (including Nationally designated sensitive ecological receptors: SSSIs)
Regional	Not applicable
County	Not applicable
Borough / District	All locations where members of the public are present (including Locally designated sensitive ecological receptors: Local Wildlife Sites)
Local / Neighbourhood	All locations where members of the public are present

Table 8.9: Definition of Sensitive Receptors

4.6. The construction and operational phase assessments consider the presence of these receptors in assessing the likelihood of impact associated with air quality, odour and dust. The selection of receptors is discussed in Appendix 8.3 and section 7.

4.7. High sensitivity residential receptors selected for the dispersion modeling assessment are detailed in Appendix 8.3.

4.8. The Air Pollution Information System (APIS)[26] will be used to obtain source background levels and loads and Critical Level and Critical Loads for relevant habitats /ecological designations.

Environmental Impacts

Construction Phase Impacts

Construction Dust

4.9. The construction works associated with the Proposed Development have the potential to generate dust, giving rise to impacts on dust soiling and human health, especially through the generation of PM_{10} and $PM_{2.5}$. The generation of dust on-site has the potential to cause adverse air quality impacts where there are human receptors within 350m and ecological receptors within 50m of construction works. A Construction Dust Assessment has therefore been scoped in.

4.10. An assessment of ecological receptors has been scoped out of the construction dust assessment, as there are no sensitive ecological receptors within 50m of the Application Site.

4.11. The impact of proposed construction work associated with the Proposed Development has been assessed in accordance with IAQM guidance. The construction phase assessment considers the anticipated physical activities occurring on-site that are likely to result in the generation of dust which gives rise to impacts on dust soiling and human- health, especially through the generation of PM_{10} and $PM_{2.5}$.

4.12. The potential impacts that may arise as a result of the construction activities at the Site are dust deposition, resulting in the soiling of surfaces; visible dust plumes; elevated PM_{10} concentrations as a result of dust generating activities on Site; and an increase in NO_2 and

[26] Air Pollution Information System (APIS), Site Relevant Critical Loads and Source Attribution, http://www.apis.ac.uk/srcl

PM_{10} concentrations due to exhaust emissions from non-road mobile machinery (NRMM) and vehicles accessing the Site.

4.13. The IAQM guidance considers the potential for dust emissions from the following activities:

- Demolition works;
- Earthworks, such as soil stripping, ground levelling and, excavation;
- Construction; and
- Trackout, i.e. incidental movement of dust and dirt from the construction or demolition site onto the public road network via construction vehicles tracking out from the Site.

4.14. For each of the potentially dust generating activities, the IAQM guidance considers three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in PM_{10} and $PM_{2.5}$ exposure.

4.15. The assessment involves the identification of whether each phase of on-site activity (demolition, earthworks, construction, and trackout) represents a low, medium, or high risk of causing a significant effect and then identifies suitable mitigation measures for the relevant level of risk assigned. The assessment methodology is detailed further in Appendix 8.1.

4.16. An assessment of non-road mobile machinery (NRMM) has been scoped out of the assessment, as it assumed that machinery will be selected to conform to the regulatory requirements outlined in the Department for Transport document on reducing emissions from NRMM[27].

[27] Department for Transport (2018) Improving air quality: reducing emissions from Non-road Mobile Machinery https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/691313/improving-air-quality-non-road-mobile-machinery-condoc.pdf

Construction Traffic

4.17. Construction traffic accessing the Site during the construction period will result in a temporary increase in vehicles on the local road network. This will result in increased vehicle emissions, and the potential for trackout of dust generated from construction activities.

4.18. The Transport Planners (Curtins) have provided assumptions relating to construction traffic. These are based on cut and fill estimates undertaken by consultants SGi, detailed in **Appendix 12** of the ES Part 1 Report which indicate that a total of 3,781m² of material will need to be moved from the Site. This would average 21 HGVs per week over the three-month period. However, to also allow for the delivery of construction materials, it is assumed that the total of HGVs per day may peak at >10 HGVs but would be less than 50 HGVs per day.

4.19. Curtins have advised that all construction traffic will route to the east towards Welsh Road. Construction traffic will not be passing through any local AQMAs. The construction traffic assessment has therefore considered sensitive receptors within 200m of the local road network where changes in traffic meet the following EPUK/ IAQM's criteria[19] applicable for outside of an AQMA:

- a change of Heavy-Duty Vehicle (HDV) flows of more than 50 AADT.

4.20. AADT construction traffic is predicted to be <50 AADT HDV along all construction routes and is therefore below the screening criteria. Detailed assessment of construction traffic has therefore not been carried out.

4.21. The details of the construction traffic routes can be controlled through a construction environmental management plan (CEMP). An outline CEMP is provided in **Appendix 14** of the ES Part 1 Report.

Operational Phase Impacts

Combustion Plant

4.22. On-site combustion plant such as boilers and generators have a potential to have an adverse impact on local air quality. Typically, any combustion plant where the NO_x emission rate is less than 5 mg per sec (mg/s) is unlikely to give rise to significant effects on air quality, provided that the emissions are released from a vent or a stack in a location and at a height that provides adequate dispersion.

4.23. The following combustion units are proposed be installed at the Application Site. The location of the associated flues is shown on Figure 8.14 in Appendix 8.5.

Unit	Item	Thermal Input	Annual operating hours
Phase 1			
PM1/E3	Cogeneration By-pass	24100 kW	200
PM1/E10	Cogeneration Main Stack	30000 kW	8500
CV1/E1	Methane gas boiler (Boiler for hall heating)	1350 kW	5100
CV1/E2	Methane gas boiler (Boiler for hall heating)	1350 kW	5100
-	Diesel generator	1015 kW	<50
Phase 2			
PM2/E3	Cogeneration By-pass	24100 kW	200
PM2/E10	Cogeneration Main Stack	30000 kW	8500
-	Diesel generator	1015 kW	<50
Phase 3			
PM3/E3	Cogeneration By-pass	24100 kW	200
PM3/E10	Cogeneration Main Stack	30000 kW	8500
CV3/E1	Methane gas boiler (Boiler for hall heating)	1350 kW	5100
CV3/E2	Methane gas boiler (Boiler for hall heating)	1350 kW	5100
-	Diesel generator	1015 kW	<50

Table 8.10: Proposed On-site Combustion

Due to the size and number of units proposed, the emission rates are predicted to significantly exceed the 5 mg per sec (mg/s) threshold value listed in the EPUK/IAQM[19] guidance for when detailed assessment is required. Dispersion modelling to assess the impact of the proposed on-site combustion has therefore been carried out, in accordance with the methodology detailed in Appendix 8.5.

4.24. A screening assessment has been undertaken using the criteria contained in the EPUK/IAQM[28] guidance document to determine whether local air quality effects associated with increased traffic emissions are likely to be significant.

4.25. The Site is not located within or close to an AQMA. The following criteria for screening of traffic flows from the EPUK/IAQM land-use guidance document[19] has therefore been used to determine whether a detailed air quality assessment is likely to be considered necessary for operational traffic.

- A change of Light Duty Vehicle (LDV) flows of more than 500 Annual Average Daily Traffic (AADT) movements; and
- A change of Heavy-Duty Vehicle (HDV) flows of more than 100 AADT movements.

4.26. Meeting either of the above criteria would indicate that detailed dispersion modelling of road traffic emissions is necessary.

4.27. Traffic data provided by Curtins in the Transport Assessment appended to the ES Technical Paper 2 shows that a maximum increase of 1921 AADT movements would occur as a result of the Proposed Development. This traffic data includes committed development sites which are listed in the cumulative impacts section of this Paper.

4.28. Curtins have advised that the development proposed across the strategic Northern Gateway site is expected to generate all the background traffic growth on the local highway network and therefore a growth factor does not need to be applied to the 2011 survey data. The base and future years are therefore dependent on construction and phasing.

4.29. The Application Site will come forward in three phases of development after the initial site enabling and infrastructure works. The opening of the Application Site will be phased as follows:

- Phase 1 – 2022 to 2024
- Phase 2 – 2024 to 2026

[28] EPUK/IAQM, (2017) Land-Use Planning & Development Control: Planning for Air Quality https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

- Phase 3 – 2034 to 2035

4.30. All ICT development traffic flows for Phases 1, 2 and 3 have been used in the operational traffic modelling assessment, to provide an indication of the total traffic flows once the development is fully operational.

4.31. As the screening criteria have been exceeded, detailed dispersion modelling has been undertaken to assess the impact of operational traffic emissions on the local road network around the Proposed Development. The detailed assessment uses ADMS-Roads Extra (version 5.0.0.1) atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC). The assessment will focus on concentrations of NO_2, PM_{10} and $PM_{2.5}$ for which air quality objectives and EU limit values are set in legislation. The methodology for this assessment is detailed in Appendix 8.3 of this ES Technical Paper.

Odour

4.32. The Proposed Development has the potential to introduce new sources of odour, in particular from the on-site treatment and processing of waste-water. Details of the on-site waste water treatment plant (WWTP) are described in the project description in Section 2 of the ES Part 1 Report and the location of this is provided in Figure 8.4 in this Technical Paper.

4.33. Should there be any off-site potentially odourous activities, there is also the potential for odour-nuisance to future site-users. Depending on the location of the odour sources with relation to sensitive receptors, there is the potential for odour nuisance to arise, which may be considered as significant, depending on its severity.

4.34. The best approach to odour assessment is to carry out a screening assessment. This screening assessment will be based on whether or not there is likely to be a significant risk of an odour impact. A source-pathway-receptor odour assessment has therefore been scoped in. A Qualitative Screening Assessment has been undertaken in accordance with IAQM guidance on the assessment of odour for planning. This guidance is currently considered to be best practice.

4.35. The screening assessment adopted a 'source-pathway-receptor' model, which is a predictive qualitative risk-based assessment that produces a relative risks score / descriptor (for example, negligible, low, medium or high-risk impact). The source-pathway-receptor model presents the hypothetical relationship between the source of odour, the pathway by which exposure might occur, and the receptor that could be adversely affected. Details of this methodology are

presented in Appendix 8.4. The findings of the screening assessment are detailed in section 7.51 to 7.49 and conclude that further detailed assessment is not required.

Significance of Effects

4.36. Within the wider project context, the importance of impacts are defined in terms of the importance of the receptors (as defined in Table 8.9), with due regard of the significance of impacts. These are summarised in Table 8.11.

Impact	Development Receptors		
	Human Significance	**Ecological Significance**	**Construction Significance**
Major	'Large' increase in airborne pollution resulting in AQO being exceeded '	Exceedance of AQO for Ecology or Significant impact as defined by H1 which results in loss, permanent damage or adverse impacts on the integrity at a European or SSSI designation. Exceedance of AQO for Ecology or Significant impact as defined by H1 which results in loss of a substantial part or key feature of a site of county importance.	High Risk, without mitigation
Moderate	'Medium' increase in airborne pollution resulting in AQO being exceeded	An impact of unlikely significance resulting in a temporary disturbance to a European or SSSI designation. An impact of Significance, but not an exceedance of AQOs at a site of county importance which results in permanent damage to any part of the site. A Significant impact which results in the loss of a key feature of local importance.	Medium Risk, without mitigation
Minor	'Small' increase in airborne pollution; or 'Medium' or 'Large' increase in air quality, but which does not result in AQO being exceeded or approached.	An impact of "unlikely significance" which results in temporary disturbance to a site of county value	Low Risk, without mitigation
Negligible/Neutral	Not Significant	Not Significant	High, Medium and Low Risk sites with correct mitigation applied.

Table 8. 21: Environmental Impacts

4.37. The significance of effect is determined using the significance matrix in Section 6 of the Environmental Statement Part 1 Report. This identifies the receptor level across the top of the matrix and the magnitude of environmental impact down the side and where they meet within the matrix identifies the significance of the effect.

4.38. For the purpose of producing this Paper, it is proposed that the above project-wide Significance Matrix table is modified to take into account the specific relationship between air quality, odour and dust. To this end, Table 8.12 sets out the modified Significance Matrix values at sensitive receptors.

4.39. The EPUK/IAQM land-use planning guidance[19] provides an approach to determining the significance of likely effects resulting from the Proposed Development on local air quality. The guidance also provides advice on how to describe the significance of the effects predicted from air quality modelling. The guidance incorporates the latest position of the IAQM on effect significance.

4.40. A framework for describing the air quality impacts set out in IAQM guidance[19] and is summarized in Table 8.12. Impacts listed as substantial and slight in IAQM guidance have been renamed as major/substantial and slight/minor, in order to align with the criteria used in the significance of impact ES matrix in Section 6 of the ES Part 1 Report.

4.41. For air quality impacts arising from surrounding sources on new occupants of a development, then the impacts are best described in relation to whether an air quality objective will not be met or is at risk of not being met. Where the air quality is such that an air quality objective at the building façade is not met, the effect on residents or occupants will be judged as significant, unless provisions is made to reduce their exposure by some means. Changes of less than 0.5%, will be described as Negligible.

Long-term average concentration at receptor in assessment year	**% Change in concentration relative to Air Quality Assessment Level (AQO)**			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Slight/Minor*	Moderate
76 – 94% of AQO	Negligible	Slight/Minor*	Moderate	Moderate
95 – 102% of AQO	Slight/Minor*	Moderate	Moderate	Major
103 – 109% of AQO	Moderate	Moderate	Major *	Major
110% or more of AQO	Moderate	Major	Major *	Major
75% or less of AQO	Negligible	Negligible	Slight/Minor*	Moderate
* listed as slight and substantial in IAQM guidance[19] have been re-labelled here as Slight/Minor to align with wider ES assessment methodology				

Table 8.12 Air Quality Environmental Impacts

Construction Phase

4.42. The potential Significance of Effects for Air Quality, Odour and Dust impacts were identified for the Construction Phase as part of the Scoping Assessment. Residential receptors of high sensitivity in the locality of the Application Site are at most risk of potential impacts during the construction phase.

4.43. The assumptions relating to dust associated with construction have been tested during the assessment by means of a construction dust assessment which is included within this Technical Paper. Construction Traffic data will be screened during the assessment stage to determine whether there is a potential risk of significant impact from emissions from construction traffic that needs to be assessed in detail. It is assumed that the on-road mobile machinery (NRMM) used during construction will be selected to conform to the regulatory requirements outlined in the Department for Transport document[27] on reducing emissions from NRMM.

Operational Phase

4.44. The potential Significance of Effects for Air Quality, Odour and Dust were impacts identified for the Operational Phase as part of the Scoping Assessment. Residential receptors of high sensitivity in the locality of the Application Site are at most risk of potential impacts during the Operational Phase.

4.45. The assumptions relating to emissions from operational traffic on on-site combustion plant have been tested through detailed dispersion modelling reported within this Technical Paper. The assumptions relating to odour nuisance were tested during the assessment stage by means of a source-pathway-receptor assessment and consultation with Flintshire County Council to determine whether there have been any historic odour nuisance complaints.

Impact Prediction Confidence

4.46. It is also of value to attribute a level of confidence by which the predicted impact has been assessed. The criteria for these definitions are set out in Table 8.13.

Confidence Level	Description
High	The predicted impact is either certain i.e. a direct impact, or believed to be very likely to occur, based on reliable information, a worst case basis for assessment and/or previous experience and professional judgment based on experience on other similar projects.

Confidence Level	Description
Low	The predicted impact and its levels are best estimates, generally derived from first principles of relevant theory and experience of the assessor. More information may be needed to improve confidence levels.

Table 8.13: Confidence Levels

4.47. The air quality impact assessment is based upon published and validated methods and information, and the assessments are completed in accordance with published guidance. Therefore, the confidence level is high.

5. Baseline Information

5.1. To assess the significance of any new development proposal (in terms of air quality, odour and dust), it is necessary to identify and understand the baseline air quality conditions in and around the study area. This provides a reference against which any potential changes in air quality can be assessed. To identify the existing air quality conditions, a review of publicly available information has been undertaken, including the latest local authority air quality reports, monitoring data, and background concentration maps. This section presents the results of the review.

5.2. Flintshire County Council has not declared any AQMAs, and there are no AQMAs declared in the vicinity of roads that have been 'screened in'. Therefore, no consideration has been made of impacts on AQMAs as part of the assessment.

Local Sources of Pollution

5.3. Industrial air pollution sources are regulated through operating permits or authorisations, which list stringent emission requirements. Regulated industrial process are classified as either Part A or Part B processes and are regulated through the Pollution Prevention and Control (PPC) system[29] which has been transposed into National legislation[30]. The larger, more polluting, Part A processes are regulated by the Environment Agency for emissions to air, water and land. The smaller, less-polluting processes are regulated by the local authority for emission to air.

5.4. A review of environmental permit data held by the Environment Agency (EA) was carried out. The latest EA Pollutant Inventory for 2018[31] did not indicate the presence of any Part A permit sites within 5km. The closest Part A site is Urenco Ltd, 5.8km to the north-east.

5.5. Part B processes are permitted by the Local Authority (Flintshire Council). Given the nature of these processes, there are not considered to be a significant source of air pollution.

5.6. The emissions both the Part A and Part B installations are assumed to be represented in the background concentrations used.

Information from Flintshire County Council

[29] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
[30] The Environmental Permitting (England and Wales) (Amendment) Regulations 2013, SI 2013/390
[31] Environment Agency, Pollution Inventory https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory

5.7. Flintshire County Council undertakes monitoring of air quality in their administrative area using passive diffusion tubes to monitor NO_2. A review of the locations of these diffusion tubes identified 24 sites that are considered relevant to informing the baseline conditions around the site and at nearby sensitive receptors, all falling within a 5km radius of the Proposed Development. The locations of these monitoring sites are shown in Figure 8.1.

5.8. Details of the diffusion tubes and recent monitoring results from 2015 to 2019 are provided in Table 8.14. None of the concentrations measured at these sites during the monitoring period between 2015 and 2019 exceeded the annual mean NO_2 objective (40µg/m^3).

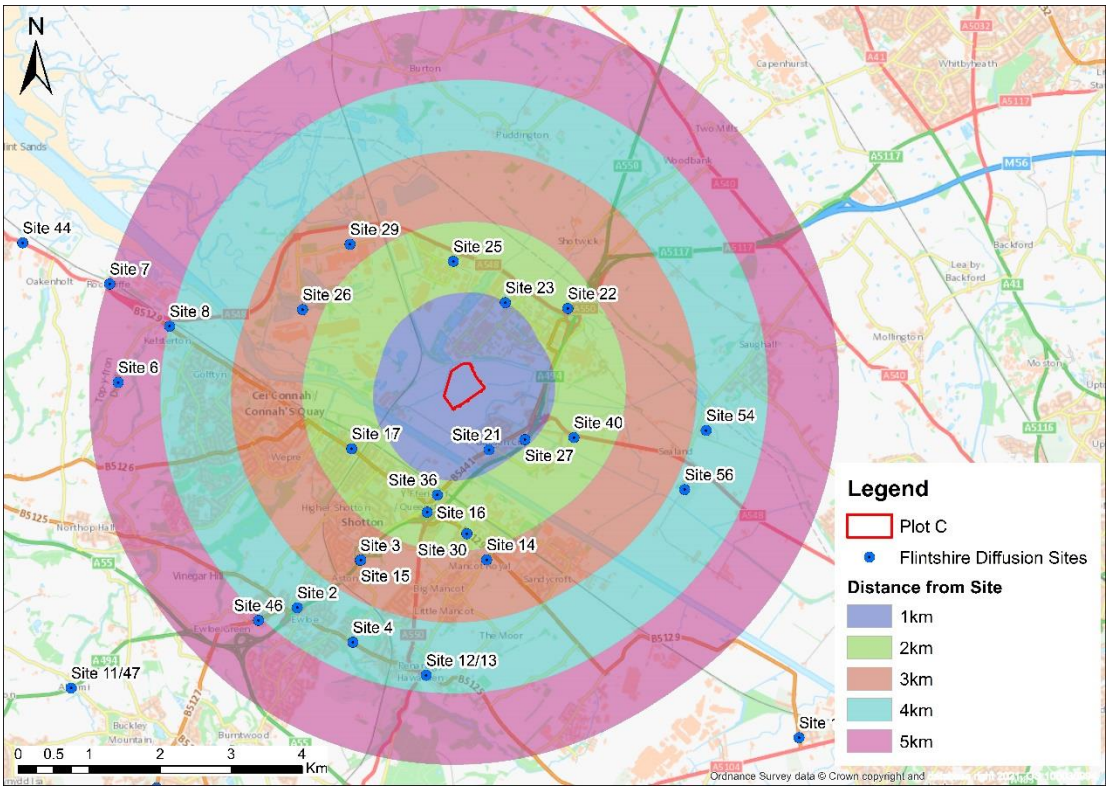

Figure 8.1 Monitoring Sites within 5km

Site ID	Location	Grid Coordinate		Type	Annual Mean NO_2 concentration (µg/m^3)					
		X	Y		2015	2016	2017	2018	2019	Ave
Site 2	1, St.Davids Close, Ewloe CH5 3AP	329830	366682	Urban	17.4	20.6	17.4	17.2	17.5	18.0
Site 3	Aston Hill Roadside	330718	367350	Kerbside	26.3	33.7	24.4	28.2	25.2	27.6
Site 4	Hawarden High School CH5 3DL	330614	366195	Kerbside	15.9	18	16	16	16	16.4

Site ID	Location	Grid Coordinate		Type	Annual Mean NO_2 concentration ($\mu g/m^3$)					
		X	Y		2015	2016	2017	2018	2019	Ave
Site 6	Kelsterton Farm, Kelsterton Lane, Connah's Quay	327307	369856	Rural background	9.3	14	8.1	10.5	10.5	10.5
Site 7	Kelsterton Road, Connah's Quay	327187	371243	Kerbside	14.9	15	13.2	14.9	14.8	14.6
Site 8	86, Kelsterton Road, Connah's Quay CH5 4BJ	328032	370647	Urban background	12.9	14.5	11.7	12.6	12.3	12.8
Site 12/13	20/22 Glynne Way, Hawarden	331648	365730	Kerbside	35.4	34	34.5	33.9	32.5	34.1
Site 14	Sandycroft CP School Leaches Lane CH5 2EH	332500	367357	Kerbside	8.6	12.7	13.4	14.7	13.9	12.7
Site 15	Aston Hill, Roadside - Additional Tube within 12m of ADDC/085	330727	367354	Kerbside	27.9	27.9	25.9	26.7	27.8	27.2
Site 16	4, Belvedere Close, Queensferry CH5 1TG	331663	368028	Urban	26.2	26.7	24.4	24.7	24.3	25.3
Site 17	32 Chester Road West, Shotton	330599	368922	Kerbside	24.8	29.2	23.8	24.8	23.6	25.2
Site 21	Sealand CP School Welsh Road CH5 2RA	332535	368907	Kerbside	13	15.2	18	20	19.1	17.1
Site 22	Green Lane West, Sealand	333645	370898	Rural background	18.7	18.6	14.6	17.6	17.2	17.3
Site 23	Second Avenue, Deeside Industrial Estate (Valspar)	332764	370981	Industrial	21.4	24.4	23.2	24.4	24.3	23.5
Site 25	BASF, Deeside Industrial Park, Sealand	332031	371562	Industrial	18.1	21.3	16	17.2	16.6	17.8
Site 26	Corus rear entrance DIP, Sealand	329906	370882	Industrial	15	16.3	13.8	14.2	14.4	14.7
Site 27	89, Riverside Park, Garden City	333040	369051	Roadside	21.7	21.3	20	20.8	17.1	20.2
Site 29	Weighbridge Road, Deeside Industrial Park, Sealand	330575	371802	Industrial	15.8	18	16.6	16.6	16.6	16.7
Site 30	28, Chester Road, Pentre, Deeside CH5 2DT	332221	367723	Kerbside	23.2	24.9	23.9	24	24.3	24.1
Site 36	43, Station Road, Queensferry CH5 1SU	331806	368271	Kerbside	21.5	23.2	20.8	20.9	20.8	21.4
Site 40	1 Manor Road, Sealand CH5 2SB	333731	369079	Kerbside	15.7	16.8	14.9	14.9	13.4	15.1
Site 46	Ewloe Green School CH5 3AU	329284	366504	Kerbside	12.5	12.7	17.5	17.8	17.8	15.7
Site 54	Elm Tree Rd Saughall	335594	369179	Kerbside	10.5	13.2	10.9	11.2	11	11.4
Site 56	Deeside Lane, Sealand	335292	368346	Kerbside	12.7	13.2	10.3(4)	11.3(4)	11.1	12.3

Table 8.14 Details and Latest Results of Diffusion Tube Monitoring

UK Automatic Urban and Rural Network (AURN) monitoring data

5.9. Automatic or continuous monitoring involves drawing air through an analyser continuously to obtain near real-time pollutant concentration data. There are three AURN sites in the wider region which have been used to inform the baseline. These sites are indicative but not completely representative of conditions in the immediate vicinity of the site in comparison with the FCC monitoring. However, this is considered relevant as FCC does not monitor concentrations of PM_{10} and $PM_{2.5}$ in the vicinity of the Proposed Development.

5.10. PM_{10} is only monitored at one of these sites during the evaluation timeframe, and $PM_{2.5}$ is only monitored at two of these sites.

5.11. The three AURN sites detailed here are located to the North, South and North East as shown in Figure 8.2.

5.12. Details of these monitoring sites are listed in Table 8.15 and the latest results are listed in Table 8.16.

Site	Site Location	OS Grid Reference		Site Type	Distance to kerb of nearest road (m)
		X	Y		
Wirral	Victoria Park, Tranmere	332054	386711	Urban background	50m
Wrexham	Kerbside of Victoria Road (A5152)	332865,	349909	Urban Traffic	

Table 8.15 Details of Automatic Monitoring Sites

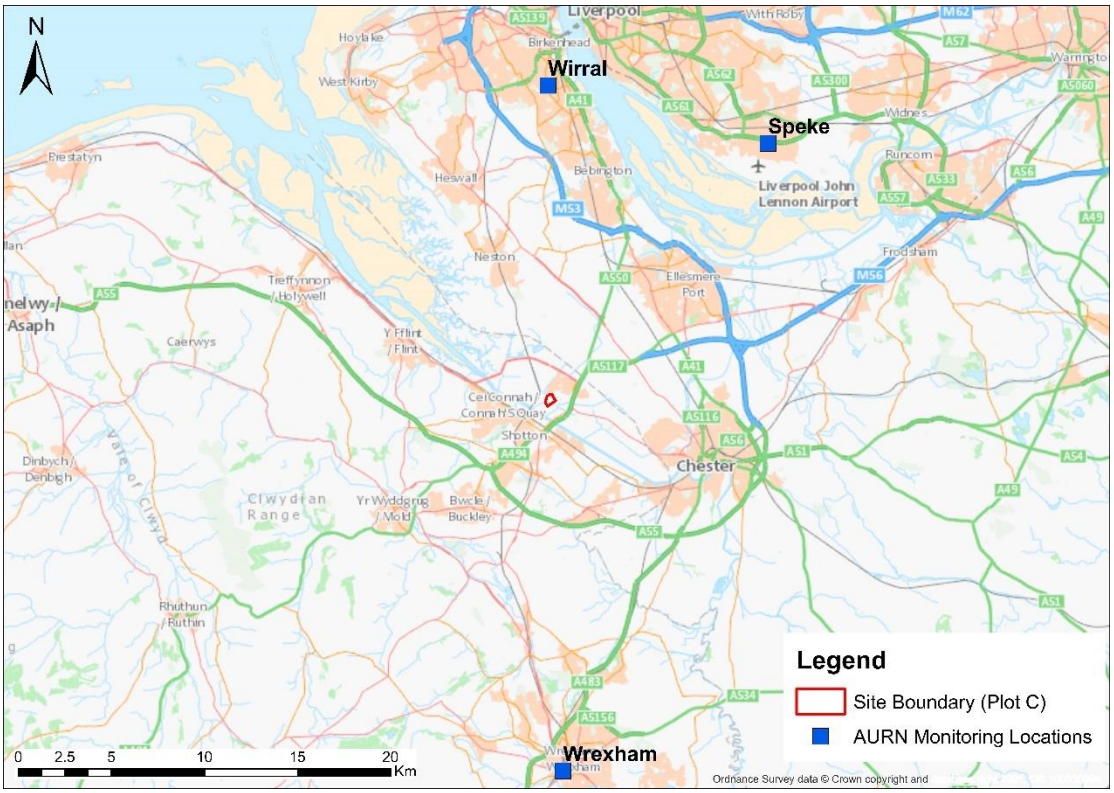

Figure 8.2: Position of AURN Sites Relative to Proposed Development

	Wirral (Urban Background)					Wrexham (Urban Traffic)				
	2016	**2017**	**2018**	**2019**	**2020**	**2016**	**2017**	**2018**	**2019**	**2020**
Annual mean NO_2	29.4	22.6	21.5	20.8	14.2	34.6	31.1	31.3	29.3	22.5
Hourly mean NO_2 >200µg/m^3	**22**	**42**	**19**	16	2	**65**	**67**	**32**	**31**	**22**
NO_2 data capture	96.9	98.9	99.1	99.2	84.2	83.9	93.8	88.6	80.2	99.2
Annual mean PM_{10}	-	-	-	-	-	-	-	13.0	12.1	11.4
24-hour mean >50µg/m^3 PM_{10}	-	-	-	-	-	-	-	23	**114**	**62**
PM_{10} data capture								15.5	80.4	99.6
Annual mean $PM_{2.5}$	7.9	6.9	21.5	8.0	7.1	-	-	9.5	7.9	7.1
$PM_{2.5}$ data capture	93.8	94.6	99.1	96.8	99.4	-	-	15.5	80.4	99.6

Table 8.16 Results of Automatic Monitoring, 2016 to 2020

5.13. Automatic monitoring results listed in Table 8-16 show that recorded concentrations were well below the respective annual air quality objectives for NO_2 (40µg/m^3), PM_{10} (40µg/m^3) and $PM_{2.5}$ (25µg/m^3).

5.14. Exceedances of the short-term objectives for NO_2 (200µg/m^3 not to be exceeded more than 18 times in a year) were exceeded at the urban traffic site every year between 2016 and 2020 but with results showing a downward trend, and between 2016 and 2018 at the urban background site.

5.15. Exceedances of the short-term objectives for PM_{10} (50µg/m^3 not to be exceeded more than 35 times in a year) were recorded at the urban traffic site in 2019 and 2020 but not in 2018. It is anticipated that these exceedances are associated with trackout of construction vehicles from a nearby construction site. PM_{10} is not monitored at the urban background site.

Defra Background Mapping

5.16. In addition to local air quality monitoring data undertaken by the local authority, Defra publishes background pollutant mapping[32] for every 1km x 1km OS grid square across the UK for NO_x, NO_2, PM_{10} and $PM_{2.5}$. Background pollutant mapping has been reviewed for the grid square in which the Proposed Development lies and surrounding grid squares. The 2019 background concentrations (which are based on 2018 monitoring data)[33] are presented in Table 8.17. Defra background concentrations are all below the air quality objectives for annual mean NO_2 and PM_{10} and $PM_{2.5}$.

OS Grid Square		Annual Mean Concentration (µg/m^3)			
X	**Y**	**NO_x**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
331500	368500	15.8	11.9	11.2	7.6
331500	369500	14.5	10.9	11.2	7.3
331500	370500	13.0	9.9	10.7	7.3
332500	368500	17.1	12.8	12.5	8.1
332500	369500	13.7	10.4	10.8	7.3
332500	370500	17.9	13.2	11.1	7.3
333500	369500	17.0	12.7	12.1	7.8
333500	370500	25.2	17.9	12.8	8.3
Average		**16.8**	**12.5**	**11.6**	**7.6**

Table 8.17 Defra's 2019 Background Concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$

[32] Defra, Background Pollutant Mapping, https://uk-air.defra.gov.uk/data/laqm-background-home
[33] 2020 backgrounds are also available and are lower than 2019 values. 2019 has been reported here to correspond to the baseline year for the assessment.

5.17. Table 8.18 shows the comparison between the measured NO_2 concentrations at the background sites within 5km to the Application Site and the estimated Defra NO_2 background concentrations for the same OS grid squares for 2019.

Site	Type	OS Grid Square		Estimated Defra background concentration (µg/m³)	2019 Measured concentration (µg/m³)	Difference	Difference (%)
		X	Y				
Site 8	Urban background	328032	370647	9.9	12.3	-2.4	-0.24
Site 22	Rural background	333645	370898	17.9	17.2	0.7	-0.04

Table 8.18 Comparison between 2019 Monitored and Defra Background Concentrations

5.18. Comparison of the mapped background concentrations with those measured at the urban background location indicate that the use of monitored data is more conservative, presumably incorporating additional local sources. Comparison of the mapped background concentrations with those measured at the rural background location indicate a close correlation, with the estimated concentrations only marginally higher than the monitored background.

Emissions from Local Traffic

5.19. The Application Site is located next to Deeside Industrial Park and is wells served by local trunk roads, Welsh Road (B5441) and A494 further to the east which connects to the M56 and A55.

5.20. (The Department for Transport (DfT) have issued road traffic statistics[34] for 2019 and these include count points in the vicinity of the Application Site. These are listed in Table 8.19 and their locations are shown in Figure 8.3. Emissions from roads in the area are assumed to be represented in the background concentrations provided by Defra.

Count ID	Road	2019 All vehicles	2019 % HGV
10618	A548	16,970	2.7
30625	A494	57,282	6.2
50609	A548	15,228	10.2
78455	A550	69,411	3.2
91225	A494	70,479	5.8
951118	B5129	18,234	0.9

[34] Department for Transport, Road traffic statistics https://roadtraffic.dft.gov.uk/local-authorities

Count ID	Road	2019 All vehicles	2019 % HGV
951132	Unclassified (Sealand Avenue)	1,886	0.7

Table 8.19 Department for Traffic 2019 Traffic Statistics

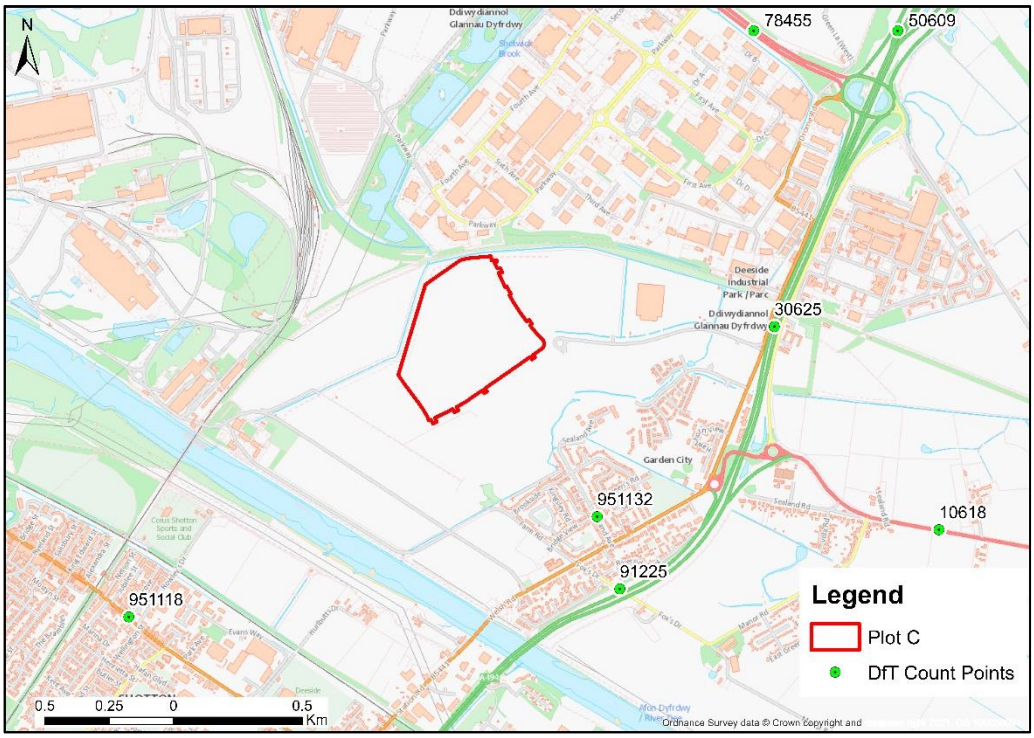

Figure 8.3 Department for Transport (DfT) 2019 Traffic Count Points

Local Sources of Potential Odour Nuisance

5.21. Potential sources of existing odour nuisance may be present within the area surrounding the Application Site. Initial analysis of Address Base Plus geographical data set indicates the existing registered site users with a potential to cause odour nuisance are like industrial workshops, and manufacturing facilities. The locations of these sites are shown in Figure 8.4.

5.22. Figure 8.4 also shows the location of the proposed wastewater treatment plant (WWTP) within the Plot C sit boundary.

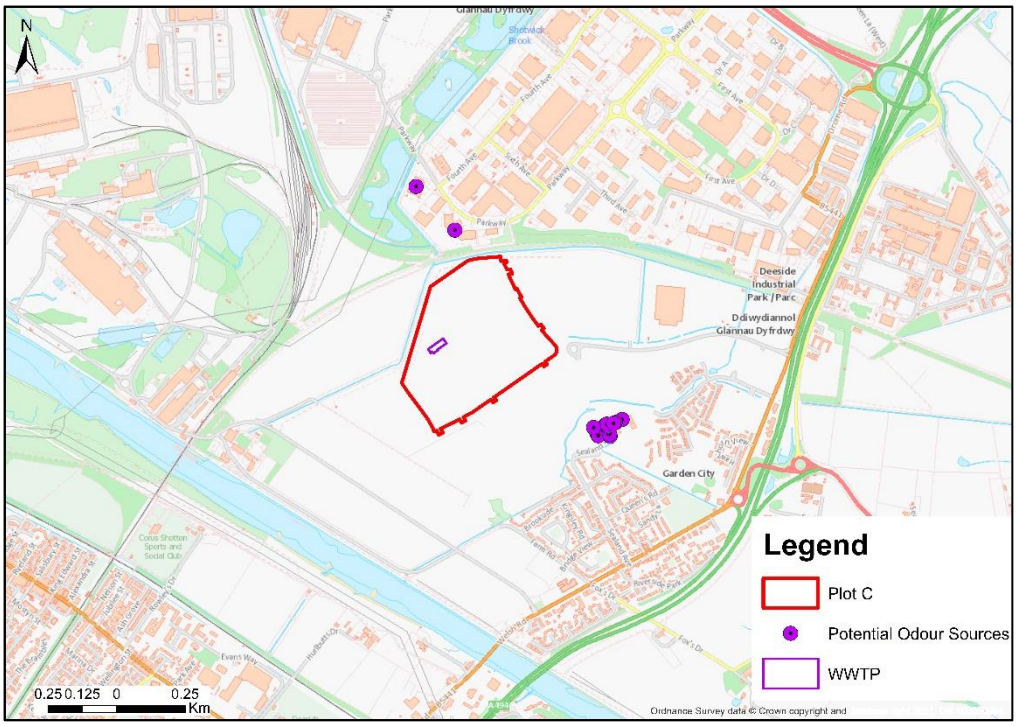

Figure 8.4 Potential Odour Sources

Receptors

Human Receptors

5.23. Sensitive human receptors have been identified in close proximity to the Application Site and the likely affected road network. Mapping data provided by Ordnance Survey has been used to identify existing sensitive receptors within 350m and include receptors within 20m of the red line boundary. These are shown on Figure 8.5 and include sites considered to be of high, medium or low sensitivity. These include several residential receptors, including the proposed residential development to the south of the Application Site, as shown in Figure 8.6. Figure 8.6 also shows the neighboring proposed commercial / industrial areas to the east of the Application Site.

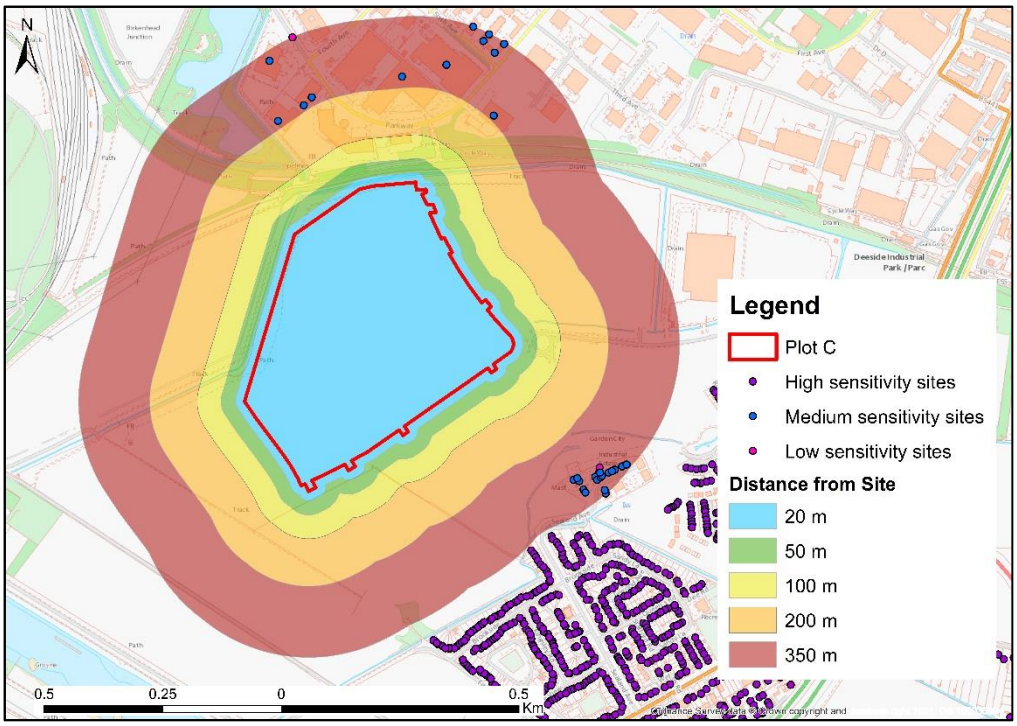

Figure 8.5 Existing Sensitive Receptors

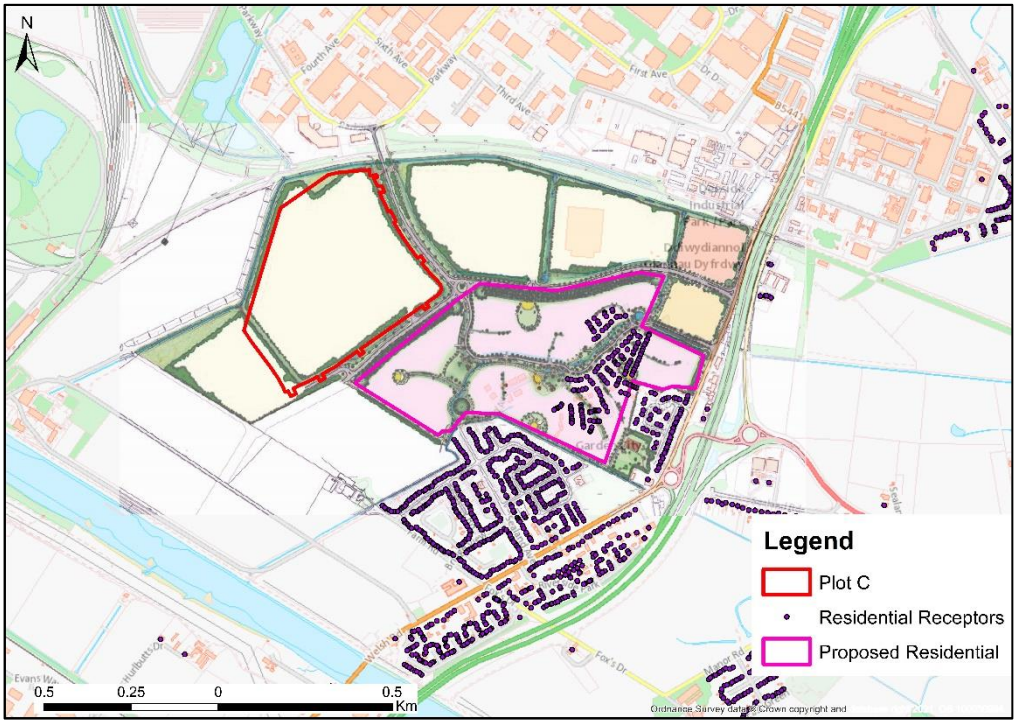

Figure 8.6 Residential Receptors

Ecological Receptors

5.24. Defra MAGIC mapping[35] has been reviewed to determine the presence of any sensitive ecological sites[36]. The Dee Estuary Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) is located 500m to the south-west of the Application Site, as shown in Figure 8.7.

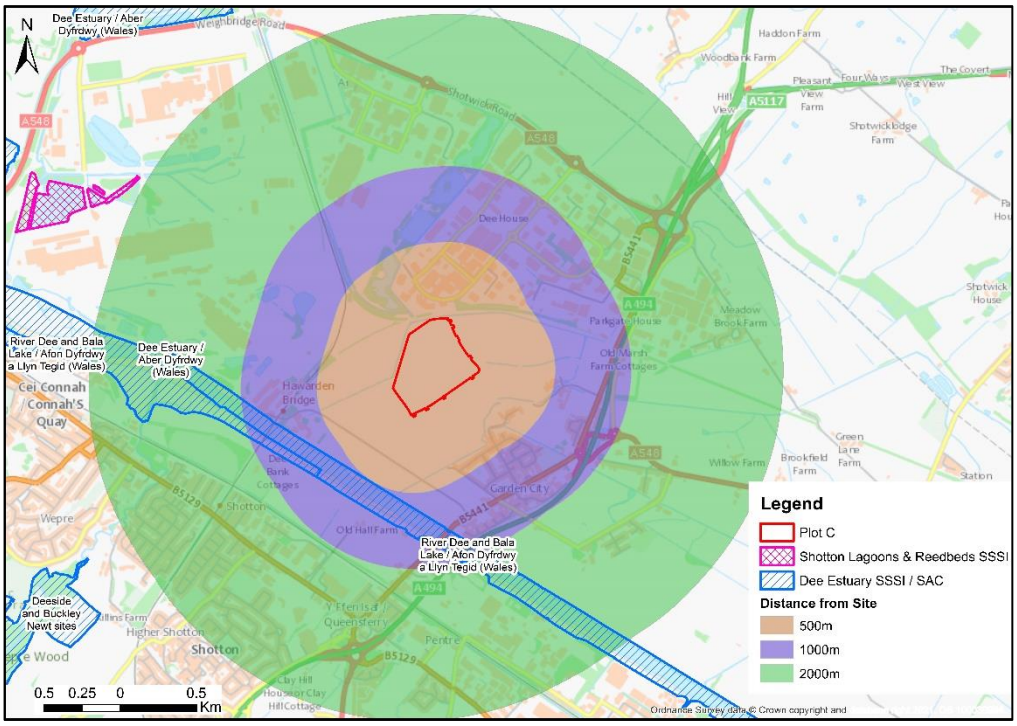

Figure 8.7 Ecological Receptors

5.25. The Air Pollution Information System (APIS)[26] has been reviewed to obtain information on Critical Levels and Critical Loads of relevance to the Dee Estuary SSSI/SAC. The critical loads represent an annual rate of nutrient nitrogen deposition below which harmful effects on sensitive features within the site are not expected to occur. They are based on a combination of experimental evidence and expert judgement and are provided as a range for each habitat to account for variability in soil types and rainfall. The lowest Nitrogen Critical Loads listed on the APIS website for the River Dee Estuary SAC and the River Dee and Bala Lake SAC are 3-10 kg N/ha/yr. Nitrogen oxide (NOx) concentrations in the area are listed on the APIS website as ranging from 3.81 to 26.07 µg/m^3, with an average of 7.46µg/m^3. The APIS website also lists average background nitrogen deposition for 2018 and the value for the grid square in which the Application Site is located is 10.5 N/ha/yr.

[35] Department for Environment, Food and Rural Affairs (Defra) (2019). MAGIC https://magic.defra.gov.uk/MagicMap.aspx

[36] Typical ecological receptors of significance include Special Conservation Areas (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs), RAMSAR sites, Local Nature Reserves with dust sensitive features.

6. Alternatives Considered

6.1. While a series of alternatives have been considered as part of the evolution of the proposals, these have not been specifically informed by the need to address air quality impacts and are therefore not discussed within this Technical Paper. Section 4 of the ES Part 1 Report provides details of the alternatives considered.

6.2. The proposed layout has evolved following detailed discussions with the appointed consultant team resulting in the waste-water treatment plant being located further away from residential receptors.

7. Potential Environmental Effects

7.1. The following sub-sections provide an assessment of air quality, odour and dust effects through the construction and operational phases against the significance criteria listed in section 4.

Construction Phase

Construction Dust

7.2. A construction dust assessment was undertaken as there are human receptors within 350m of the boundary of the Application Site; and 50m of the route used by construction vehicles on the public highway, up to 500m from the site entrance. There are also ecological receptors within 50m of the boundary of the Application Site. The assessment has been carried out in accordance with IAQM guidance[19], the methodology for which is detailed in Appendix 8.1.

Dust Emission Magnitude Analysis

7.3. Potential dust emission magnitudes from construction activities associated with the Proposed Development were determined in accordance with IAQM guidance and are detailed below.

Demolition

7.4. There are currently no buildings on site that require demolition. There are also no areas of hardstanding that will require removal. Demolition is therefore not considered further in this assessment.

Earthworks

7.5. Earthworks will be required to establish development platforms and foundations for all elements of the development, and to undertake landscaping works. The Application Site area is significantly larger than 10,000m^2 and while not all the site will require earthworks, it is anticipated that the level of works will be sufficient for the site's potential dust emission magnitude to be considered Large.

Construction

7.6. The total building volume to be constructed will exceed 100,000 m^3 during the construction phase. Materials with a high potential for dust release, such as concrete, will be used on the Site. Based on this, the emissions category for construction activities is likely to be Large.

Trackout

7.7. During the most intense elements of the construction phase there will be an estimated three HGV trips per hour importing fill material onto the Site, together with additional HGV

movements supporting the wider construction activities. It is therefore assumed that there is potential to exceed 50 outward HGV movements in any given day. As such, the potential dust emission magnitude for trackout is Large.

7.8. The potential dust emission magnitudes for each construction phase activity are summarised in Table 8.20. Assumptions listed are based on the project description in Section 2 of the ES Part 1 Report, the proposed Layout and Elevations Plans in Appendix 4 and 6 of the ES Part 1 Report and the estimates relating to construction have been provided by the Transport Consultants Curtins.

Stage	Relevant Definition	Dust Emission Magnitude
Demolition	▪ None required	n/a
Earthworks	▪ Estimated site area is >10,000 m^2 ▪ Potentially dusty soil type (loamy clayey soils)	**Large**
Construction	▪ Estimated total building volume is >100,000 m^3 ▪ Potentially dust construction material (concrete)	**Large**
Trackout	▪ Potential for 10-50 HDV (3.5 tonnes) outward movements in any one day during the construction period. Based on the volume of earthworks material it is estimated that daily HGVs would not exceed 40 HGVs per day and will usually be <10 per day.	**Medium**

Table 8.20: Determination of the Potential Dust Emission Magnitude

7.9. The highest dust emission magnitude is likely to be Large.

Sensitivity of the Area

7.10. Using the IAQM guidance, the sensitivity of the surrounding area has been determined for dust soiling effects and human health effects, based on the receptor type and density, as well as low annual mean PM_{10} concentrations. The determined sensitivities for each phase of construction are summarised in Appendix 8.1.

7.11. The surrounding area has a significant density of sensitive receptors, which have wide range of sensitivities to dust soiling and health effects. The numbers of these receptors likely to be affected by earthworks and construction activities during the construction phase has been assessed. The analysis involved counting receptors, identified via the current Address Base Plus geographical data set, within each of the distance bands from the Proposed Development boundary. Consideration has also been made for the introduction of receptors in the area that may be constructed prior to the completion of the Application Site, such as the residential areas to the south. Buffers illustrating the assessment distances of 20, 50, 100, 200 and 350 metres from the Proposed Development boundary are illustrated in Figure 8.7. The analysis of sensitive receptors within each distance band is presented in Table 8.21.

7.12. The receptors listed in Table 8.21 are based on existing receptors and do not include the proposed residential development to the south of the Site. Should these residential properties be constructed before the completion of the site works at the Application Site, they will be receptors for construction dust. The extent of the proposed residential development is shown in Figure 8.7. Allowing for the landscaped buffer zone around the site perimeter, which will be established by CHEL and Welsh Government as part of separate site enabling works, the nearest proposed residential property is likely to be 100m from the Application Site boundary.

7.13. Defra MAGIC mapping[37] has been reviewed to determine the presence of any sensitive ecological sites[38]. There are no designated ecological receptors sensitive to dust within 50m of the Application Site boundary, with the nearest located 1km away. The sensitivity of the area to ecological receptors is therefore negligible.

Distance (metres)	Receptor Type				
	Residential / Development (High)	Commercial / Retail / Office (High)	Commercial / Retail / Office (Medium)	Commercial / Leisure / Transport (Low)	Totals
20	0	0	0	0	0
50	0	0	0	0	0
100	0	1	0	0	1
200	0	2	0	0	2
350	0	5	31	3	39

Table 8.21: Number of Receptors Identified in Distance Bands from the Proposed Development

[37] Department for Environment, Food and Rural Affairs (Defra) (2019). MAGIC https://magic.defra.gov.uk/MagicMap.aspx

[38] Typical ecological receptors of significance include Special Conservation Areas (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs), RAMSAR sites, Local Nature Reserves with dust sensitive features.

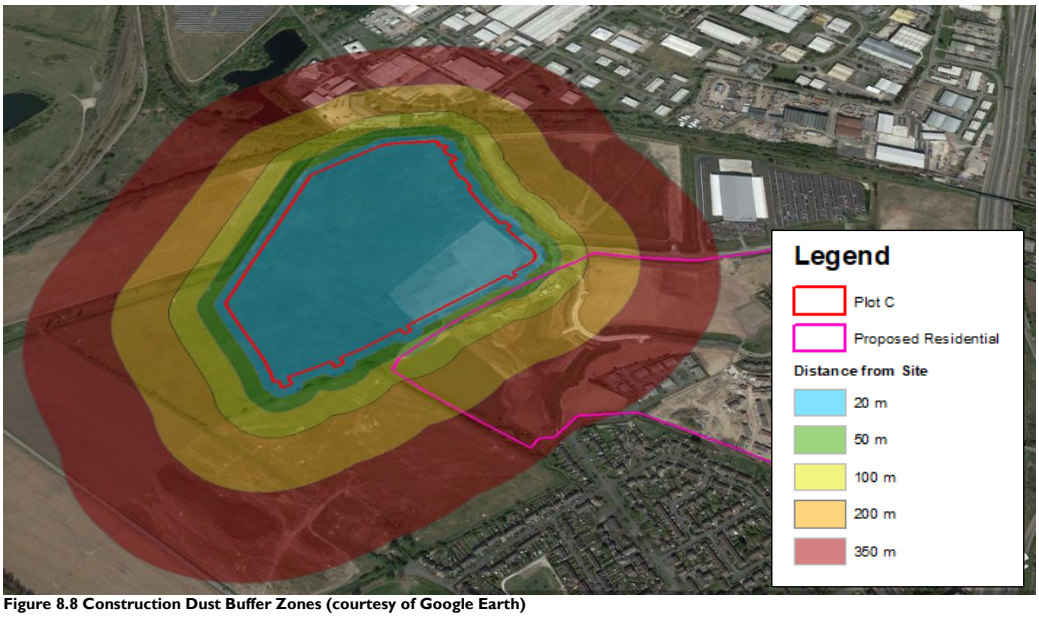

Figure 8.8 Construction Dust Buffer Zones (courtesy of Google Earth)

7.14. In summary, the evaluation shows that:

- 1-10 existing high-risk residential receptors are located within 100m of the Proposed Development boundary
- Allowing for the proposed residential development to the south-east, there is potential for 10-100 high risk residential properties to be located within 100m of the Proposed Development boundary.

7.15. The sensitivity of the area to dust soiling effects on people and property from earthworks and construction activities is therefore Low. The addition of the new residential properties to the south-east does not change this conclusion.

7.16. The Defra PM_{10} background concentration in the area of the Proposed Development is 12.5µg/m^3. There are 1-10 high sensitivity receptors within 100m of the Proposed Development boundary. The sensitivity of the area to human health impacts for earthworks and construction activities is therefore **Low**.

7.17. Sensitive receptors are also susceptible to dust soiling and health effects resulting from construction vehicle trackout. The IAQM guidance states that trackout may occur from roads up to 500 m from large sites and 200m from medium sites. As the highest dust emission magnitude is large, a 500m distance band has been applied accounting for sensitive receptors 50m from the proposed construction route (Figure 8.9).

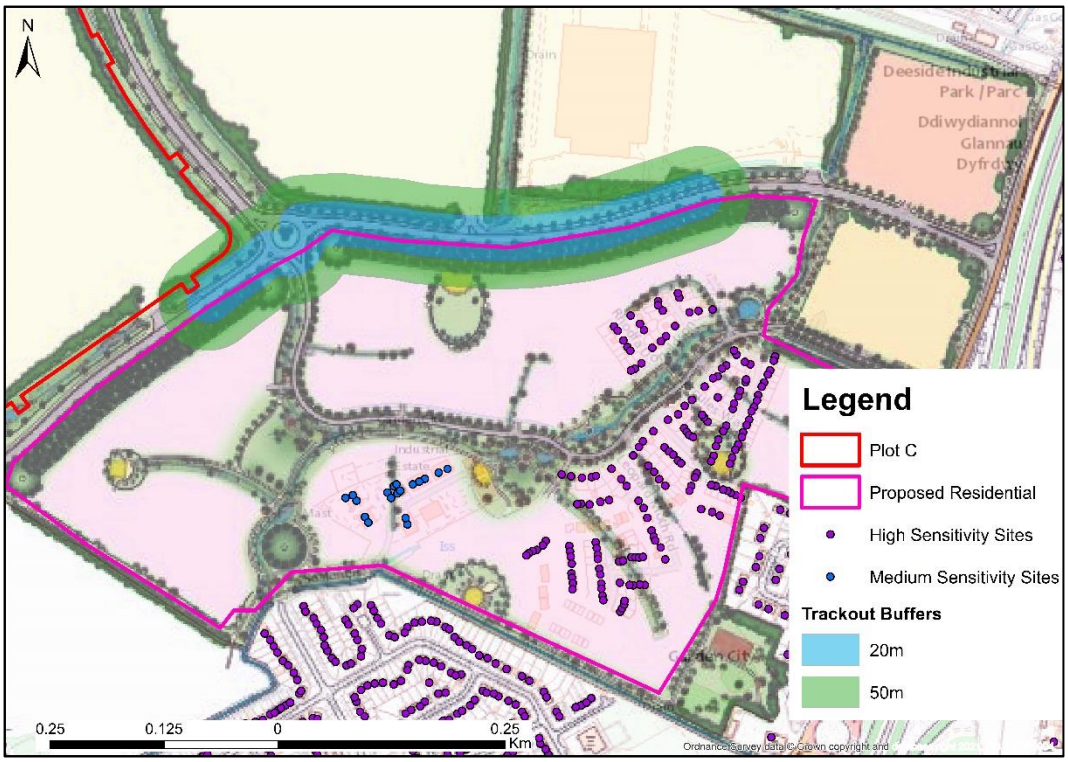

Figure 8.9 Trackout 500m Distance Band around the Site Exit Route

7.18. An evaluation of numbers of sensitive receptors lying within 20m and 50m of the edge of the carriageway of the construction routes within 500m of the site exit has been carried out. There are currently no sensitive receptors within this area. The sensitivity of the area to dust soiling effects from trackout on people and property from trackout activities would therefore be **Low.**

7.19. Once the proposed residential development to the south-east has been constructed, there is potential for 10-100 high sensitivity receptors to be located within 50m of the construction, 500m of from the Application Site exit. The sensitivity of the area to dust soiling effects from trackout on people and property from trackout activities would therefore be **Medium.**

7.20. The Defra PM_{10} background concentration in the area of the Proposed Development is 12.5µg/m^3. There would be maximum 10-100 high sensitivity receptors within 50 m of the construction phase boundary of roads used by construction traffic within 500m of the site exit. The sensitivity of the area to human health impacts for trackout activities is therefore **Low.**

Sensitivity of Areas Analysis

7.21. The sensitivity of the receptors and area has been defined for both dust soiling and human-health impact as shown in Table 8.22

Receptor Sensitivity	Sensitivity of the Receptors	Relevant Definition	Sensitivity of the Area
Dust Soiling for Earthworks, Construction	High	Maximum of 10 – 100 receptors within 100m of site.	Low
Dust Soiling for Trackout	High	Currently no sensitivity receptors within 500m of the trackout route.	Low
		Once residential properties to the south-east have been constructed there will be 10 – 100 receptors within 50m of route used by construction traffic	Medium
Human-Health Effects of PM_{10} for Earthworks and Construction	High	<24 $\mu g/m^3$ annual mean PM_{10} concentration. 10 – 100 receptors within 20m of site.	Low
Human-Health Effects of PM_{10} for Trackout	High	<24 $\mu g/m^3$ annual mean PM_{10} concentration. 10 – 100 receptors within 50m of route used by construction traffic	Low

Table 8.22: Determination of the Sensitivity of the Surrounding Area

Risk of Impact

7.22. The risk of dust impact to both dust soiling and human-health effects for each construction activities are summarised in Table 8.23.

Potential Impact (Sensitivity of the Area)	Dust Risk (Dust Emission Category)				
	Demolition (n/a)	**Earthworks (Large)**	**Construction (Large)**	**Trackout (Medium)**	**Overall Risk**
Dust Soiling (Low for Earthworks, Construction and Low/Medium for Trackout)	n/a	Low	Low	Low	Low
Human-health (Low for Earthworks and Construction and Trackout)	n/a	Low	Low	Low	Low
Overall	**n/a**	**Low**	**Low**	**Low**	**Low**

Table 8.23: Risk of Impacts during Construction

7.23. The dust impact assessment has demonstrated that the risk of dust soiling without any mitigation is Low for earthworks, construction and trackout

7.24. The risk of adverse human-health effects of PM_{10} without any mitigation is Low for earthworks, construction and trackout.

7.25. The overall risk of unmitigated impacts is Low for earthworks, construction and trackout

Summary of Construction Impacts

7.26. Table 8.24 presents the potential Significance of Effects for Air Quality, Odour and Dust impacts identified for the Construction Phase.

Nature of Impact	Receptor	Environmental Impact	Significance of Effect	Confidence Level
PM_{10} and NO_x from on-site Construction NRMM machinery	Local high sensitivity human receptors	Minor Negative	Negligible to Minor Adverse	High
PM_{10} and NO_x from Construction traffic exhaust emissions (trackout)	Local high sensitivity human receptors	Moderate Negative	Negligible to Minor to Adverse	High
Dust and PM_{10} associated with earthworks activities	Local high sensitivity human receptors	Minor Negative	Negligible to Minor to Adverse	High
Dust and PM_{10} associated with construction activities	Local high sensitivity human receptors	Minor Negative	Negligible to Minor Adverse	High

Table 8.24: Significance of Effects- Construction

Operational Effects

Operational Traffic

7.27. The results of dispersion modelling of NO_2, PM_{10} and $PM_{2.5}$ emission associated with operational traffic are listed in Appendix 8.5. These include results for 2019 baseline year and future opening year 2022 predictions for do-minimum and do-something.

7.28. In terms of impacts associated with road traffic, the assessment considers the impacts on air quality that would arise from growth in baseline traffic that would occur irrespective of the Proposed Development resulting from other committed developments.

7.29. Modelling using traffic flows for all phases of the development, (Phases 1, 2 and 3) but keeping backgrounds and emissions at commencement year Phase 1 (2022), assuming no improvement in vehicle emissions by the opening years (2024 to 2034) and is therefore considered to constitute a conservative approach. The changes in annual mean NO_2 concentrations between DM and DS scenarios are predicted to range between 0.1µg/m^3 and 0.8µg/m^3 at all modelled receptors. A maximum concentration of 36.9 µg/m^3 is predicted at Receptor 4. This is below the annual mean objective (40µg/m^3). Based on the predicted concentrations and the magnitude of change, the impact descriptor at all locations is negligible.

7.30. Modelling has also been carried out using traffic flows for all phases of the development, (Phases 1, 2 and 3) but keeping backgrounds and emissions at anticipated Phase 1 opening (2024), assuming no improvement in vehicle emissions by the opening years (2025 to 2034) and is therefore considered to constitute a conservative approach. The changes in annual mean NO_2 concentrations between DM and DS scenarios are predicted to range between 0.1µg/m^3 and 0.6µg/m^3 at all modelled receptors. A maximum concentration of 31.0 µg/m^3 is predicted at Receptor 4. This is below the annual mean objective (40µg/m^3). Based on the predicted concentrations and the magnitude of change, the impact descriptor at all locations is negligible.

7.31. Following guidance provided in LAQM.TG16[6], as all modelled results predict annual mean concentrations less than 60µg/m^3, it is unlikely that the opening of the Proposed Development in 2022 would exceed the hourly mean NO_2 objective.

7.32. The most conservative changes in annual mean PM_{10} and $PM_{2.5}$ concentrations between DM and DS scenarios are predicted to range between <0.1µg/m^3 and 0.2µg/m^3 at all modelled receptors. Based on the predicted concentration and the magnitude of change, the impact is negligible at all sensitive receptors due to the operation of the Proposed Development.

Operational On-site Combustion Plant

7.33. The predicted process contributions to the long-term (annual mean) NO_2 concentrations associated with operation of the combustion plant (as part of Phases 1, 2 and 3) at each of the residential receptors are listed in Table 8.58, Appendix 8.7. The predicted contributions for Phase 1 only are listed in Table 8.59, Appendix 8.7.

7.34. The maximum process contribution (PC) associated with combustion plant from Phase 1 only is 1.1µg/m^3 NO_2 predicted at Receptor 11. For phase 1 only, the maximum percentage change is 2.8%[3] at Receptor 11. All impacts at all receptors are predicted to be negligible.

7.35. The maximum process contribution associated with the combined emissions from Phase 1, 2 and 3 combustion plant is 2.5 µg/m^3 predicted at Receptor 9. Receptor 9 is a proposed residential receptor located closest to the Application Site. The maximum percentage change relative to the air quality objective is 6.3% at Receptor 9, which is slightly above the significance threshold of 6%, and therefore indicates a slight impact. However, with the use of 2022 background NO_2 concentrations, the total concentrations are well below the annual mean objective.

7.36. The gridded results across the assessment extent are summarized in Appendix 8.7 and include plots to illustrate the predicted impacts. It can be seen from Appendix 8.6 Figure 8.19 that the maximum combined impact for Phases 1, 2 and 3 occurs within the centre of the Application Site, closest to the main flues. Figure 8.20 in Appendix 8.7 shows that the maximum impact for Phase 1 only is to east of the site.

7.37. Appendix 8.7 Figure 8.21 shows the percentage NO_2 contribution to annual mean for the combined impact of on-site combustion processes associated with Phases 1, 2 and 3, with values >6% predicted at locations to the east of the Application Site. As it apparent from the point receptor results, this includes some of the proposed residential area to the south of the Application Site. However, Appendix 8.7 Figure 8.22 shows the total NO_2 annual mean concentrations for Phases 1, 2 and 3, having added the total process contributions to the 2022 Defra backgrounds concentrations, and are all well below the annual mean objective (40µg/m^3) at all locations across the modelled domain.

7.38. Predicted total annual mean NOx concentrations at receptor locations within the ecological sites in the area (15km buffer) are all below the limit value (30µg/m^3). A maximum total concentration of 28.1µg/m^3 was predicted at location 39, which is within Halkyn Common and Holywell Grasslands SAC, located 12km to the north-east from the Application Site. The process contribution at this site is <0.1µg/m^3, and therefore the operational combustion plant

is having a negligible impact on NOx concentrations, with existing background concentrations being the main source. The maximum change relative to the air quality objective (AQO) is 1.0% at receptors within the River Dee SAC/SSSI. As the % changes at all locations are not >1% a negligible impact is predicted at all ecological receptors. The impact of the operation of the Application Site all ecological features can therefore be screened out as insignificant.

7.39. Table 8.64 shows change in nitrogen deposition for both Phase 1 only and Phase 1, 2 and 3 combined at each of the ecological receptor points is <1% of the corresponding minimum critical load (CL). A maximum of 0.71% PC to CL is predicted at receptor point 28 on the River Dee and Bala Lake SAC/ SSSI. The impact of the operation of the Application Site all ecological features can therefore be screened out as insignificant. NRW requested that further consideration of other relevant projects may be required to ascertain whether there are possible in-combination effects, and liaison with the LPA regarding other potentially relevant projects. We have approached the Council, however they have confirmed there is no data available on other potential projects in the locality.

7.40. Sensitivity testing of flue heights has been carried out for the gas turbines (E3 and E10) for all phases. Due to the size and hours of operation these are the on-site combustion source with maximum potential for impact on operational emissions. The results of flue height sensitivity testing accounting for the combined operational impact of all combustion plant and operational traffic are listed in Appendix 8.8 and discussed in the following paragraph. Tables 8.65 to 8.68 in Appendix 8.7 report the results from operational combustion plant emissions with an increased flue height of 30m for the main and by-pass units (E3 and E10). Based on the predicted process contributions (PC) and total concentration or predicted environmental concentrations (PEC) for on-site combustion plant associated with Phase 1 only or Phases 1,2 and 3, impacts are predicted to be negligible at all residential and ecological receptors. With the embedded mitigation of increased flue height of 30m for the main and by-pass units (E3 and E10), the impact of the on-site combustion plant has therefore been assessed as insignificant.

Combined Impact from Operational Traffic and On-Site Combustion Plant

7.41. Table 8.69 in Appendix 8.8 shows the combined impact of the operational traffic (all phases) and Phase 1 only on-site combustion plant at each of the modelled residential receptors. The traffic increases represent the combined impacts of Phases 1, 2 and 3 but backgrounds and emissions have been retained at Phase 1 commencement year (2022). Completion of Phase 1 and the start of operation is not anticipated to be until 2024, so there is an element of over conservatism within the data presented. Based on 2022 emissions and backgrounds, a negligible impact is predicted at all modelled residential receptors.

7.42. Table 8.70 in Appendix 8.8 shows the combined impact of the operational traffic and on-site combustion plant for Phases 1, 2 and 3 at each of the modelled residential receptors. Evaluation of the combined Impact from Operational Traffic and On-site Combustion Plant emissions based on 2022 emissions and backgrounds, a maximum concentration of 37.3µg/m^3 is predicted at receptor 4, which is still below the annual mean objective (40µg/m^3). Slight adverse impacts are predicted at receptors 3, 4 and 9. Negligible impacts are predicted at all other residential receptors.

7.43. Receptors 3 and 4 are existing receptors close to the modelled road network. Do-minimum (DM) concentrations are already higher as a result of proximity to these roads. The operational impact of the Application Site is predicted to increase NO_2 annual mean concentrations by a total of 0.9µg/m^3 at Receptor 3, but the total concentration remains below the annual mean objective (40µg/m^3). Due to the overly conservative approach of using 2022 emissions and backgrounds with the inclusion of Phase 2 (2024) and Phase 3 (2034) traffic flows within the model, this impact is considered to be not significant.

7.44. Receptor 9 is a proposed residential receptor. Due to the absence of nearby roads in the do-minimum scenario, the change in emissions associated with the operation of the Application Site is larger, with a total predicted increase of 2.6µg/m^3 at Receptor 9. However, the overall predicted concentrations are well below the annual mean objective. In addition, due to the overly conservative approach of using 2022 emissions and backgrounds but the inclusion of Phase 2 (2024) and Phase 3 (2034) traffic flows within the model, this impact is considered to be not significant.

7.45. Sensitivity testing of flue heights has been carried out for the gas turbines (units E3 and E10), which due to the size and hours of operation are the on-site combustion source with maximum potential for impact on operational emissions. The results for potential E3 and E10 stack heights of 29m and 30m including emissions from all phases are shown in Table 8.71 in Appendix 8.8. Increasing the flue height from 28.5m to 29m does not change the impact descriptor of slight adverse at Receptor 9, however the impact at receptor 9 is reduced to negligible if the stack height is increased to 30m. As the ambient NO_2 concentrations in the wider area are low, the total concentrations predicted at Receptor 9 are all well below the annual mean objective, regardless of the stack height. A stack height of 30m still results in a slight adverse impact descriptor for receptors 3 and 4. This is due to the already elevated traffic flows in the area. Total concentrations remain below the annual objective. Increasing the flue height beyond 30m therefore has minimum impact and is therefore not considered necessary.

7.46. Following guidance provided in LAQM.TG16[6], as all modelled results associated with the combined impact from operational traffic and on-site combustion plant predict that annual mean concentrations will be less than 60µg/m^3, it is unlikely that the commencement of the Proposed Development in 2022 would exceed the hourly mean NO_2 objective.

7.47. Accounting for the contribution from the on-site combustion plant and the operational traffic, predicted total annual mean NOx concentrations at receptor locations within the ecological sites in the area (15km buffer) are all below the limit value (30µg/m^3). The change in concentrations does not exceed 0.3µg/m^3 at any of the ecological receptors. As the % changes at all locations are not >1%, a negligible impact is predicted at all ecological receptors.

7.48. The change in nitrogen deposition for the 2022 scenario (process contribution (PC)) at each of the ecological receptor points is <1% of the corresponding minimum critical load (CL). A maximum of 0.79% PC to CL is predicted at receptor point 47 on the River Dee Estuary SAC/ SSSI. The impact of the operation of the Application Site all ecological features can therefore be screened out as insignificant.

Odour

Source Odour Potential

7.49. In accordance with IAQM guidance and the professional judgement of the practitioner, medium source odour potential has been assigned to wastewater treatment from the on-site facilities. The wastewater requiring treatment is not from an overly odourous source.

Receptors and Sensitivity to Odour Effects

7.50. In accordance with IAQM guidance[18] and the professional judgement of the practitioner, the local residential properties, such as the existing and properties to the south-east of the Application Site boundary are determined to be of 'High Sensitivity' to odour. This judgement has been made because these receptors could reasonably expect enjoyment of a high level of amenity and could reasonably be expected to be present regularly for extended periods as part of the normal pattern of use of the properties.

Pathway Effectiveness for Odour Flux

7.51. The pathway effectiveness was assessed in accordance with IAQM guidance[23], paying due consideration to the following:

- The close proximity of local receptors to the source (which would potentially give rise to a 'Moderately Effective' pathway), and:
- The release of odours from a high level (for example, stacks or roof vents greater than 3m above ridge height) and no reduction of dispersion by surrounding buildings

7.52. There are proposed residential receptors close to the boundary of the Application Site. However, design proposals shown these to be set back beyond a green buffer zone. In addition the potentially odourous on-site on activities, such as the wastewater treatment plant, are to be located on the opposite site of the site to the sensitive receptors, with tall buildings located in between.

7.53. There will be embedded mitigation in place at the wastewater treatment plant, such as closed primary and biological sludge tanks, deodorized with activated carbon. This is discussed further in the mitigation section of this Paper.

7.54. Having considered these factors, the overall pathway effectiveness was determined to be 'Ineffective'.

Odour Effects

7.55. A screening assessment was undertaken at sensitive receptor locations around the site perimeter. A summary of the likely odour effects at each of the screening assessment receptors is shown in Table 8.25.

Receptor Details and Location	Source Odour Potential	Pathway Effectiveness	Odour Exposure	Receptor Sensitivity	Likely Odour Effect/ Impact
Residential properties at Garden City to the south-east	Medium	Ineffective	Negligible Risk	High Sensitivity	Negligible effect

Table 8.25: Summary of the Likely Odour Effects at Screening Assessment Receptors

Summary of Operational Impacts

7.56. Table 8.26 presents the potential Significance of Effects for Air Quality, Odour and Dust impacts identified for the Operational Phase.

Nature of Impact	Receptor	Environmental Impact	Significance of Effect	Confidence Level
Emissions from an increase in operational traffic	Local high sensitivity human receptors	Negligible to Minor Negative	Negligible*	High
Emission from on-site combustion plant	Local high sensitivity human receptors	Negligible to Minor Negative**	Negligible**	High
Odour nuisance from existing and future sources	Local high sensitivity human receptors	Negligible	Negligible***	High

* Using Phase 1 commencement year (2022) background and emissions, the impact is predicted to be negligible at all receptors. This is still considered to be conservative as background concentrations and emissions are traffic flows for all phases of the Application Site were included in the dispersion modelling. Backgrounds and emissions are anticipated to reduce further by the time Phase 1 becomes fully operational in 2024 and further still by the opening year of Phase 3 (2034).

** Increasing the heights of the gas turbine flues to 30m results in a predicted negligible impact at the receptor closest to the Site and has therefore been recommended as embedded mitigation. A slight impact is still predicted at residential receptors close to the modelled road network to the south of the Application Site, due to already elevated concentrations associated with traffic flows. However, accounting for background NO_2 concentrations, the total NO_2 concentration remains below the annual mean objective. The impact is therefore not considered to be significant.

*** Due to the provision of embedded mitigation, as well as the distance of the odour source to sensitivity receptors, a negligible impact is predicted.

Table 8.26: Significance of Effects – Operation

8. Proposed Mitigation

Construction Phase

8.1. The primary aim of the dust risk assessment is to identify the appropriate site-specific mitigation measures that will be adopted to ensure there will be no significant effect on local amenity and human health.

8.2. Full details of mitigation measures to mitigate construction dust are presented in Appendix 8.9 and should be read in accordance with the findings of the construction dust assessment (section 7). As the construction dust assessment has concluded a low risk for earthworks, construction and trackout activities, all primary measures listed for low risk sites will be required. These include measures relating to site management. site maintenance, operating vehicles, site operations, waste management. Secondary measures applicable for low risk sites may also be required, subject to agreement with the Local Authority. These are also listed in Appendix 8.9 and relate to site preparation and maintenance, operating machinery, construction procedures and trackout.

8.3. Best Practice mitigation measures identified in Appendix 8.9 will be implemented via a Construction Environmental Management Plan (CEMP) to avoid, minimise or mitigate any construction effects on the environment in respect. It is anticipated that this will be formally requested by Planning Condition and will include the requirement fora Dust Management Plan. The Dust Management Plan is to ensure that all recommended mitigation measures will be implemented properly. The Framework CEMP is included in Appendix 15 of ES Part 1 Report.

8.4. Emissions from NRMM will be mitigated through the specification of minimum Non Road Mobile Machinery (NRMM) emission requirements, in accordance with Department for Transport guidance[27].

8.5. It is anticipated that the dust generation and harmful emissions from construction site activities will be greatly reduced or eliminated with the correct implementation of the best practice methods identified.

Operational Phase

8.6. Based on the predicted concentrations using opening (2022) emissions and backgrounds the impact of the operation on all traffic sensitive receptors is negligible, and therefore no mitigation measures are required. The predicted concentrations associated with operational

traffic will be accounted for as a cumulative impact in the assessment of the on-site combustion plant.

8.7. The combined impact of the operational traffic and operational combustion for Phases 1, 2 and 3 indicates a slight impact at some of the receptors. However, this is due to already elevated traffic flows in the area or the absence of any existing flows and therefore a greater change in emissions. Sensitivity testing of the flue height of the gas turbines (E3 and E10) demonstrated that increasing the flue heights to 30m would result in negligible impacts at the receptors closest to the site. A slight impact still remained at some of the receptors close to the road network. However, increasing the flue height beyond 30m has minimum impact on these receptors and is therefore not considered necessary, therefore a height of 30m for the gas turbines (E3 and E10) flues is recommended as embedded mitigation. The predicted concentrations at all modelled receptors are below the NO_s annual mean objective and therefore a negligible impact is predicted.

8.8. Embedded mitigation will be adequately designed to not cause an odour nuisance issues to nearby receptors associated with the WWTP. This will include embedded mitigation such as closed primary and biological sludge tanks, deodorized with activated carbon.

8.9. The following aspects have been included within the design of the development to minimise air quality impacts:

- The design and layouts for the buildings on Site have been selected to reduce the impact of the Site on its local setting. This includes locating the potentially odourous processes furthest from the residential development;
- The plant will be equipped with a heat recovery system through a heat exchanger dedicated to heating the combustion air and makeup air of the drying system, reducing energy consumption;
- A heat recovery system will be installed as part of the cogeneration system. The recovered heat will be used for the paper machine hall ventilation system as well as converting hall and warehouses heating.

8.10. A Travel Plan has been developed and is submitted with the planning application. This identifies an overarching framework for minimising the impacts of travel, ensuring easy access for all and allowing site users to make informed travel choices. The Travel Plan sets out a range of key objectives and potential measures relevant to users for each land use and processes for the management and review of travel behaviour. This sets out measures to encourage the use

of public transport, cycling and car sharing. The proposals also include provision for a total of 15 electric vehicle charging points.

9. Potential Residual Effects

9.1. The following tables show the residual significance of the environmental effect from air quality, dust and odour post mitigation, through both the construction and operational phase.

Potential Residual Effects – Construction Phase

9.2. The overall impact of the proposal in terms of air quality, odour and dust issues during the construction phase is highlighted in the Table 8.27.

9.3. In recognition that there is the potential for short term impacts to arise on occasion, and therefore result in nuisance issues at nearby sensitive human receptors, it has been assumed that even with the implementation of a Construction Environmental Management Plan (CEMP), it cannot be guaranteed that all impacts will be reduced to negligible significance. This is potentially relevant where there are construction activities taking place near sensitive receptors close to the Application Site boundary. Under these conditions, it is predicted that worst-case residual impacts will be reduced to Minor Adverse. These impacts are temporary, during the construction phase.

Nature of Impact	Receptor	Environmental Impact	Significance of Effect	Confidence Level	Mitigation	Residual Significance of Effect
PM_{10} and NO_x from on-site Construction NRMM machinery	Local high sensitivity human receptors within 350m of site boundary.	Detrimental impacts to ambient air quality	Negligible to Minor Adverse	High	Specification of minimum NRMM emission requirements	Negligible
PM_{10} and NO_x from Construction traffic exhaust emissions (trackout)	Local high sensitivity human receptors within 50m of the trackout route for construction vehicles, within 200m from the site exit.	Detrimental impacts to ambient air quality	Negligible to Minor to Adverse	High	Listed in Appendix 8.6. Based on the construction dust assessment within this Technical Paper, these should include high risk mitigation measures for trackout of construction vehicles	Negligible

Nature of Impact	Receptor	Environmental Impact	Significance of Effect	Confidence Level	Mitigation	Residual Significance of Effect
Dust and PM_{10} associated with earthworks activities	Local high sensitivity human receptors within 350m of site boundary	Detrimental impacts to human health for increases in PM_{10}. Nuisance to human health	Negligible to Minor Adverse	High	Listed in Appendix 8.6 6. Based on the construction dust assessment within this Technical Paper, these should include high risk mitigation measures for earthworks	Negligible
Dust and PM_{10} associated with construction activities	Local high sensitivity human receptors within 350m of site boundary.	Detrimental impacts to human health for increases in PM_{10}. Nuisance to human health and possible smothering effects for ecological receptors for dust.	Negligible to Minor Adverse	High	Listed in Appendix 8.6 6. Based on the construction dust assessment within this Technical Paper, these should include high risk mitigation measures for construction	Negligible

Table 8.27: Residual Significance of Effect – Construction Phase

Potential Residual Effects – Operational Phase

9.4. The overall impact of the proposal in terms of air quality, odour and dust issues during the operational phase is highlighted in the Table 8.28.

Nature of Impact	Receptor	Environmental Impact	Significance of Effect	Confidence Level	Mitigation	Residual Significance of Effect
Emissions from an increase in operational traffic	Local high sensitivity human receptors	Detrimental impacts to ambient air quality	Negligible to Minor Adverse	High	None proposed	Negligible
Emission from on-site combustion plant	Local high sensitivity human receptors	Detrimental impacts to ambient air quality	Negligible	High	Embedded mitigation with gas turbine heights to 30m above proposed ground levels*	Negligible*

Nature of Impact	Receptor	Environmental Impact	Significance of Effect	Confidence Level	Mitigation	Residual Significance of Effect
Odour nuisance from existing and future sources	Local high sensitivity human receptors	Odour nuisance in the local area	Negligible	High	Embedded mitigation measures included within the design of the on-site wastewater treatment works.	Negligible
Notes: * Increasing the stack height of the main turbines above 30m would result in a negligible impact associated with the on-site combustion plant at the nearest receptors.						

Table 8.28: Residual Significance of Effect - Operation Phase

9.5. In conclusion, it is considered that following appropriate mitigation, which is embedded in the detailed design, the overall effects are considered to be not significant.

10. Additive Impacts (Cumulative Impacts and their Effects)

10.1. For the purposes of this ES we define the additive cumulative effects as:

> ***'Those that result from additive impacts (cumulative) caused by other existing and/or approved projects together with the project itself***

10.2. The developments that are likely to have a cumulative impact when considered with the Proposed Development have been scoped with the Local Authority and Key Consultees during the preparation of this ES (a full list is included within Section 9 of the ES Part 1 Report). The following table includes the agreed list of cumulative developments that have been assessed in respect of Air Quality, Odour and Dust. These are also shown geographically on the plan included at **Appendix 13** of the ES Part 1 Report.

No.	Cumulative Development	Details	Status	Justification for Inclusion in Cumulative Assessment
1	Airfields (former RAF Sealand) Site (Northern Gateway) LPA ref: 049320 and last varied S73 application LPA ref: 061125. Applicant: Praxis Holdings / Crag Hill Estates Ltd.	Outline application for the redevelopment of a strategic brownfield site for an employment led mixed use development with new accesses and associated infrastructure including flood defences and landscaping. The Net Cumulative Development associated with the Airfields site after deducting the floor space (124,344m²) taken up by the Proposed ICT Paper Mill Facility (B2, B8, ancillary B1a) and operational Amazon development (ref: 060222) is as follows: Development comprises: Residential (C3): 689 units Retail (A1): 4,646m² Office (B1a): 6,533m² B2 /B8 Employment: 60,044m² Car Dealership (Sui generis): 7,779m² **Total floorspace: 689 units / 79,002m²**	LPA ref: 049320 Planning permission granted by Flintshire County Council in January 2013. The last varied S73 application was granted on the 26 April 2021 (ref: 061125) to remove conditions 26, 28, 30, 34 and 44 and vary condition 13. Development expected to come forward over the next 0-5 years.	Potential relationship in terms of traffic and transportation. Given the distance to the Proposed Development and the potential for construction phases to overlap, cumulative air quality impacts should be considered. Operational traffic flows associated with the Proposed Development have already been included within in the future baseline scenario (do-minimum) and have therefore not been considered further as part of the cumulative assessment.

No.	Cumulative Development	Details	Status	Justification for Inclusion in Cumulative Assessment
2	Former Corus Garden City Site (Northern Gateway) Applicant: PGNGL Outline (LPA ref: 054758) / S73 application (LPA ref: 059635)	Employment-led mixed-use development, incorporating Logistics and Technology Park (B1, B2, B8) with residential (C3), local retail centre (A1), hotel (C1), training and skills centre (C2, D1), new parkland; conversion of buildings, demolition of barns; and associated infrastructure comprising construction of accesses, roads, footpaths / cycle paths, earthworks and flood mitigation / drainage works at Northern Gateway, Land off Welsh Road, Deeside. Development comprises: Residential (C3): 770 units Retail (A1): 2500m² Office (B1a): 3300m² Light industrial uses (B1b, B1c): 7400m² Hotel Uses (C1): 3000m² Training and skills centre (C2, D1): 4000m² Logistics Park (B2, B8, ancillary B1a): 120000m² **Total floorspace: 770 units / 140,200m²**	Outline planning permission granted by Flintshire County Council in May 2014. The last permission to be granted under a S73 application was approved in June 2020 (ref: 059635) was for removal of conditions 6, 8, 11 and 32 and variation of conditions 7, 31, 36 and 44. Development expected to come forward over the next 0-10 years.	Potential relationship in terms of traffic and transportation. Given the distance to the Proposed Development and the potential for construction phases to overlap, cumulative air quality impacts should be considered. Operational traffic flows associated with the Proposed Development have already been included within in the future baseline scenario (do-minimum) and have therefore not been considered further as part of the cumulative assessment.

Table 8.29: Cumulative Development

10.3. There is the potential for cumulative air quality impacts to arise resulting from traffic generated by these schemes in the vicinity of the Proposed Development.

10.4. The increase in traffic associated with these developments has already been included within in the future baseline scenario (do-minimum) and has therefore not been considered as part of the cumulative assessment.

10.5. Both Construction and Operational phases have considered and the short, medium and long-term impacts assessed. There are no short, medium or longer-term impacts associated with cumulative air quality impacts resulting from traffic generated by all cumulative development.

10.6. Natural Resources Wales (NRW) in their statutory pre-application consultation letter (10th October 2021) advised that consideration of other relevant projects may be required to ascertain whether there are possible in-combination effects. We have approached the Council,

however they have confirmed there is currently no data available on other potential projects in the locality. The results of modelling at ecological receptor points included in this assessment could be used, if still necessary, to assess the in-combination effects on European Habitats arising from the on-site combustion plant and emissions from the surrounding area. These results will be used to inform a Habitats Risk Assessment (HRA) along with the emissions contributions from surrounding consented development, as yet to be agreed with Flintshire County Council

11. Conclusion

11.1. This Technical Paper has assessed the environmental impact of Air Quality, Odour and Dust associated with the Proposed Development. A review of current legislation and national and local policy has been made. An assessment has been made of existing baseline conditions and potential impacts associated with construction and operational of the Proposed Development.

11.2. The Proposed Development is not located within or near an AQMA. No exceedances of the annual mean NO_2 objective (40µg/m^3) were recorded at any of the sites NO_2 diffusion monitoring sites within 5km of the Proposed Development between 2015 and 2019. The nearest PM_{10} monitoring data indicates exceedances of the short-term objective. This site is however located a considerable distance from the Application Site so not considered to be representative of local conditions but has been reported in the absence of local data. Defra background concentrations within the study are area below the NO_2, PM_{10} and $PM_{2.5}$ air quality objectives.

11.3. Emissions of construction dust have been assessed using the qualitative approach outlined in the IAQM guidance. It was concluded that in the absence of any adequate mitigation, there is a low risk from earthworks, construction and trackout dust-generating activities associated with the Proposed Development. Overall, there is potential for an unmitigated high adverse impact. However, with the implementation of appropriate mitigation measures, it is anticipated that the dust generation and harmful emissions from construction site activities will not be significant.

11.4. The mitigation of construction dust emissions will be addressed by an appropriate Construction Environmental Management Plan (CEMP), developed by the main contractor, controlled by planning condition. Several best practice construction dust mitigation measures recommended for inclusion within the CEMP have been provided within this Technical Paper (See Appendix 8.6) and an outline CEMP is provided in **Appendix 14** of the ES Part 1 Report.

11.5. The impact of emissions from operational traffic have been assessed using atmospheric dispersion modelling. Adopting a conservative approach, emissions and backgrounds have been kept commencement of Phase 1 (2022) or opening year for Phase 1 (2024) or for all 3 phases of the scheme, even though Phase 3 is not due to commence until 2035. The maximum predicted annual mean NO_2 concentrations at these receptors is 36.9µg/m^3 which is below the annual mean objective (40µg/m^3). Modelling using 2022 or 2024 emissions and backgrounds predicts a negligible impact at all receptors. Using 2022 or 2024 emissions and backgrounds is also considered to be conservative, as traffic flows from all 3 phases of the development have been included and further reductions in emissions and backgrounds are

anticipated by the commence of Phase 3 (2035). Particulate matter (PM_{10} and $PM_{2.5}$) concentrations are predicted to be negligible at all receptors with predicted concentrations well below the annual means. It can therefore be concluded that the impacts associated with operational traffic are likely to be negligible and therefore no further mitigation measures are required.

11.6. Excluding one location, detailed assessment of the on-site combustion plant associated with operation of phases 1, 2 and 3 predicts negligible impacts at the sensitive receptors. Detailed assessment on the operational on-site combustion predicts a slight impact at a proposed residential receptor to the south of the Application Site, however the percentage NO_2 contribution to annual mean is only slightly above the threshold for slight impact. In addition, the total NO_2 concentrations are well below the annual mean objective. A significant impact is therefore not predicted and the impact. Sensitivity testing of flue heights for the gas turbines indicates that that flues at a height of 30m results in a predicted negligible impact at this closest receptor, Therefore a height of 30m for gas turbines (E3 and E10) is recommended as embedded mitigation. With a negligible impact predicted at all residential receptors, the impact of the operation of the on-site combustion plant associated with Phases 1, 2 and 3 of the Application Site has therefore been assessed as insignificant.

11.7. It has been demonstrated that the combined operational traffic and combustion plant emissions have a negligible impact on NOx concentrations at sensitive ecological receptors, with existing background concentrations being the main source. Predicted total annual mean NOx concentrations at receptor locations within the ecological sites in the area (15km buffer) are all below the EU limit value (30µg/m^3). A negligible impact is therefore predicted at all ecological receptors.

11.8. An assessment of nitrogen deposition rates for Phase 1 only and Phases 1, 2 and 3 combined at each of the ecological receptor points predicted a deposition rate of below 1% of the corresponding minimum critical load. The impact of the operation of the Application Site on all ecological features has been therefore been assessed as insignificant.

11.9. The results of modelling at ecological receptor points included in this assessment could be used, if still necessary, to assess the in-combination effects on European Habitats arising from the on-site combustion plant and emissions from the surrounding area. These results will be used to inform a Habitats Risk Assessment (HRA) along with the emissions contributions from surrounding consented development, as yet to be agreed with Flintshire County Council

11.10. A source pathway receptor assessment for odour impact has been undertaken. This has predicted a negligible impact and low likelihood of odour nuisance complaints as a result of

the Proposed Development. This is based on the assumption of embedded mitigation at the wastewater treatment plant, and also a consideration of distance to sensitive receptors.

11.11. On this basis, all effects are considered 'Not Significant' in EIA terms or insignificant in terms of air emissions risk assessment to inform an environmental permit application.

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13. Appendices

Appendix 8.1 IAQM Construction Assessment Methodology

Screening (Step 1)

13.1. As 'human receptors' were identified within 50 m of the boundary of the site; and within 50 m of the route(s) to be used by construction vehicles on the public highway, up to 500 m from the site entrance, a detailed risk assessment was undertaken.

Dust Emission (Step 2A)

13.2. The potential dust emission magnitude for different activities have been defined based on the criteria listed in Table 8.30.

Stage	Description	Large	Medium	Small
Demolition	Definitions for demolition are:	Total building volume >50,000 m^3 Potentially dusty construction material (e.g. concrete) On-site crushing and screening Demolition activities >20 m above ground level	Total building volume 20,000 m^3 – 50,000 m^3 Potentially dusty construction material (e.g. concrete) Demolition activities 10 – 20 m above ground level	Total building volume <20,000 m^3 Construction material with low potential for dust release (e.g. metal cladding or timber) Demolition activities <10 m above ground, demolition during wetter months
Earthworks	Earthworks will primarily involve excavating material, haulage, tipping, and stockpiling. This may also involve levelling the site and landscaping.	Total site area >10,000 m^2 Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) >10 heavy earth moving vehicles active at any one-time formation of bunds >8 m in height Total material moved >100,000 tonnes	Total site area 2,500 m^2 – 10,000 m^2 Moderately dusty soil type (e.g. silt) 5-10 heavy earth moving vehicles active at any one-time formation of bunds 4 m – 8 m in height Total material moved 20,000 tonnes – 100,000 tonnes	Total site area <2,500 m^2 Soil type with large grain size (e.g. sand) <5 heavy earth moving vehicles active at any one-time formation of bunds <4 m in height Total material moved <20,000 tonnes, earthworks during wetter months

Stage	Description	Large	Medium	Small
Construction	The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s) / infrastructure, method of construction, construction materials, and duration of build.	▪ Total building volume >100,000 m^3 ▪ On-site concrete batching and sandblasting	▪ Total building volume 25,000 m^3 – 100,000 m^3 ▪ Potentially dusty construction material (e.g. concrete) ▪ On-site concrete batching	▪ Total building volume <25,000 m^3 ▪ Construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout	Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology, and duration. Only receptors within 50 m of the routes used by vehicles on the public highway and up to 500 m from the site entrances are considered to be at risk from the effects of dust.	▪ >50 HDV (>3.5 tonnes) outward movements in any one day ▪ Potentially dusty surface material (e.g. high clay content) ▪ Unpaved road length >100 m	▪ 10-50 HDV (>3.5 tonnes) outward movements in any one day ▪ Moderately dusty surface material (e.g. high clay content) ▪ Unpaved road length 50 m – 100 m	▪ <10 HDV (3.5 tonnes) outward movements in any one day ▪ Surface material with low potential for dust release ▪ Unpaved road length <50 m

Table 8.30 Potential Dust Emission Magnitude Criteria

Sensitivity of the Area (Step 2B)

13.3. The sensitivity of the area takes account of several factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

13.4. Table 8.31 provides guidance on the sensitivity of different types of receptor.

Description	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Sensitivities of People to Dust Soiling Effects	1. Users can reasonably expect enjoyment of a high level of amenity 2. The appearance, aesthetics, or value of their property would be diminished by soiling 3. The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land 4. Indicative examples include dwellings, museums, and other culturally important collections, medium, and long-term car parks, and car showrooms	5. Users would expect a to enjoy a reasonable level of amenity, but would not reasonably expect a to enjoy the same level of amenity as in their home 6. The appearance, aesthetics, or value of their property could be diminished by soiling 7. The people or property wouldn't reasonably be expected a to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land 8. Indicative examples include parks and places of work	9. The enjoyment of amenity would not reasonably be expected; or 10. Property would not reasonably be expected a to be diminished in appearance, aesthetics, or value by soiling 11. There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land 12. Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short-term car parks, and roads
Sensitivities of People to the Health Effects of PM_{10}	13. Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day) 14. Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment	15. Locations where the people exposed are workers d, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). 16. Indicative examples include office and shop workers but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation	17. Locations where human exposure is transient. 18. Indicative examples include public footpaths, playing fields, parks, and shopping streets

Description	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Sensitivities of Receptors to Ecological Effects	19. Locations with an international or National designation and the designated features may be affected by dust soiling 20. Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain 21. Indicative examples include a Special Area of Conservation designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings	22. Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown 23. Locations with a National designation where the features may be affected by dust deposition 24. Indicative example is a Site of Special Scientific Interest with dust sensitive features	25. Locations with a local designation where the features may be affected by dust deposition. 26. Indicative example is a local Nature Reserve with dust sensitive features

Table 8.31 Sensitivities of People to Dust Soiling Effects, Health Effects of PM_{10}, and Sensitivities of Receptors to Ecological Effects

13.5. Full details of the sensitivities of receptors are provided in the IAQM Guidance document.

13.6. Table 8.32, Table 8.33, and Table 8.34 show how the sensitivity of the area has been determined for dust soiling, human-health, and ecosystem impacts respectively.

13.7. These tables take account of several factors which may influence the sensitivity of the area. The highest level of sensitivity from each table has been recorded.

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 8.32 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Number of Receptors [d]	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<28	>10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table 8.33 Sensitivity of the Area to Human-Health Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table 8.34 Sensitivity of the Area to Ecological Impact

13.8. The highest level of sensitivity from each table has been recorded. Professional judgement has been used to determine alternative sensitivity categories with consideration of additional factors, such as any pre-existing screening between the source and the receptors, the season during which the works will take place, and duration of the potential impact.

Risk of Impact Definition

13.9. The dust emission magnitude (Step 2A) was combined with the sensitivity of the area (Step 2B) to determine the risk of impact with no mitigation applied. Tables 8.35 to 8.38 provide the method of assigning the level of risk of each activity and used to determine the level of site-specific mitigation.

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Medium risk
Medium	High risk	Low risk	Low risk
Low	Low risk	Low risk	Negligible

Table 8.35 Risk of Impact – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Medium risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

Table 8.36 Risk of Impact – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Medium risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

Table 8.37 Risk of Impact – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Medium risk
Medium	Medium risk	Low risk	Low risk
Low	Low risk	Low risk	Negligible

Table 8.38 Risk of Impact – Trackout

Appendix 8.2 – IAQM Local Air Quality Assessment Screening

Comparison Against IAQM Criteria

13.10. IAQM's guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' (updated in January 2017) was issued to ensure that air quality is adequately considered in the land-use planning and developmental control process.

13.11. It provides a decision-making process which assists with the understanding of air quality impacts and implications because of development proposals. It provides a framework for air quality considerations within local development control processes, promoting a consistent approach to the treatment of air quality issues within development control decisions.

13.12. The guidance includes a method for screening the requirement for an air quality assessment, the undertaking of an air quality assessment, the determination of the air quality impact associated with a development proposal and whether this impact is significant.

13.13. The guidance also provides some clarification as to when air quality constitutes a material consideration and highlights the links to other relevant issues (for example traffic speed reduction measure and the use of alternative technology to provide energy) and the importance of the understanding of these with the input from other discipline specialists. The 'creeping baseline' is another issue raised about cumulative impacts.

13.14. The guidance note is widely accepted as the most appropriate reference method for this purpose. This guidance refers to the Town and Country Planning (Development Management Procedure) Order (England) 2010 definition of a 'major' development when scoping assessments required for the planning process.

13.15. A 'major' development includes developments where:

- The number of dwellings is 10 or above;
- The residential development is carried out of a site of more than 0.5ha where the number of dwellings is unknown;
- The provision of more than 1,000m^2 commercial floor space; or,
- Development carried out on land of 1ha or more.

13.16. There are two types of air quality impacts to be considered:

- The impact of existing sources in the local area on the Proposed Development (governed by background pollutant levels and proximity to sources of air pollution); and,

- The impacts of the Proposed Development on the local area.

13.17. Regarding the changes in air quality or exposure to air pollution, the guidance indicates that each local authority will be likely to have their own view on the significance of this; these are to be described in relation to whether a National Air Quality Objective (NAQO)predicted to be met, or at risk of not being met. Exceedances of these objectives are considered as significant, if not mitigated.

13.18. As part of the impact of the Proposed Development on the local area, a two-staged assessment is recommended as per current guidance.

13.19. Stage 1: Determines whether an air quality assessment is required. In order to proceed to Stage 2, it requires any of the criteria under (A) coupled with any of the criteria under (B) in Table 8.39 to apply.

13.20. Stage 2: Where an assessment is deemed appropriate, this may take the form of a Simple Assessment or a Detailed Assessment, using suitable guidance provided in Table 8.40.

Criteria to Proceed to Stage 2
A. If any of the following apply: • 10 or more residential units of a site area of more than 0.5ha • More than 1,000m^2 of floor space for all other uses or a site area greater than 1ha
B. Coupled with any of the following: • The Proposed Development has more than 10 parking spaces • The Proposed Development will have a centralised energy facility or other centralised combustion process **Note:** Consideration should still be given to the potential impacts of neighbouring sources on the site, even if an assessment of impacts of the Proposed Development on the surrounding area is screened out.

Table 8.39 Stage 1 Criteria for Air Quality Assessment

	The Proposed Development will	Indicative Criteria to Proceed to an Air Quality Assessment
1.	**Cause a significant change in Light Duty Vehicle (LDV) traffic slows on local roads with relevant receptors.** **(LDV = cars and small vans <3.5t gross vehicle weight).**	A change of LDV flows of: • More than 100 AADT within or adjacent to an AQMA • More than 500 AADT elsewhere.
2.	**Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors.** **(HDV = goods vehicles + buses >3.5t gross vehicle weight).**	A Change of HDV flows of: • More than 25 AADT within or adjacent to an AQMA • More than 100 AADT elsewhere.
3.	**Realign roads, i.e. changing the proximity of receptors to traffic lanes.**	Where the change is 5m or more and the road is within an AQMA
4.	**Introduce a new junction or remove an existing junction near to relevant receptors.**	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. Traffic lights, or roundabouts.
5.	**Introduce or change a bus station.**	Where bus flows will change by: • More than 25 AADT within or adjacent to an AQMA • More than 100 AADT elsewhere.
6.	**Have an underground car park with extraction system.**	The ventilation extract for the car park will be within 20m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).
7.	**Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors.** **NB. this includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.**	Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates. Conversely, where existing NO_2 concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

Table 8.40 Indicative Criteria for Requiring an Air Quality Assessment

Impact Descriptors for Individual Receptors

13.21. The IAQM guidance contains a two Stage process for determining the likely significant effects of the impacts on air quality:

- A qualitative or quantitative description of the impacts on local air quality arising from the Proposed Development; and
- A judgement on the overall significance of the effects of any impacts.

13.22. A framework for describing the impacts is set out in IAQM guidance and summarised in Table 8.41 below.

Receptor ID	% Change in concentration relative to Air Quality Assessment Level (AQO)			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76 – 94% of AQO	Negligible	Slight	Moderate	Moderate
95 – 102% of AQO	Slight	Moderate	Moderate	Substantial
103 – 109% of AQO	Moderate	Moderate	Substantial	Substantial
110% or more of AQO	Moderate	Substantial	Substantial	Substantial

Table 8. 41: Indicative Criteria for Requiring an Air Quality Assessment

13.23. For air quality impacts arising from surrounding sources on new occupants of a development, then the impacts are best described in relation to whether an air quality objective will not be met or is at risk of not being met. Where the air quality is such that an air quality objective at the building façade is not met, the effect on residents or occupants will be judged as significant, unless provisions is made to reduce their exposure by some means.

13.24. Changes of less than 0.5%, will be described as Negligible.

Results of Screening Assessment

Where the Proposed Development will:	Indicative Criteria to Proceed to an Air Quality Assessment	Information Relevant to the Proposed Development
1. Cause a significant change in Light Duty Vehicle (LDV) traffic slows on local roads with relevant receptors.	IAQM Guidance states a change of LDV flows of: • More than 100 AADT within or adjacent to an Air Quality Management Area (AQMA) • More than 500 AADT elsewhere.	Traffic data provided by Curtins predicts changes of >500 AADT. Dispersion modelling of operational traffic has therefore been carried out to assess the impact.
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors.	A Change of HDV flows of: • More than 25 AADT within or adjacent to an AQMA • More than 100 AADT elsewhere.	Operational HDV flows are anticipated to be >50 AADT. Dispersion modelling of operational traffic has therefore been carried out to assess the impact. Predicted AADT construction traffic flows are <50 HDV. Construction traffic will be a temporary impact, during the construction period.
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA	No realignment of >5m proposed for any roads within an AQMA
4. Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. Traffic lights, or roundabouts.	New junctions included within the proposed road layout. Dispersion modelling of operational traffic has therefore been carried out to assess the impact.
5. Introduce or change a bus station.	Where bus flows will change by: • More than 25 AADT within or adjacent to an AQMA • More than 100 AADT elsewhere.	New coach station proposed
6. Have an underground car park with extraction system.	The ventilation extract for the car park will be within 20m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).	No underground car parking proposed
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors.	Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion.	There are a number of combustion plant proposed for the site. A detailed assessment will be carried out to inform the permit application and recommend mitigation measures as required.

Table 8.42 Indicative Criteria for Requiring a Detailed Air Quality Assessment

Appendix 8.3 – Methodology for Assessment of Operational Traffic Impacts

Dispersion Model

13.25. Detailed dispersion modelling of NO_x, PM_{10} and $PM_{2.5}$ emissions from operational traffic has been carried out using the latest version of ADMS-Roads Extra (version 5.0.0.1), which is an internationally recognised new generation dispersion model developed by CERC. ADMS uses advanced algorithms to describe the boundary layer structure, turbulence and stability.

13.26. The annual mean background and modelled roads contribution from ADMS-Roads were added together to give total concentrations and enable a comparison to be made with the air quality criteria for annual mean concentrations. The background concentrations used in the results processing are discussed in the following section. Modelled NO_2 concentrations were estimated from the modelled NO_x concentrations. For roads, Defra's NO_x to NO_2 calculator[39] was used with the 'All other urban UK traffic' mix assumed.

Background Pollutant Concentrations

13.27. Defra's mapped background pollutant concentration were used in the verification and model results processing. The modelling has assumed that there will be no reduction in background NO_2 concentrations between the phases of the development, with the background value for the commencement of Phase 1 (2022) used in of modelling of the total operational traffic associated with Phases 1, 2 and 3. Modelling has also been carried out using Phase 1 opening year (2024) emissions and backgrounds. This still retains an element of conservatism, as the traffic data for as three phases of the development were included in the modelling and phase 3 does not commence until 2034. As a gradual downward trend in background concentrations is anticipated in the future, assuming no reduction in background concentrations after 2022 is therefore considered to constitute a conservative approach.

13.28. Modelling using 2019 backgrounds and emissions was also carried out to enable model verification against 2019 monitoring data.

13.29. The annual mean background and modelled roads contribution from ADMS-Roads were added together to give total concentrations and enable a comparison to be made with the air quality criteria for annual mean concentrations. NO_2 concentrations were estimated from the

[39] Defra, Background Maps https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc.

modelled NO_x concentrations. For roads, Defra's NOx to NO_2 calculator[39] was used with the 'All other UK urban traffic' mix assumed.

Meteorological Data

13.30. Hourly sequential meteorological data is required as an input to the model. Data from Liverpool Airport meteorological station for 2019 were obtained for use in this assessment. Liverpool Airport is located approximately 15km to the north-east of the Proposed Development. Given its similar estuarine near coastal location it is considered appropriate for use in this assessment.

13.31. Defra's LAQM.TG16[6] guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably greater than 90%. Unusable hours include missing hours and calm hours[40]. The 2019 Liverpool Airport dataset has been checked for usability. There are 8,760 lines of usable hourly data for 2019, which equates to 100% of the hourly in a year. As this is well above the 90% threshold, the data is considered to be adequate for dispersion modelling, in accordance with LAQM TG16 guidance[6].

13.32. Figure 8.10 shows the data as a windrose. It can be seen that the predominant wind direction is west or easterly.

[40] Wind speeds <0.75m/s would be classed as calm. ADMS Roads sets the speed to 0.75m/s for speeds <0.75m/s and uses the wind direction from the previous hour. ADMS-5 does not model calm conditions, so data with wind speeds <0.75m/s are skipped in the modelling.

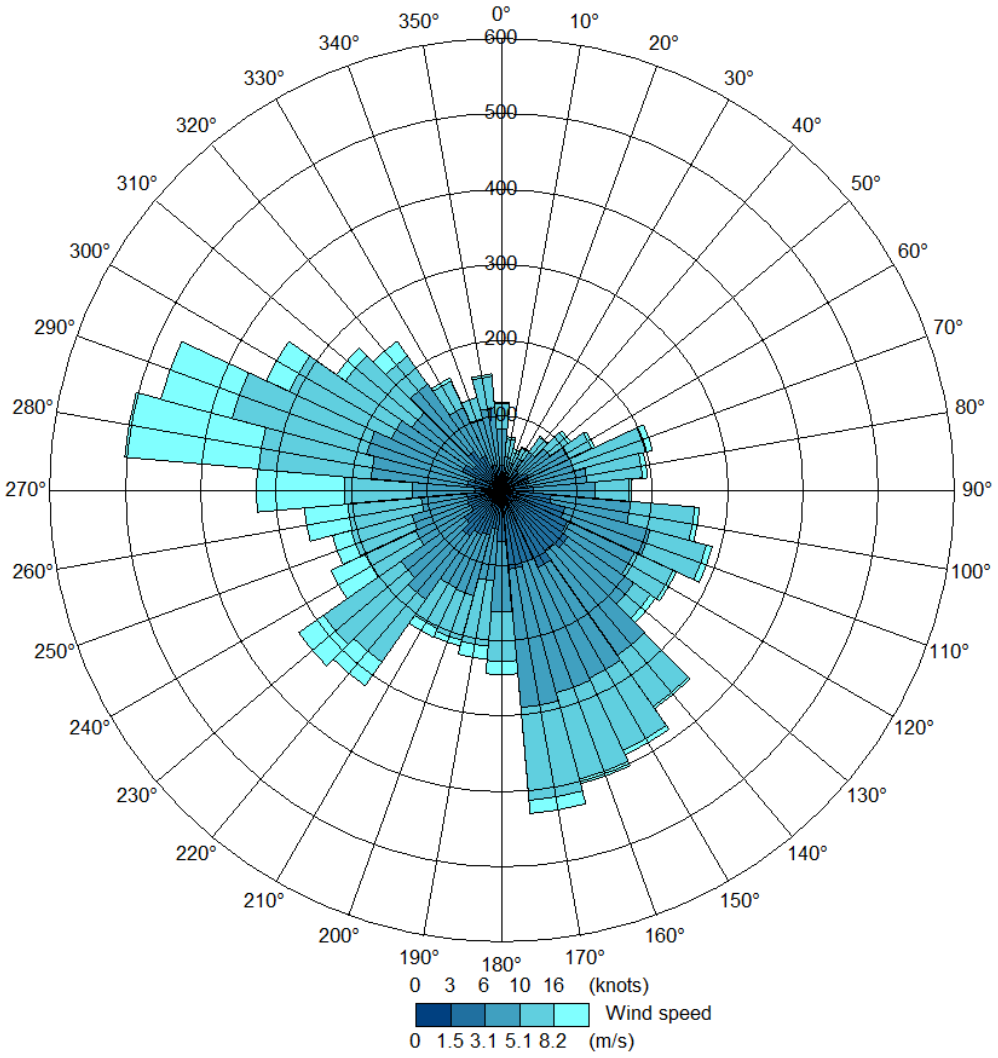

Figure 8.10 – Windrose for Liverpool Airport 2019

Topography and Terrain

13.33. Surface roughness is a component of surface texture. Air travelling over the surface is affected by the surface roughness, rough surface would result in higher roughness to smoother surfaces. Typical surface roughness values range from 1.5m (for cities, forests and industrial areas) to 0.0001m (for water or sandy deserts). The future setting of the Proposed Development has been considered in the modelling by setting the surface roughness length to 0.5m. This is the value recommended by the model developers for parkland and open suburbia. A lower surface roughness of 0.2m has been selected for the meteorological station, which is described in the model as representative of 'agricultural areas (min)'.

13.34. The Monin-Obukhov length is used to describe the effects of buoyancy on turbulence kinetic energy, particular in the lowest atmospheric boundary layer. This relates to the urban heat island effect, and its effects on turbulence due to surface topology and the effects from heated and shaded building surfaces. Monin-Obukhov values typically range from 2m to 10m in rural settings but can be higher in urban area where buildings and traffic results in more heat generation. In this assessment, the minimum Monin-Obukhov Length Scale for the Proposed Development and the meteorological station was set to 10 m (the recommended model setting for small towns).

13.35. Terrain Topographical features such as hills can have a significant effect on the dispersion of pollutants, generally when the ground level within 1 km of the sources varies by more than 100m (1 in 10). A review of the local area indicated a maximum difference in height of <30m. The use of terrain data was therefore excluded from further consideration within the assessment.

Traffic Links

13.36. Traffic data has been provided by Curtins Transport Consultants for the operational vehicle flows in 24-hour AADT format. These are included in the Transport Assessment appended to the Traffic and Transportation Technical Paper 2.

13.37. For each road link for each scenario, the following data has been included in the model:

- 24-hour Average Annual Daily Traffic (AADT) flows
- % Heavy Good Vehicles (HGVs)
- Vehicle speeds based on speed limits, reduced to 20kph at junctions

13.38. The traffic data provided shows that a maximum increase of 1,921 AADT movements would occur as a result of the Proposed Development.

13.39. The latest full year of ratified monitoring data available at the time of writing was 2019. To enable verification with local monitoring data, 2019 was therefore modelled as the baseline year.

13.40. The assessment scenarios modelled are as follows:

- 2019 baseline scenario
- 2022 opening year without the Proposed Development (Do-Minimum (DM) scenario); and,
- 2022 opening year with the Proposed Development (Do-Something (DS) scenario).

13.41. A summary of the traffic data for the modelled road links is provided in Table 8.43 and shown in Figure 8.11.

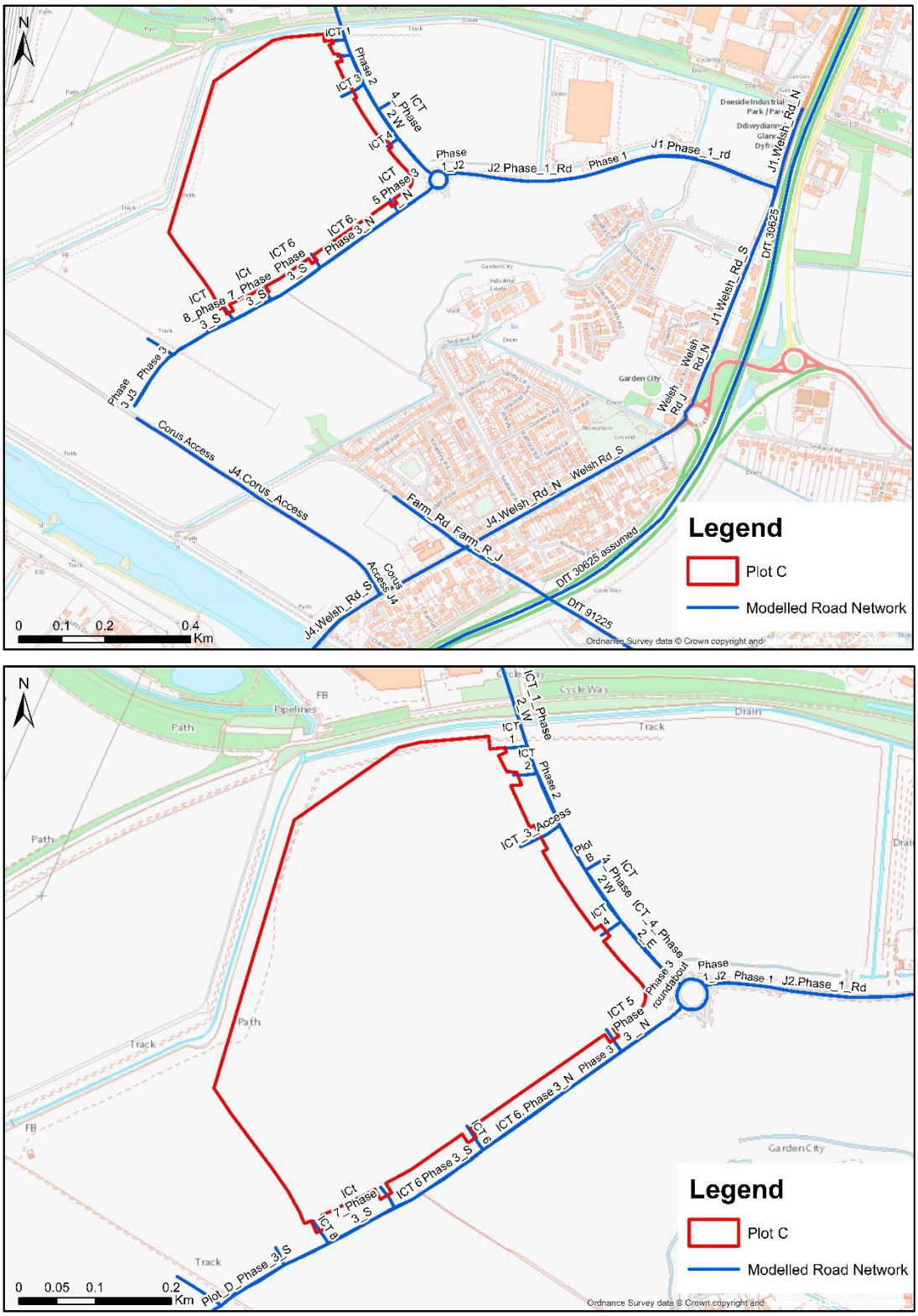

Figure 8.11 Modelled Roads

Link	2019 Base		2022 Do Minimum		2022 Do Something		Speed kph
	AADT	% HGV	AADT	% HGV	AADT	% HGV	
DfT 30625	8444	6.2	8444	6.2	8444	6.2	48
DfT 91225	69411	5.8	69411	5.8	69411	5.8	48
DfT 95118	4267	0.9	4267	0.9	4267	0.9	48
DfT91225_J	69411	5.8	69411	5.8	69411	5.8	20
J1 Welsh_Rd_S	3505	6	6041	11	6862	6	48
Welsh_Rd_ (N & S links)	5623	6	10660	11	11489	6	20
J4.Welsh_Rd_N	7742	6	15279	11	16115	6	48
J4.Welsh_Rd_S	7742	6	12713	11	13534	6	48
J1.Welsh_Rd_N	3505	6	13373	11	14693	6	48
Farm_R_J	7323	6	7323	11	7323	6	20
Farm_Rd	7323	6	7323	11	7323	6	48
J1.Phase_1_rd	n/a	n/a	10777	11	12698	11	48
J1.Phase_1_Rd_J	n/a	n/a	10777	11	12698	11	20
J2.Phase_1_Rd	n/a	n/a	2126	11	4047	11	48
J2.Phase_1_Rd_J	n/a	n/a	2126	11	4047	11	20
J2.Phase_2_Rd_J	n/a	n/a	513	11	1936	11	20
ICT_5_Phase3_J	n/a	n/a	3724	11	4208	11	48
PGNGL_Access	n/a	n/a	5264	11	5469	11	20
J4.Corus_Access	n/a	n/a	11833	11	12464	11	48
J4.Corus_Access_J	n/a	n/a	11833	11	12464	11	20
J4.Corus_Access_J2	n/a	n/a	11833	11	12464	11	20
ICT_1_Phase 2_W	n/a	n/a	0	11	0	11	48
ICT_1_Access	n/a	n/a	0	45	645	45	48
ICT_1_Phase_2_E	n/a	n/a	0	11	645	11	48
ICT_2_Access	n/a	n/a	0	45	762	45	48
ICT_2_Phase_2_E	n/a	n/a	0	11	1408	11	48
ICT_3_Access	n/a	n/a	0	45	571	45	48
ICT_3_Phase_2_E	n/a	n/a	0	11	1247	11	48
ICT_4_Access	n/a	n/a	13	45	13	45	48

Link	2019 Base		2022 Do Minimum		2022 Do Something		Speed kph
	AADT	% HGV	AADT	% HGV	AADT	% HGV	
ICT_4_Phase 2_E	n/a	n/a	455	11	1714	11	48
Plot_B_Access	n/a	n/a	455	45	455	45	48
ICT 4_Phase 2 W	n/a	n/a	455	11	1701	11	48
ICT 5 Phase 3 _ N	n/a	n/a	3739	11	4223	11	48
ICT_5_Access	n/a	n/a	0	45	279	45	48
ICT 6. Phase 3_N	n/a	n/a	3739	11	4047	11	48
ICT_6_Access	n/a	n/a	0	45	0	45	48
ICT 6 Phase 3_S	n/a	n/a	3739	11	4047	11	48
ICT_7_Access	n/a	n/a	88	45	88	45	48
ICt 7_Phase 3_S	n/a	n/a	3739	11	3988	11	48
ICT_8_Access	n/a	n/a	308	45	308	45	48
ICT 8_phase 3_S	n/a	n/a	3710	11	3798	11	48
Plot_D_Access	n/a	n/a	235	45	235	45	48
Plot_D_Phase_3_S	n/a	n/a	3592	11	3666	11	48
PGNL_Phase_3_S	n/a	n/a	3959	11	4018	11	48
Phase 3 Roundabout	n/a	n/a	2121	11	3397	11	20

Notes: % HGVs of 11% and 45% are based on assumptions provided by Curtins.
n/a – not applicable. Links not present in the baseline.

Table 8.43: Traffic Data Summary

Street Canyons

13.42. The street canyon effect can impact dispersion, such as increasing concentrations on the leeside of the road, as shown in Figure 8.12. Modelling with ADMS-Roads Extra accounts for the effects of street canyons and traffic-induced turbulence are included when roads are modelled in ADMS-Roads Extra. Due to the absence of high buildings either side of the road and a proportional narrower street, street canyons have not been modelled on any of the roads included within the modelled network.

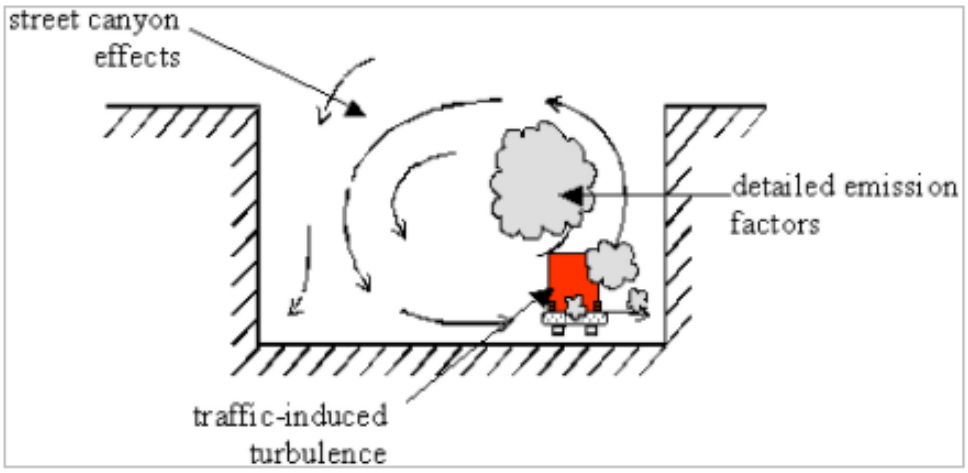

Figure 8.12 Conventional Air Flow in a Street Canyon (courtesy of CERC[41])

Vehicle Emission Rates

13.43. Vehicle emission rates for NOx, PM_{10} and $PM_{2.5}$ were obtained from the latest version of Defra's Emission Factor Toolkit (EFT10.1)[42,] for 'Wales', with a 'Basic Split' traffic split format. In accordance with LAQM TG16 guidance[6], speeds were reduced to 20 kilometres per hour close to road junctions.

13.44. Vehicle emission rates are expected to decrease in the future due to increasingly stringent Euro emission standards, but there is uncertainty as to the rate of improvement for NO_x emissions from diesel vehicles, considering recent measurements of exhaust emissions and ambient air quality. Vehicle emissions for the 2019 baseline have also been used in modelling for the future year scenarios. This is a conservative assumption, as some improvements are likely by the Proposed Development opening year of 2022 (Phase 1) and by the time the site is fully operational (2034). Future scenarios have also been modelled using opening year (2022) emissions and backgrounds, to provide an indication of the range of predicted results. This is still considered conservative as traffic data includes all phases 3, including the flows from phase 3 (commencing 2034).

[41] CERC, ADMS Urban, Traffic Flow, https://www.cerc.co.uk/environmental-software/ADMS-Urban-model/data.html
[42] Defra, Emissions Factors Toolkit https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

Receptors

13.45. Detailed dispersion modelling of NO_x, PM_{10} and $PM_{2.5}$ emissions from operational traffic was used to undertake assessment of human exposure at the existing and proposed receptors close to the modelled road network.

13.46. Worst-case locations were selected, such as close to junctions and closest to the road, to be representative as receptors for this assessment.

13.47. The modelled receptors in relation to the road network are shown in Figure 8.13 and Table 8.44. A height of 1.5m corresponds to a ground floor property.

Receptor ID	Site Address	Location		Height (m)
		Easting	Northing	
1	4 Glan Y Fferi	332390	368803	1.5
2	Ysgol Gynradd Sealand Primary School	332538	368928	1.5
3	2 Farm Road	332586	368948	1.5
4	38 Welsh Road	332600	368915	1.5
5	23 Welsh Road	332682	368997	1.5
6	1 Welsh Road	333093	369260	1.5
7	93 Welsh Road	333160	369432	1.5
8	86 Sealand Avenue	332504	369360	1.5
9	Plot 9 proposed residential	332257	369497	1.5
10	Plot 6 proposed residential	332569	369747	1.5
11	Plot 2 proposed residential	333063	369796	1.5
12	Plot 8 proposed residential	332501	369702	1.5

Table 8.44 Modelled Receptors

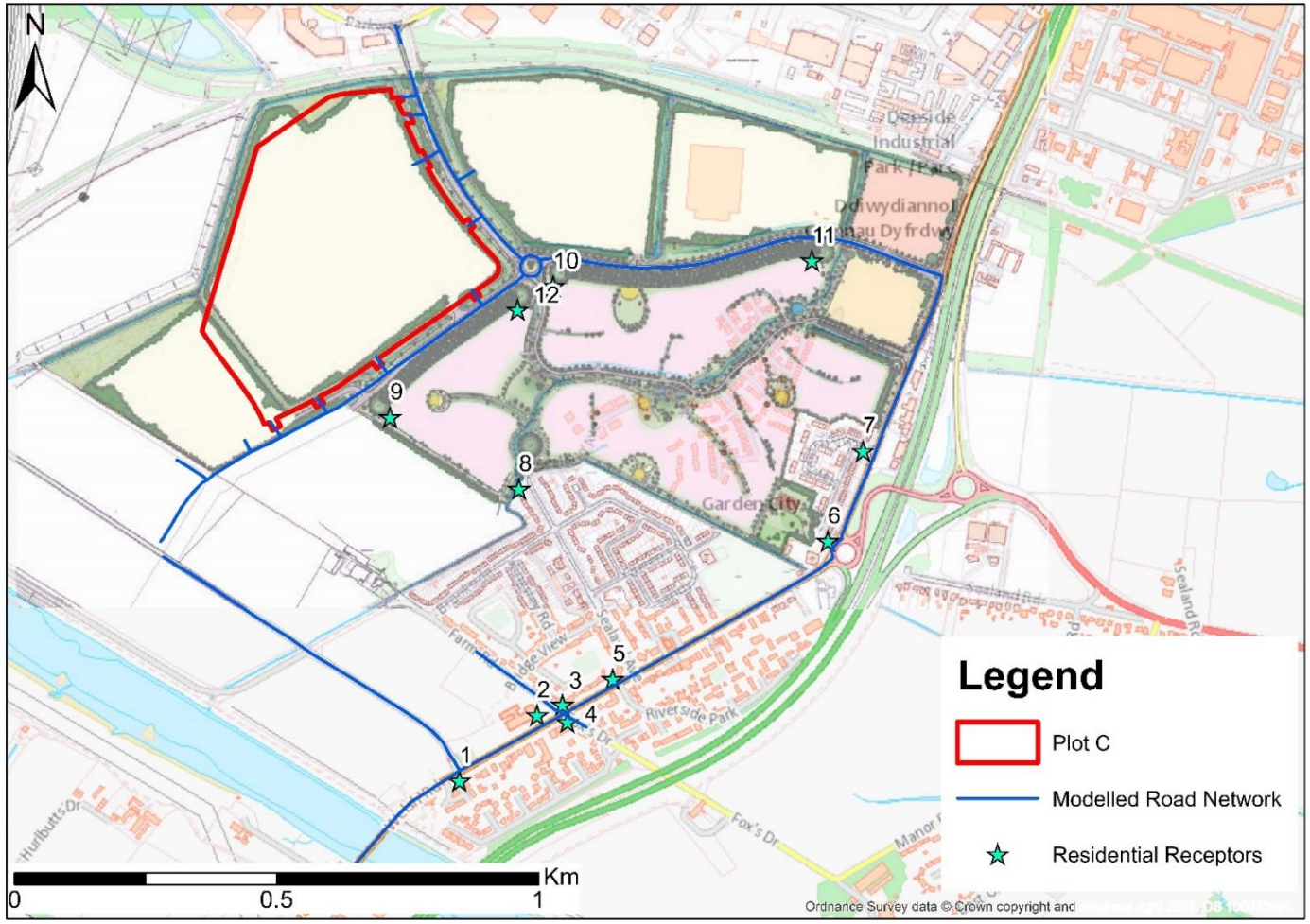

Figure 8.13 Modelled Receptors and modelled road network

Model Verification

13.48. Model verification is the process of comparing modelled and measured pollutant concentrations at the same points to determine the performance of the model. LAQM.TG16[6] guidance advises that should model results for NO_2 be mostly within ±25% of the measured values and there is no systematic over or under-prediction of concentrations no adjustment is necessary. Should the difference between monitored and modelled results be >25%, modelled concentrations should be adjusted based on the observed relationship between modelled and measured NO_2 concentrations to provide a better agreement.

13.49. Using the guidance provided in LAQM.TG (16)[6], the modelled output has been verified against local monitoring data obtained from diffusion tube surveys operated by Flintshire Council. Monitoring undertaken by Flintshire Council in 2019 includes two locations close to the modelled road network in the vicinity of the site. These are Site 21 and Site 27, kerbside and roadside sites and their details are listed in Table 8.45. In addition to the baseline flows provided by Curtins, availability of Department for Transport traffic data for 2019 has also been reviewed to determine if there data next to monitoring sites to enable their use for verification. DfT 2019 traffic data for count points 30625 and 91225 were also included in the modelling.

Site ID	Location	Grid Coordinate		Type
		X	Y	
Site 21	Sealand CP School Welsh Road CH5 2RA	332535	368907	Kerbside
Site 27	89, Riverside Park, Garden City	333040	369051	Roadside

Table 8.45 Verification Sites

13.50. The performance of the dispersion model was assessed by comparing the modelled concentrations with measured concentrations at monitoring sites 21 and 27. Meteorological data, monitored concentrations, vehicle emission rates (using Defra EFT v10.1) and traffic data for 2019 were all used in the model verification process. Defra background NO_2 concentration of 12.7µg/m^3 and 12.8µg/m^3 were used in the verification.

13.51. The model adjustment was undertaken using methodology which requires the determination of the ratio between the measured and modelled road contributed NOx at each comparison site. The ratio between them, referred to as the adjustment factor, is applied to the modelled road contributed NOx. The modelled NO_2 is then determined using the Defra NOx/NO_2

calculator[39]. Table 8.46 presents a summary of the model performance prior to bias adjustment.

Ref	Monitoring Site	Monitored NO_2 µg/m^3	Modelled NO_2 µg/m^3	% Difference (Modelled-Measured)/Measured
Site 21	Sealand CP School Welsh Road CH5 2RA	19.1	18.1	-5.4
Site 27	89, Riverside Park, Garden City	17.1	13.5	-21.1

Table 8.46 Model Performance Prior to Bias Adjustment

13.52. These comparisons show that the model underpredicted annual mean concentrations of NO_2 at both sites. Model verification was therefore carried out and an adjustment factor calculated and applied in all scenarios, in accordance with the methodology prescribed in LAQM.TG (16)[6]. A regression analysis was undertaken of modelled and measured road NOx concentrations at these locations. The derived adjustment factor (1.09) was then applied to the modelled road NOx concentrations to adjust for model bias. The comparison of modelled with measured values was then repeated and the results are shown in Table 8.47.

Ref	Monitoring Site	Monitored NO_2 µg/m^3	Modelled NO_2 µg/m^3	% Difference (Modelled-Measured)/Measured
Site 21	Sealand CP School Welsh Road CH5 2RA	19.1	18.6	-2.5
Site 27	89, Riverside Park, Garden City	17.1	13.7	-20.5

Table 8.47 Model Performance After Bias Adjustment

13.53. The final adjusted total NO_2 concentration predicted at the three diffusion tubes is within ±25% of the measured values and is therefore considered satisfactory.

13.54. The accuracy of the adjusted model was also considered via the calculation of the Root Mean Square Error (RMSE) and fractional bias. With the unadjusted model results, the RMSE was 2.656µg/m^3, while with the adjusted model results this was reduced to 2.449µg/m^3 so the adjustment has further reduced the average error or uncertainty in the model results to <10%. LAQM.TG (16)[6] states that ideally, an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual average NO_2 objective. Given the added uncertainties associated with the assumptions applied to the traffic data, this level of uncertainty would appear reasonable.

13.55. The fractional bias was 0.137 with the unadjusted model, which shows a tendency to under-predict, and 0.114 with the adjusted model, which shows that the under prediction has been reduced.

13.56. The adjustment factor of 1.09 was applied at all receptors within the study area. The modelled road contributed NO_x was adjusted by the factor 1.09 and then converted to total NO_2 using the Defra NO_x/NO_2 calculator. In the absence of suitably located sampled PM_{10} or $PM_{2.5}$ data, the same factor has been applied to the modelled road PM_{10} and $PM_{2.5}$ contributions, as recommended in LAQM.TG (16)[6]. The total PM_{10} and $PM_{2.5}$ concentrations are derived by adding the adjusted road contribution value to the Defra background concentrations.

Results Processing

13.57. The results of dispersion modelling at sensitive residential receptors have been compared to relevant air quality objectives for the protection of human health listed in the Air Quality Standards[3].

13.58. The results of dispersion modelling at sensitive ecological receptor points have been compared to the air quality standards for the protection of vegetation and ecosystems listed in the Air Quality Standards[3] and the relevant habitat Critical Loads sourced from APIS[26].

Appendix 8.4 – IAQM Odour Screening Assessment

13.59. The basic concept of risk assessment is that the overall risk depends on the probability of the event together with the likely consequence if that event actually occurred. The probability can be considered to be the likelihood of exposure (impact), and the consequence can be considered to be the effect of the receptor if the exposure (impact) took place.

13.60. Odour exposure (impact) has been determined by FIDO of the FIDOL factors:

- frequency
- intensity
- duration
- odour unpleasantness

13.61. The effect is the result of the change on specific receptors taking into account their sensitivities (specifically, their responsiveness to odour); the l (location) in FIDOL is used to categorise the sensitivity.

- Estimates of Source Odour Potential (SOP) were made taking into account:
- the scale (magnitude) of the release from the odour source
- how inherently odorous the emission is
- the relative pleasantness / unpleasantness of the odour

13.62. The effectiveness of the pollutant pathway, as the transport mechanism for odour through the air to the receptor, versus dilution / dispersion in the atmosphere was estimated considering:

- the distance of (sensitive) receptors from the odour source
- the location of receptors relative to the odour source
- the effectiveness of the point of release of odour

- the topography and terrain between the source and the receptor

13.63. The justification for the assignment of the selected categories for source odour potential and Pathway Effectiveness was documented and presented in this Technical Paper.

13.64. The estimates of Source Odour Potential and Pathway Effectiveness were then considered together to predict the risk of odour exposure (impact) at the screening assessment receptors using the matrix presented in Table 8.48.

	Source Odour Potential		
Pathway Effectiveness	**Small**	**Medium**	**Large**
Highly Effective Pathway	Low Risk	Medium Risk	High Risk
Moderately Effective Pathway	Negligible Risk	Low Risk	Medium Risk
Ineffective Effective Pathway	Negligible Risk	Negligible Risk	Low Risk

Table 8.48 – Risk of Odour Exposure Impact) at a Specific Receptor Location

13.65. Estimates of the effect of odour impacts on exposed receptors were made taking account of receptor sensitivity, using the matrix presented in Table 8.49.

Risk of Odour Exposure	**Receptor Sensitivity**		
	Low	**Medium**	**High**
High	Slight adverse effect	Moderate adverse effect	Substantial adverse effect
Medium	Negligible effect	Slight adverse effect	Moderate adverse effect
Low	Negligible effect	Negligible effect	Slight adverse effect
Negligible	Negligible effect	Negligible effect	Negligible effect

Table 8.49 – Likely Magnitude of Odour Effect at Specific Receptor Location

13.66. Likely odour effects at individual screening assessment receptors were then summarised to estimate the overall odour effect on the surrounding area.

13.67. Where the overall effect was greater than 'slight adverse', the effect was considered to be significant. Concluding that an effect is significant does not mean, of itself, that a development is unacceptable; rather it means that careful consideration needs to be given to the consequences, scope for securing further mitigation, and the balance with any wider environmental, social and economic benefits that the Proposed Development would bring.

13.68. Where the overall effect was equal to or less than 'slight adverse', the effect was considered to be not significant.

Appendix 8.5 – Methodology for Assessment of On-Site Combustion Plant

13.69. Detailed dispersion modelling of NOx, emissions has been carried out using the latest version of ADMS-Roads Extra (version 5.0.0.1), which is an internationally recognised new generation dispersion model developed by CERC. ADMS uses advanced algorithms to describe the boundary layer structure, turbulence and stability. The methodology for this is detailed in the following sections.

Combustion Plant Process Conditions

13.70. ICT have provided information on the proposed on-site combustion plant. For each of the stages 1, 2 and 3, there will be a cogeneration main stack (E10) and a cogeneration by-pass stack (E3). There will also be two sets of gas boilers (E1 and E2) to be installed as part of Stage 1 and Stage 3.

13.71. The individual process conditions for each of this units are listed in the Table 8.50. The locations of the modelled flues are also shown on Figure 8.14.

Parameter	Unit	Cogeneration main stack (E10)	Cogeneration by-pass stack (E3)	Gas boiler (E1, E2)
Thermal input	kW	52,360	24160	1350
Location, Stage 1	NGR	PM1/E10: 332020, 369755	PM1/E3: 332055, 369786	CV1/E1: 332377, 369851 CV1/E2: 332375, 369855
Location, Stage 2	NGR	PM2/E10: 332090, 369653	PM2/E3: 332132, 369676	
Location, Stage 3	NGR	PM3/E10: 332108, 369628	PM3/E3: 332143, 369660	CV3/E1: 332425, 369778 CV3/E2: 332423, 369781
Operating hours	hr/yr	8500	200	5100
Exhaust flow	m^3/h	180000	220000	2300
Exhaust velocity*	m/s	19.7	24.0	5.8***
Exhaust temperature	°C	220	519	120
Flue diameter	m	1.8	1.8	0.45
Emission limit value (ELV)***	mg/Nm^3	50	50	100

Parameter	Unit	Cogeneration main stack (E10)	Cogeneration by-pass stack (E3)	Gas boiler (E1, E2)
NOx emission rate**	g/s	2.5	3.1	0.09***
Stack height	m	28.5 – 30****	28.5 – 30****	12.5

Notes: * Exhaust velocity calculated as flow rate m^3/s divided by area in m^2
** NOx emission rate calculated as flow rate m^3/s multiplied by ELV in mg/Nm^3
*** Flow rates used in the calculations for the exhaust velocity and NOx emission rate for the boilers (E1 and E2) have been corrected from actual exhaust temperature. No temperature correction has been carried out for the flow rates for E3 and E10 as the flow rates provided are already at actual exhaust temperature
**** NOx emission limit values from the Industrial Emissions Directive (IED)[11] for gas fired combustion plant ($100mg/Nm^3$) and gas turbines ($50mg/Nm^3$) have been used as worst-case values in the absence of other information
***** Stack heights of between 28.5m and 30m for E3 and E10 units have been included in the additional sensitivity testing to determine appropriate height to mitigate any adverse impacts.

Table 8.50 Process Conditions for on-site combustion plant

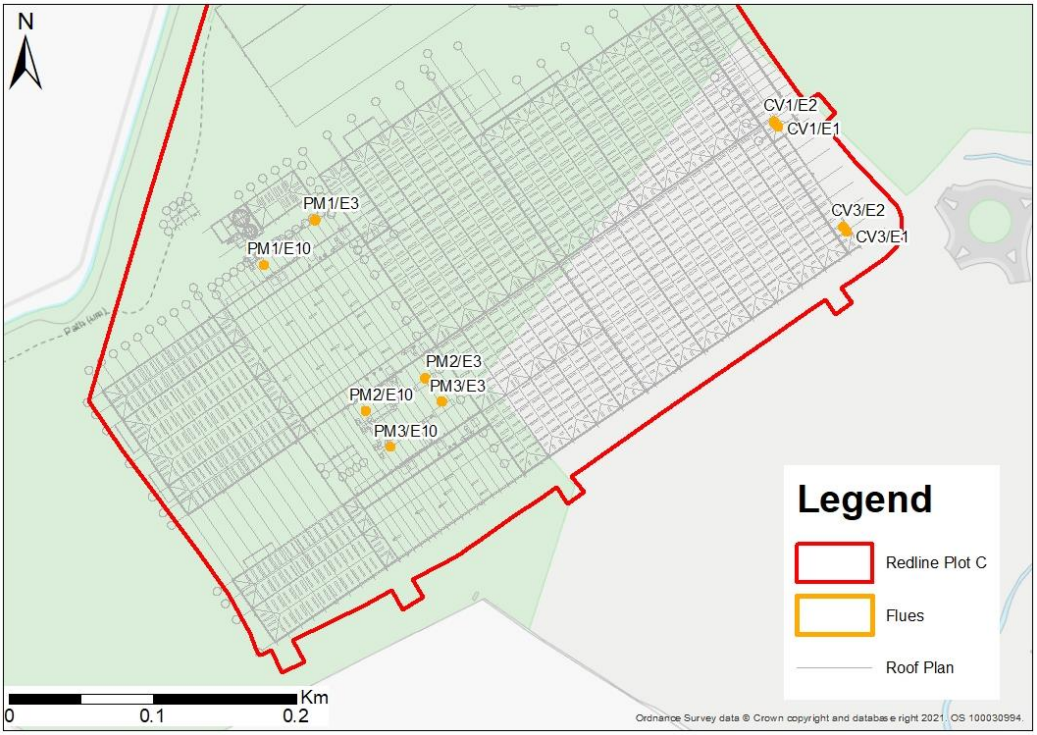

Figure 8.14 Modelled Flue Locations

Building Effects

13.72. Buildings can have a significant effect on the dispersion of pollutants from the flue. The presence of tall buildings close to a flue can cause the plume to be entrained in the cavity zone downwind of the building. This could result in higher ground concentrations near the flue than would be expected in the absence of buildings and can affect the dispersion of pollutants in the atmosphere. The presence of the buildings may induce better pollutant mixing and dispersion with ambient air, thereby resulting in lower concentrations further downwind.

13.73. The assessment has considered the buildings in the vicinity of the proposed flues. There are several buildings proposed for the site. Those that are taller than any of the flues have been included in the modelling due to their location and height are anticipated to have the main impact on dispersion. Sensitivity testing of buildings 4, 7, 10, 11 and 13 was carried out to determine which building should be set as the main building in the model. The highest concentrations were predicted with Building 4 as the main building. Building 4 which is between the main flues has therefore been set as the main building.

13.74. Figure 8.15 shows the buildings which have been included within the dispersion model. Buildings can only be added to the dispersion model as rectangular or circular shapes; therefore, some simplification has been made. As the selected buildings are broadly rectangular, simplification is likely to be minimal. Details of building geometries included in the model are provided in Table 8.51.

Building	Coordinates		Height (m)	Length (m)	Width (m)	Angle of Building (degrees)*
	Easting	Northing				
1	332177	369997	13.25	107	31	146
2	332086	369942	39.65	95	176	146
3	332147	369597	20	102	40	58
4	332067	369713	20	102	80	58
5	332129	369619	13.7	102	10	58
6	332092	369674	13.7	102	9	58
7	332039	369751	13.7	102	9	58
8	332353	369897	12.15	118	12	146
9	332300	369804	11.65	211	180	146
10	332083	369798	14.7	60	22	146
11	332189	369715	11.65	194	104	146
12	332126	369828	11.65	60	82	146

Building	Coordinates		Height (m)	Length (m)	Width (m)	Angle of Building (degrees)*
	Easting	Northing				
13	332052	369539	10	90	50	58
14	331974	369651	10	102	96	149
15	332095	369568	12	12	50	58
16	332021	369679	12	102	9	149
Notes: *The angle of the building is the angle the "Length" makes with north, measured clockwise and is required for rectangular buildings						

Table 8.51 Modelled buildings

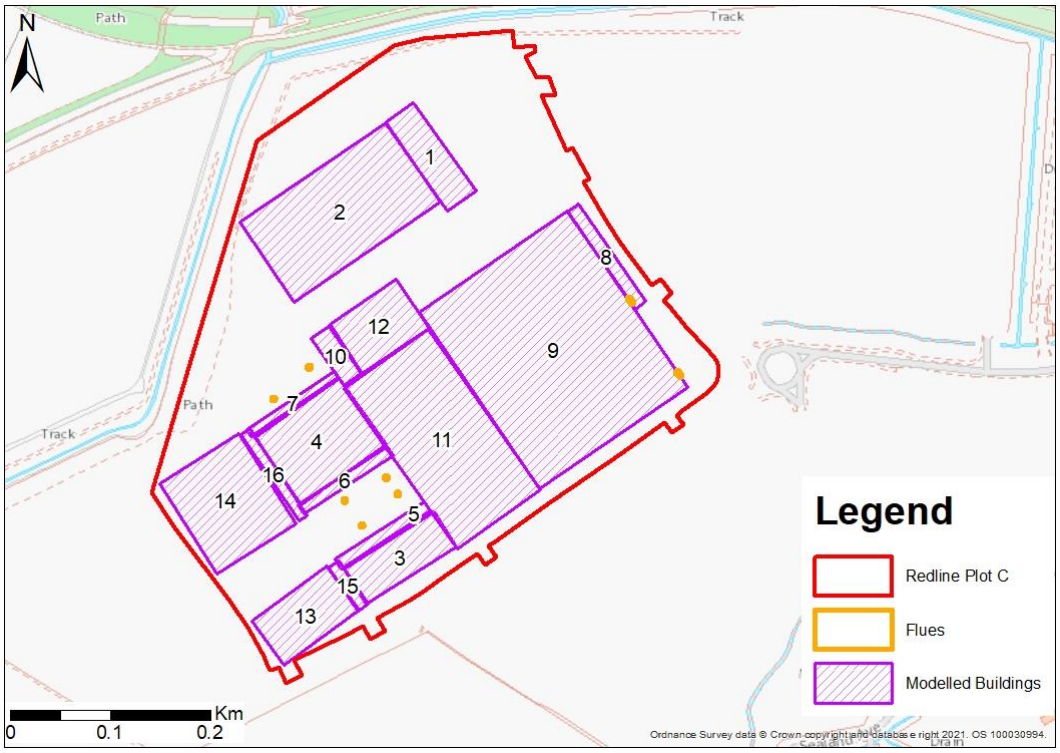

Figure 8.15 Modelled buildings

Meteorological Data

13.75. Hourly sequential meteorological data is required as an input to the model. Data from Liverpool Airport meteorological station for 2016, 2017, 2018, 2019 and 2020 were obtained for use in this assessment. Liverpool Airport is located approximately 15km to the north-east of the Proposed Development. Given its similar estuarine near coastal location it is considered appropriate for use in this assessment.

13.76. Defra's LAQM.TG16[6] guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably greater than 90%. Unusable hours include missing hours and calm hours[43]. The 2016, 2017, 2018, 2019 and 2020 Liverpool Airport datasets have been checked for usability. The lines of usable hourly data and the percentage for the year are listed in Table 8.52. As the lines of usable hourly data for each of the years is well above the 90% threshold, the data is considered to be adequate for dispersion modelling, in accordance with LAQM TG16 guidance[6].

Year	Lines of usable hourly data	% of hourly year data
2016	8784	100
2017	8760	100
2018	8760	100
2019	8760	100
2020	8784	100

Table 8.52 Usable Hourly Data from Met Files

13.77. Figure 8.10 shows the data as a windrose for each of the datasets from 2016 to 2020. It can be seen that the predominant wind direction is between west and south

[43] Wind speeds <0.75m/s would be classed as calm. ADMS Roads sets the speed to 0.75m/s for speeds <0.75m/s and uses the wind direction from the previous hour. ADMS-5 does not model calm conditions, so data with wind speeds <0.75m/s are skipped in the modelling.

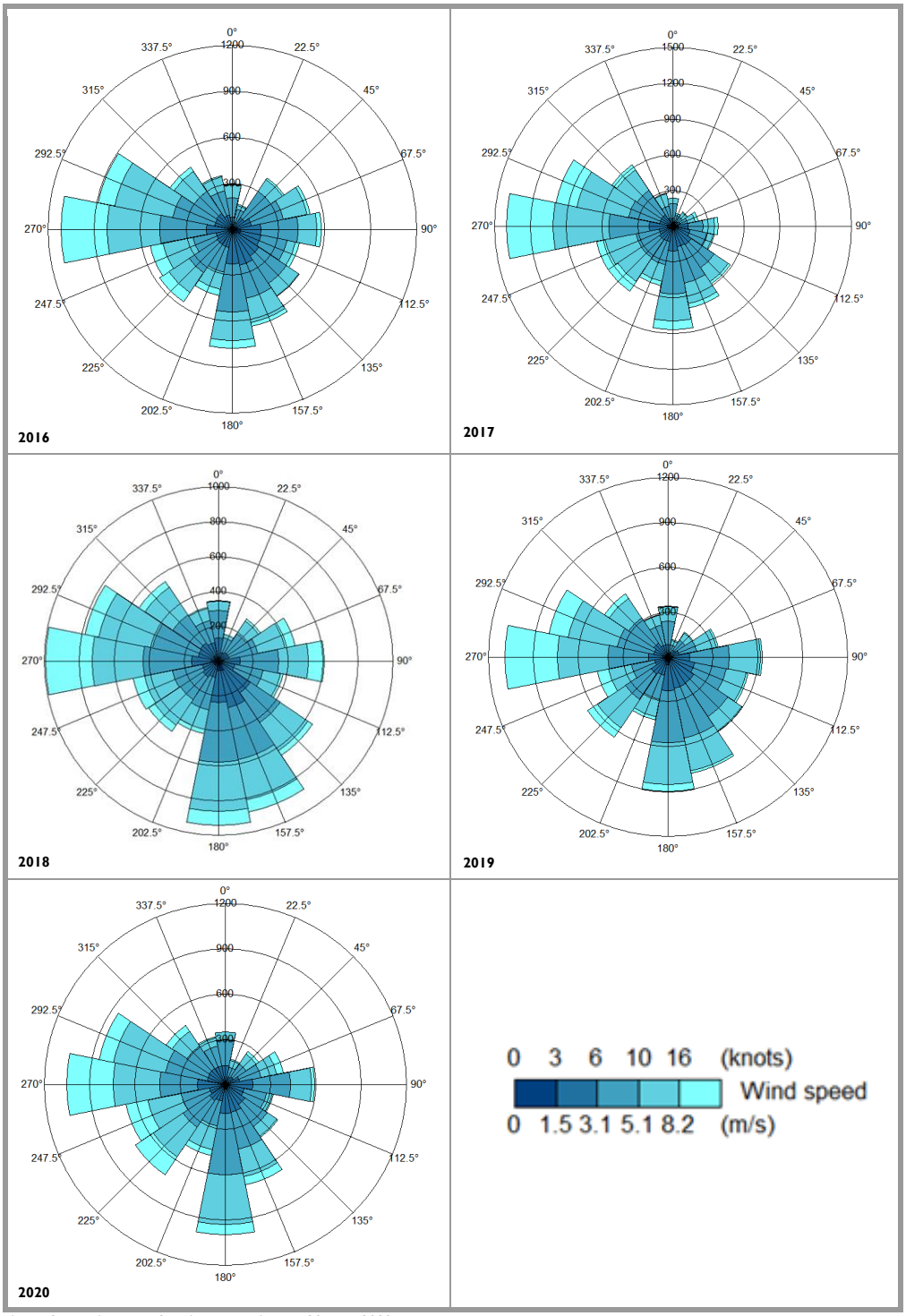

Figure 8.15 Windroses for Liverpool Airport, 2016 to 2020

Topography and Terrain

13.78. Surface roughness is a component of surface texture. Air travelling over the surface is affected by the surface roughness, rough surface would result in higher roughness to smoother surfaces. Typical surface roughness values range from 1.5m (for cities, forests and industrial areas) to 0.0001m (for water or sandy deserts). The future setting of the Proposed Development has been considered in the modelling by setting the surface roughness length to 0.5m. This is the value recommended by the model developers for parkland and open suburbia. A lower surface roughness of 0.2m has been selected for the meteorological station, which is described in the model as representative of 'agricultural areas (min)'.

13.79. The Monin-Obukhov length is used to describe the effects of buoyancy on turbulence kinetic energy, particular in the lowest atmospheric boundary layer. This relates to the urban heat island effect, and its effects on turbulence due to surface topology and the effects from heated and shaded building surfaces. Monin-Obukhov values typically range from 2m to 10m in rural settings but can be higher in urban area where buildings and traffic results in more heat generation. In this assessment, the minimum Monin-Obukhov Length Scale for the Proposed Development and the meteorological station was set to 10 m (the recommended model setting for small towns).

13.80. Terrain Topographical features such as hills can have a significant effect on the dispersion of pollutants, generally when the ground level within 1 km of the sources varies by more than 100m (1 in 10). A review of the local area indicated a maximum difference in height of <30m. The use of terrain data was therefore excluded from further consideration within the assessment.

Receptors

Assessment Extent

13.81. For the assessment of effects from the one-site combustion plant, a grid of regularly spaced receptors was created covering a domain of 2km x 2km area with a 10m grid spacing. This method ensures that potential impacts are assessed across the entire study area. The receptor grid has been modelled at a height of 1.5m to represent the breathing zone of the average adult. The assessment extent is shown on Figure 8.16.

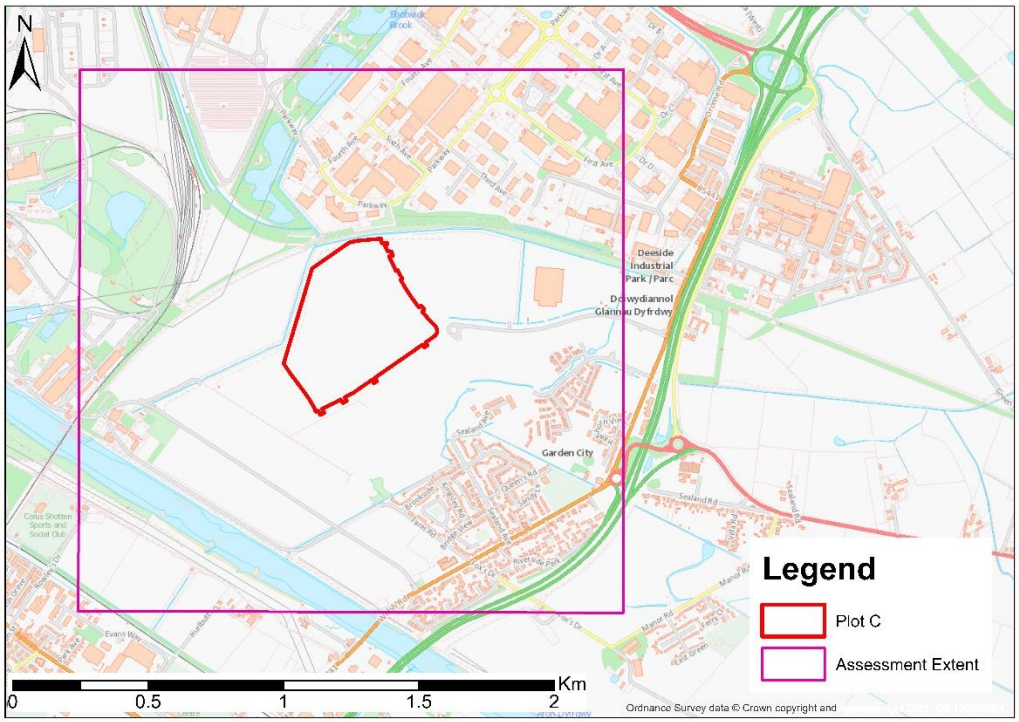

Figure 8.16 Assessment Extent

Modelled Receptors

13.82. Detailed dispersion modelling of NOx, PM_{10} and $PM_{2.5}$ emissions from operational traffic was undertaken in order to assess human exposure at existing receptors close to the modelled road network. This work was undertaken in accordance with the methodology listed in Appendix 8.3. Worst-case locations were selected, such as those close to junctions and those closest to the road, in order to represent existing receptors within this assessment. In order to assess the impact of the NOx emissions associated with on-site combustion plant, residential receptors have been include worst case residential properties closest to the proposed generator flues (receptors 9 and 12). The positions of the modelled residential receptors in relation to the modelled flues are shown in Figure 8.17 and Table 8.53. A height of 1.5m corresponds to a ground floor property.

Receptor ID	Site Address	Location		Height (m)
		Easting	Northing	
1	4 Glan Y Fferi	332390	368803	1.5
2	Ysgol Gynradd Sealand Primary School	332538	368928	1.5
3	2 Farm Road	332586	368948	1.5
4	38 Welsh Road	332600	368915	1.5
5	23 Welsh Road	332682	368997	1.5
6	1 Welsh Road	333093	369260	1.5
7	93 Welsh Road	333160	369432	1.5
8	86 Sealand Avenue	332504	369360	1.5
9	Plot 9 proposed residential	332257	369497	1.5
10	Plot 6 proposed residential	332569	369747	1.5
11	Plot 2 proposed residential	333063	369796	1.5
12	Plot 8 proposed residential	332501	369702	1.5

Table 8.53 Modelled Residential Receptors

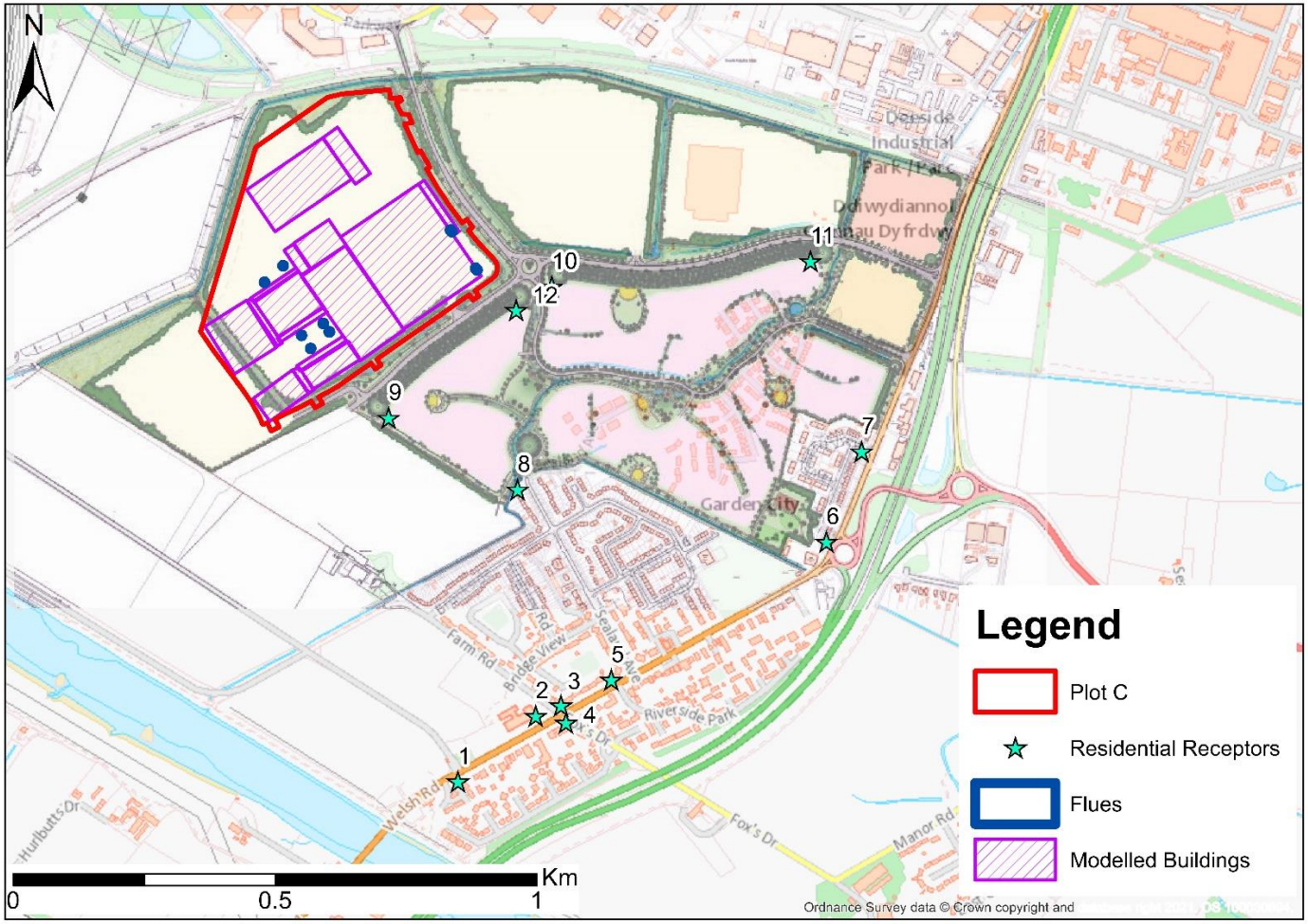

Figure 8.17 Modelled Residential Receptors and Modelled Flues

13.83. Modelling was also undertaken to assess the impact of ecological receptors within 15km of the Application in order to inform the permit application. Additional point receptors were also included at these sites. These are receptors 19 to 50 and have been modelled at ground level (0m) to represent worst-case for ecological receptors. The modelled residential receptors are shown in Figure 8.18 and Table 8.54.

Receptor ID	Ecological Site	Location		Height (m)
		Easting	Northing	
19	River Dee SAC SSSI	331729	369060	0
20	Dee Estuary SSSI	330844	372134	0
21	Shotton Lagoons and Reedbeds SSSI	330230	371042	0
22	Dee Estuary SPA	330740	373000	0
23	Dee Estuary SSSI	329392	371282	0
24	Wepre Brook SSSI	329849	368516	0
25	River Dee and Bala Lake SSSI	328743	371027	0
26	The Gathering Grounds Wood SSSI	328933	368706	0
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SAC	329120	365618	0
28	River Dee and Bala Lake SSSI and SAC	333500	367972	0
29	River Dee and Bala Lake SSSI and SAC	338597	365532	0
30	Inner Marsh Farm SPA	331001	373297	0
31	Dee Estuary SAC and SPA	330179	373410	0
32	Deeside and Buckley Newt sites SAC	326485	366660	0
33	Connah's Quay Ponds and Woodland SAC	329028	367196	0
34	Deeside and Buckley New sites SAC	327386	365266	0
35	Buckley Claypits and Common SAC	328306	365776	0
36	Manchester Ship Canal/ Mount Manisty SPA	338890	379004	0
37	Manchester Ship Canal/ Mersey Estuary SPA	340760	377337	0
37	Manchester Ship Canal Eastham Locks, Mersey Estuary SPA	337203	380909	0
38	Manchester Ship Canal/ Stanlow Point SPA	342350	377082	0
39	Halkyn Common and Holywell Grasslands SAC	321524	369836	0

Receptor ID	Ecological Site	Location		Height (m)
		Easting	Northing	
40	Alyn Valley Woods and Alyn Gorge Caves SAC	319870	366297	0
41	Tyddyn-Dows Wood SAC	320763	362395	0
42	Alyn Valley Woods and Alyn Gorge Caves	320532	363420	0
43	Alyn Valley Woods/ Devil's Gorge SAC	318965	364291	0
44	Halkyn Common and Holywell Grasslands SAC	320335	371054	0
45	Dee Estuary SSSI and SAC	325683	372199	0
46	Dee Estuary SAC	327576	374367	0
47	Dee Estuary (Golf Course) SAC and SPA	326919	379506	0
48	Dee Estuary SPA, SSSI and SAC	320593	377503	0
49	Mersey Estuary/ Eastham Channel SPA	336129	382846	0
50	River Dee SAC SSSI	331729	369060	0

Table 8.54 Modelled Ecological Receptors

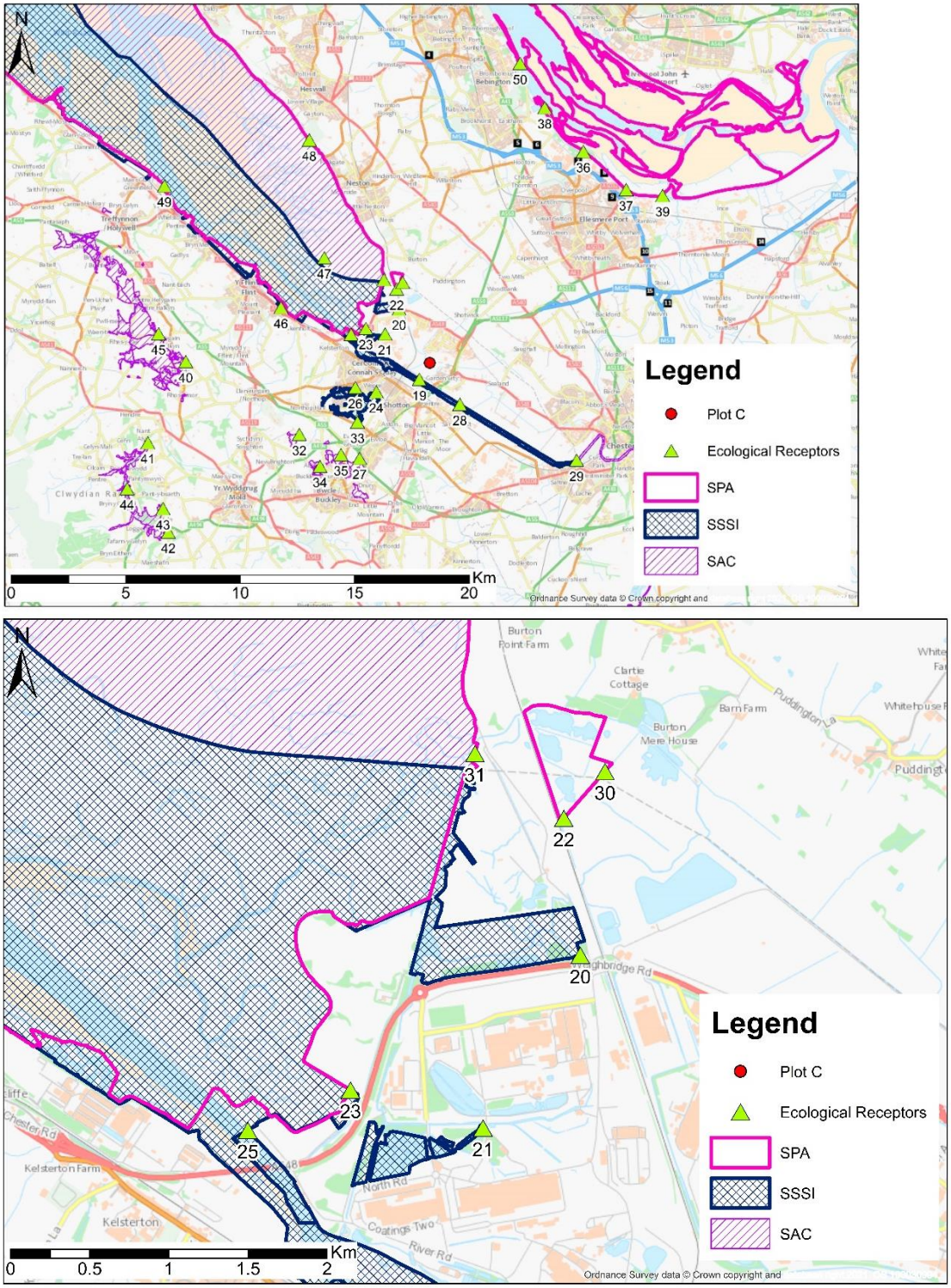

Figure 8.18 Modelled Ecological Receptors

Results Processing

Atmospheric Chemistry

13.84. NO_2 is associated with effects on human health and therefore the air quality standards for the protection of human health are based on NO_2 rather than total NOx or NO. The model predicts NOx concentrations which comprise nitric oxide (NO) and nitrogen dioxide (NO_2). NOx is emitted from combustion processes primarily as NO with a small percentage (usually <5%) of NO_2. The emitted NO reacts with oxidants in the air (mainly ozone) to form secondary NO_2. Factors affecting the rate of this oxidation occurs include the concentration of oxidants in the air, wind speed and temperature.

13.85. Predicted NOx concentrations have been processed to determine annual mean nitrogen dioxide (NO_2) concentrations for comparison with the annual mean NO_2 objectives. A NOx:NO_2 conversion has been applied to the modelled NOx concentrations, in order to determine the impact of the NOx emissions on ambient concentrations of NO_2.

13.86. For the on-site combustion plant, Environment Agency guidance[44] was followed, which states that 70% of long-term (annual mean) and 35% of short-term (all other averaging periods) NOx concentrations will convert to NO_2. Close to the emission point the above assumptions (70% and 35% NO_2) are likely to be overly pessimistic and reported concentrations will be an over-estimate.

Background Pollutant Concentrations

13.87. The modelled on-site combustion plant contributions from ADMS and 2022 annual mean Defra background concentration and were added together to give total concentrations associated with the proposed on-site combustion plant. This is to enable a comparison to be made with the air quality criteria for annual mean concentrations.

13.88. The contribution from modelled roads was also added to the modelled on-site combustion plant contributions and the 2022 Defra backgrounds to provide an indication of the prediction combined operational impact.

[44] Environment Agency (2006), Air Quality Management and Assessment Unit- Conversion Ratios for NO_x and NO_2.

Comparison with Air Quality Standards

13.89. The results of dispersion modelling at sensitive residential receptors have been compared to relevant air quality objectives for the protection of human health listed in the Air Quality Standards[3].

13.90. The results of dispersion modelling at sensitive ecological receptor points have been compared to the air quality standards for the protection of vegetation and ecosystems listed in the Air Quality Standards[3] and the relevant habitat Critical Loads sourced from APIS[26].

Ecological Assessment

13.91. In order to assess the operational impact of the Application Site on sensitive habitats, values have been obtained from the APIS website and the following calculations have been made. The dry deposition flux (µg/m^2/sec) has been calculated by multiplying the process contribution NO_2 concentrations (µg/m^3) from the combined results of operational traffic and operational on-site combustion plant modelling by the deposition velocity (m/s). A deposition velocity of 0.0015m/s has been used, as this is considered appropriate for short habitats in accordance with the Environment Agency AQTAG06 Technical Guidanceon detailed modeling approach for an appropriate assessment for emissions to air [45]. The dry deposition flux (µg/m^2/sec) has then been multiplied by a conversion factor of 96[46] to derive the process contribution (PC) nitrogen dry deposition in kg N/ha/yr.

13.92. The background nitrogen deposition (kg N/ha/yr) has been added to the results to determine the total dry deposition for both the 2022DM and 2022DS scenarios. A background value for the corresponding grid in which the ecological receptor lies has been obtained from the mapping on the APIS website, and ranges from 9.66 kg N/ha/yr to 18.34 kg N/ha/yr. The backgrounds used are listed in the results table (Table 8.68) in Appendix 8.8.

In-Combination Assessment

13.93. The results of the ecological assessment (Table 8.68 in Appendix 8.8) can be used to assess the in-combination effects on European Habitats arising from operation of the Application Site

[45] Air Quality Advisory Group (2014), AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air.
[46] (14/46 x 3600 x 24 x 365 x 10-9)/0.001

and emissions from other developments in the surrounding area. These results can be used to inform a Habitats Risk Assessment (HRA) which will determine whether there will be any significant likely adverse effects as a result of in-combination effects.

Appendix 8.6 – Operational Traffic Dispersion Modelling Results

Long-Term NO_2 Concentrations- Emissions from Road Traffic

13.94. Table 8.55 presents the predicted annual mean NO_2 concentration at the selected sensitive receptors near the Proposed Development for 2019 baseline and do-minimum (DM) and do-something (DS) for 2022 and 2024. This is based on the methodology outlined in Appendix 8.3.

ID	Location	NO_2 Annual Mean Concentrations µg/m³								
		Base 2019	DM 2022	DS 2022	Change	Impact descriptor	DM 2024	DS 2024	Change	Impact descriptor
1	4 Glan Y Fferi	15.2	19.0	19.5	0.4	Negligible	16.5	16.8	0.3	Negligible
2	Ysgol Gynradd Sealand Primary School	18.7	23.6	24.0	0.4	Negligible	20.1	20.5	0.3	Negligible
3	2 Farm Road	28.1	35.7	36.1	0.5	Negligible	30.0	30.3	0.4	Negligible
4	38 Welsh Road	35.4	36.6	36.9	0.3	Negligible	30.8	31.0	0.3	Negligible
5	23 Welsh Road	18.8	26.1	26.8	0.6	Negligible	22.2	22.7	0.5	Negligible
6	1 Welsh Road	15.8	22.8	23.6	0.8	Negligible	19.4	20.0	0.6	Negligible
7	93 Welsh Road	14.2	14.9	15.3	0.4	Negligible	13.2	13.5	0.3	Negligible
8	86 Sealand Avenue	11.0	10.3	10.3	0.1	Negligible	9.5	9.5	0.0	Negligible
9	Plot 9 proposed residential	10.8	10.0	10.1	0.0	Negligible	9.3	9.3	0.0	Negligible
10	Plot 6 proposed residential	10.7	10.1	10.4	0.2	Negligible	9.4	9.6	0.2	Negligible
11	Plot 2 proposed residential	10.8	12.5	12.6	0.2	Negligible	11.3	11.4	0.1	Negligible
12	Plot 8 proposed residential	10.7	10.1	10.2	0.1	Negligible	9.3	9.4	0.1	Negligible

Table 8.55 NO_2 Annual Mean Concentrations at Modelled Receptors During the Operation Phase

Long-Term PM_{10} Concentrations- Emissions from Road Traffic

13.95. Table 8.56 presents the predicted annual mean PM_{10} concentration at the selected sensitive receptors near the Proposed Development for 2019 baseline and do-minimum (DM) and do-something (DS) for 2022 and 2024. This is based on the methodology outlined in Appendix 8.3.

ID	Location	PM_{10} Annual Mean Concentrations µg/m^3								
		Base 2019	DM 2022	DS 2022	Change	Impact descriptor	DM 2024	DS 2024	Change	Impact descriptor
1	4 Glan Y Fferi	15.9	14.1	14.2	0.1	Negligible	13.8	13.9	0.1	Negligible
2	Ysgol Gynradd Sealand Primary School	13.6	15.1	15.2	0.1	Negligible	14.8	14.9	0.1	Negligible
3	2 Farm Road	13.0	17.6	17.7	0.1	Negligible	17.3	17.4	0.1	Negligible
4	38 Welsh Road	12.8	17.5	17.6	0.1	Negligible	17.2	17.3	0.1	Negligible
5	23 Welsh Road	12.6	16.0	16.1	0.1	Negligible	15.7	15.9	0.2	Negligible
6	1 Welsh Road	12.2	13.7	13.9	0.2	Negligible	13.5	13.6	0.1	Negligible
7	93 Welsh Road	12.2	12.6	12.7	0.1	Negligible	12.3	12.4	0.1	Negligible
8	86 Sealand Avenue	10.9	10.6	10.6	<0.1	Negligible	10.3	10.3	<0.1	Negligible
9	Plot 9 proposed residential	10.9	10.5	10.5	<0.1	Negligible	10.3	10.3	<0.1	Negligible
10	Plot 6 proposed residential	10.8	10.5	10.6	<0.1	Negligible	10.3	10.3	<0.1	Negligible
11	Plot 2 proposed residential	10.8	12.0	12.0	<0.1	Negligible	11.7	11.8	<0.1	Negligible
12	Plot 8 proposed residential	10.8	10.5	10.5	<0.1	Negligible	10.3	10.3	<0.1	Negligible

Table 8.56: PM_{10} Annual Mean Concentrations at Modelled Receptors During the Operation Phase

Long-Term $PM_{2.5}$ Concentrations- Emissions from Road Traffic

13.96. Table 8.57 presents the predicted annual mean $PM_{2.5}$ concentration at the selected sensitive receptors near the Proposed Development for 2019 baseline and do-minimum (DM) and do-something (DS) for 2022 and 2024. . This is based on the methodology outlined in Appendix 8.3.

ID	Location	$PM_{2.5}$ Annual Mean Concentrations µg/m^3								
		Base 2019	DM 2022	DS 2022	Change	Impact descriptor	DM 2024	DS 2024	Change	Impact descriptor
1	4 Glan Y Fferi	10.1	8.8	8.9	0.1	Negligible	8.6	8.6	<0.1	Negligible
2	Ysgol Gynradd Sealand Primary School	8.7	9.4	9.4	<0.1	Negligible	9.1	9.2	0.1	Negligible
3	2 Farm Road	8.4	10.8	10.9	0.1	Negligible	10.5	10.6	0.1	Negligible
4	38 Welsh Road	8.3	10.8	10.9	0.1	Negligible	10.5	10.6	0.1	Negligible
5	23 Welsh Road	8.2	9.9	10.0	0.1	Negligible	9.6	9.7	0.2	Negligible
6	1 Welsh Road	7.8	8.6	8.7	0.1	Negligible	8.4	8.5	0.1	Negligible
7	93 Welsh Road	7.8	7.9	8.0	0.1	Negligible	7.7	7.8	0.1	Negligible
8	86 Sealand Avenue	7.3	7.1	7.1	<0.1	Negligible	6.9	6.9	<0.1	Negligible
9	Plot 9 proposed residential	7.3	7.0	7.1	0.1	Negligible	6.9	6.9	<0.1	Negligible
10	Plot 6 proposed residential	7.3	7.0	7.1	0.1	Negligible	6.9	6.9	<0.1	Negligible
11	Plot 2 proposed residential	7.3	7.6	7.6	<0.1	Negligible	7.4	7.4	<0.1	Negligible
12	Plot 8 proposed residential	10.1	8.8	8.9	0.1	Negligible	6.9	6.9	<0.1	Negligible

Table 8.57: $PM_{2.5}$ Annual Mean Concentrations at Modelled Receptors During the Operation Phase

Appendix 8.7 – Operational Combustion Plant - Dispersion Modelling Results

13.97. To assess the operational impact of emissions from the on-site combustion plant, dispersion modelling was undertaken following the methodology outlined in Appendix 8.5.

NO_2 Concentrations- Residential Receptors

13.98. The predicted process contributions to long-term (annual mean) NO_2 concentrations associated with operational of the combustion plant as part of Phase 1, 2 and 3 at each of the residential receptors is listed in Table 8.58. The predicted contributions for Phase 1 only are listed in Table 8.59. Total concentrations listed include Defra background NO_2 concentrations for 2022 and 2024.

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_2)	Total concentration (plus 2024 background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
1	4 Glan Y Fferi	0.3	11.4	10.5	0.8	Negligible
2	Ysgol Gynradd Sealand Primary School	0.4	11.5	10.6	1.0	Negligible
3	2 Farm Road	0.4	11.6	10.7	1.1	Negligible
4	38 Welsh Road	0.4	11.5	10.7	1.1	Negligible
5	23 Welsh Road	0.6	11.7	10.8	1.5	Negligible
6	1 Welsh Road	0.8	11.9	11.0	2.1	Negligible
7	93 Welsh Road	0.9	11.9	11.1	2.2	Negligible
8	86 Sealand Avenue	1.6	10.9	10.3	4.0	Negligible
9	Plot 9 proposed residential	2.5	11.8	11.2	6.3	Slight
10	Plot 6 proposed residential	1.8	11.1	10.5	4.5	Negligible
11	Plot 2 proposed residential	2.0	13.0	12.1	4.9	Negligible
12	Plot 8 proposed residential	2.1	11.4	10.8	5.3	Negligible

Table 8.58 Predicted Process Contributions at Residential Receptors – Phase 1, 2 and 3

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_2)	Total concentration (plus 2024 background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
1	4 Glan Y Fferi	0.1	11.2	10.4	0.3	Negligible
2	Ysgol Gynradd Sealand Primary School	0.1	11.2	10.4	0.3	Negligible
3	2 Farm Road	0.1	11.2	10.4	0.3	Negligible
4	38 Welsh Road	0.2	11.3	10.4	0.4	Negligible
5	23 Welsh Road	0.3	11.4	10.5	0.6	Negligible
6	1 Welsh Road	0.3	11.3	10.5	0.7	Negligible
7	93 Welsh Road	0.4	11.5	10.6	1.0	Negligible
8	86 Sealand Avenue	0.4	9.7	9.1	1.1	Negligible
9	Plot 9 proposed residential	1.0	10.3	9.7	2.6	Negligible
10	Plot 6 proposed residential	0.3	9.6	9.0	0.8	Negligible
11	Plot 2 proposed residential	1.1	12.2	11.3	2.8	Negligible
12	Plot 8 proposed residential	0.1	9.4	8.8	0.2	Negligible

Table 8.59 Predicted Process Contributions at Residential Receptors – Phase 1 only

Gridded Results

13.99. The dispersion model was run over a 2km grid, as detailed in Appendix 8.5, using combined meteorological data from 2016 to 2020. The maximum predicted process contributions from the on-site combustion plant at ground level during this 5-year time period are presented in Table 8.60, for both the total Phase 1, 2 and 3 inputs, and for Phase 1 only. These results are provided for information only and do not represent impacts at specific receptors. They represent the maximum impact within the assessment extent. Elevated concentrations are expected close to the flues. As stated in paragraph 13.84 of Appendix 8.5, the assumption of 70% conversion of NOx to NO_2 close to the emission point are likely to be overly pessimistic and reported concentrations will be an over-estimate.

Phase	Annual mean NO_2			Hourly mean NO_2 (99.79th percentile)		
	Process contribution ($\mu g/m^3$)	% Change relative to annual mean objective ($40\ \mu g/m^3$)	Impact descriptor	Process contribution ($\mu g/m^3$)	Change relative to annual mean objective ($200\ \mu g/m^3$)	Impact descriptor
1,2,3	13.1	32.8	Moderate	100.8	50.4	Major
1 only	10.5	26.3	Moderate	79.6	39.8	Moderate

Table 8.60 Maximum process contributions to NO_2 ($\mu g/m^3$)

13.100. The maximum process contribution to annual mean NO_2 concentrations is predicted to be 13.1µg/m^3 (32.8% of the national objective). The maximum process contribution to hourly mean NO_2 concentrations is predicted to be 100.8µg/m^3 (50.4% of the national objective).

13.101. Modelled 2022 Defra Background concentrations for the corresponding grid square have been added to the modelled process concentrations. Following LAQM TG16[6] guidance, background hourly mean NO_2 concentrations have been calculated by doubling the annual mean NO_2 concentration. The maximum concentrations for annual mean and hourly mean NO_2 are listed in Table 8.61. Predicted total concentrations are well below the relevant NO_2 objectives.

Phase	Total NO_2 process contribution	Total NO_2 concentration (plus 2022 background NO_2)	Corresponding location
Annual mean			
1, 2 and 3	13.1	22.4	333150, 368780
1	10.5	19.8	333150, 368780
Hourly mean			
1, 2 and 3	100.8	119.4	332060, 369660
1	79.6	98.1	332060, 369660

Table 8.61 Location of total NO2 process contribution and total concentration

13.102. It can be seen from Figure 8.19 that the maximum predicted impact for Phases 1, 2 and 3 combined is within the centre of the Application Sites. Figure 8.20 shows that the maximum impact for Phase 1 only is to east of the site.

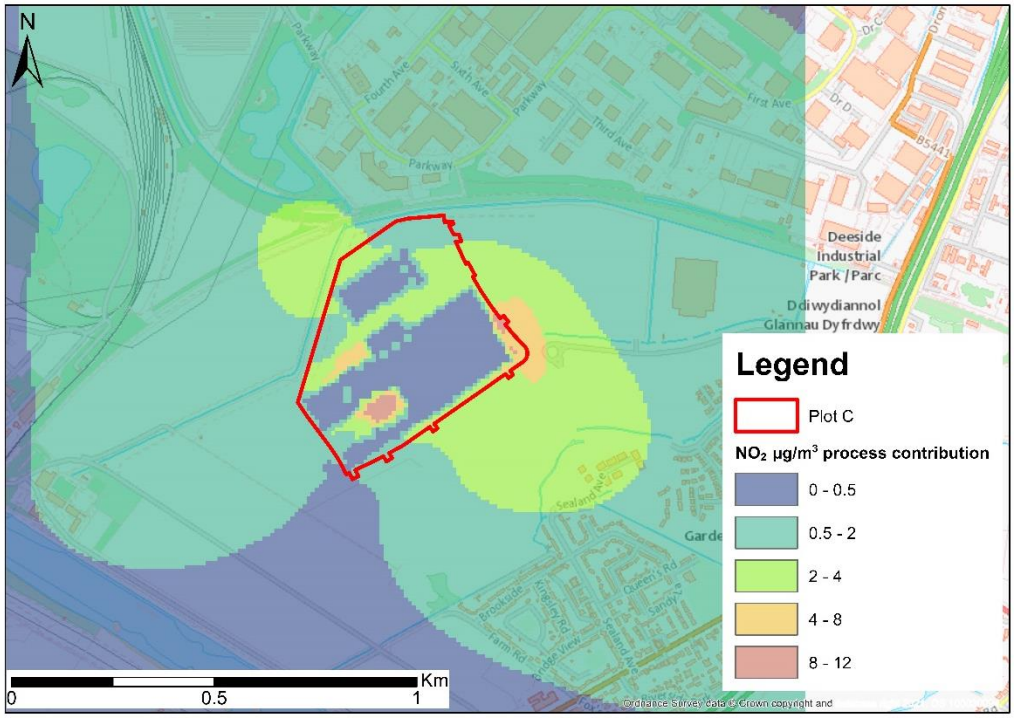

Figure 8.19: NO_2 process contribution to annual mean, Phase 1, 2 and 3

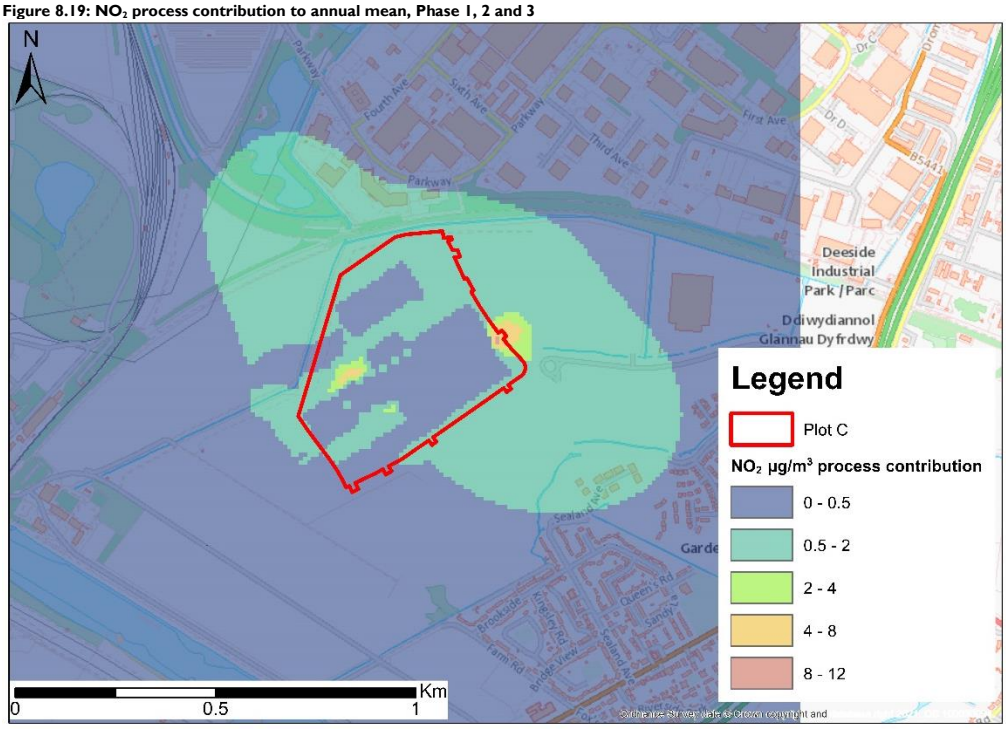

Figure 8.20: NO_2 process contribution to annual mean, Phase 1 only)

13.103. Figure 8.21 shows the percentage NO_2 contribution to annual mean for the combined impact of on-site combustion associated with Phases 1, 2 and 3, with values >6µg/m^3 predicted at locations to the east of the Application Site.

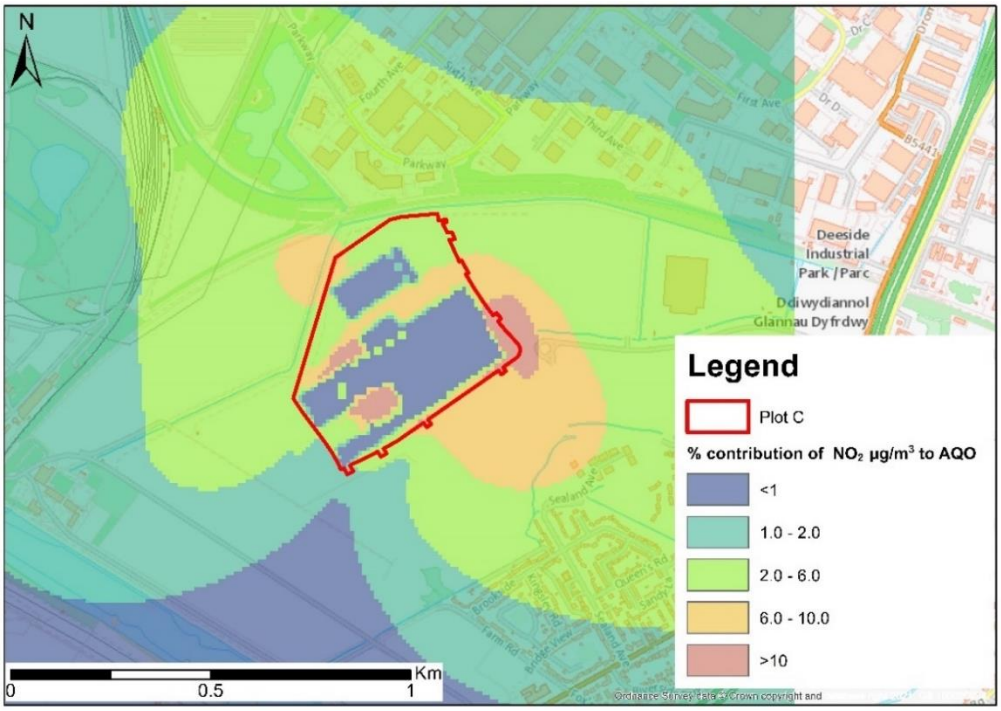

Figure 8.21: Percentage contribution of NO_2 to annual mean objective, Phases 1, 2 and 3

13.104. Figure 8.22 shows the total NO_2 annual mean concentrations for Phases 1, 2 and 3, having added the total process contributions to the 2022 Defra backgrounds concentrations. Total concentrations in the area are all well below the annual mean objective (40µg/m^3).

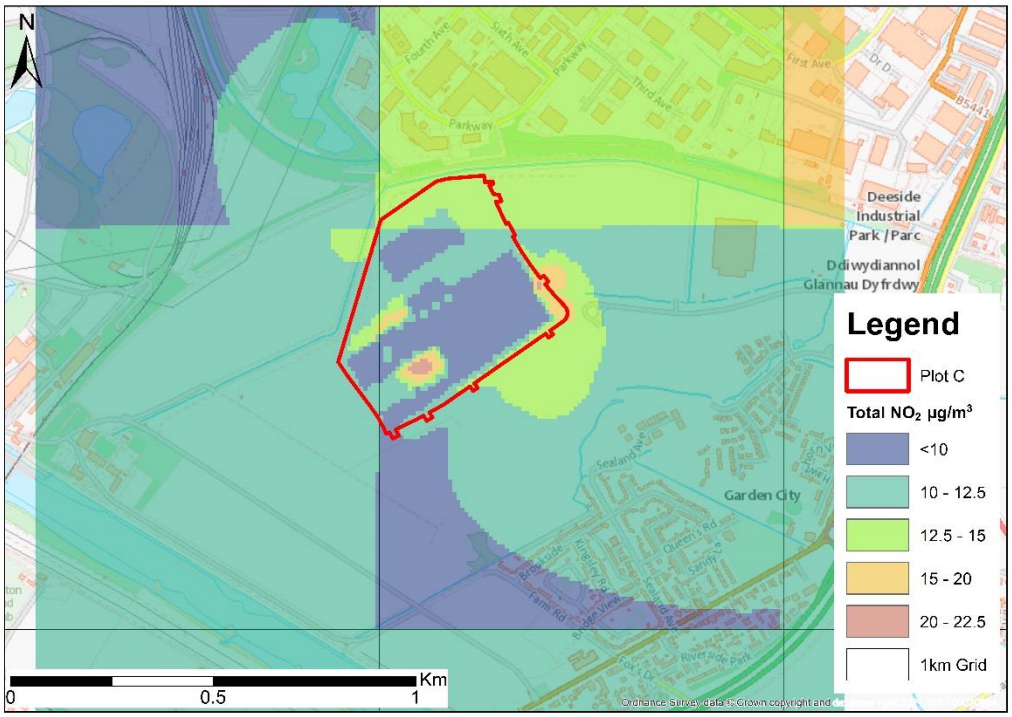

Figure 8.22: Total Percentage contribution of NO_2 to annual mean objective

Ecological Receptors

13.105. The predicted process contributions to long-term (annual mean) NOx concentrations associated with operation of the combustion plant as part of Phases 1, 2 and 3 at each of the ecological receptors are listed in Table 8.58. The predicted contributions for Phase 1 only are listed in Table 8.62.

ID	Location	NO_x annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_x)	% change relative to AQO ($30\mu g/m^3$)	Impact descriptor
19	River Dee SAC SSSI	0.3	13.4	1.0	Negligible
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	0.3	11.1	1.0	Negligible
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	0.2	13.5	0.8	Negligible
22	The Dee Estuary SPA and Ramsar	0.2	9.9	0.8	Negligible
23	The Dee Estuary Ramsar SSSI, SAC, SPA	0.2	14.0	0.5	Negligible
24	Deeside and Buckley Newt Sites SAC and SSSI	0.2	10.5	0.5	Negligible

ID	Location	NO_x annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_x)	% change relative to AQO ($30\mu g/m^3$)	Impact descriptor
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	0.1	9.2	0.4	Negligible
26	The Gathering Grounds Wood SSSI and SAC	0.1	10.4	0.4	Negligible
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	0.1	12.5	0.2	Negligible
28	River Dee and Bala Lake SAC and SSSI	0.2	16.1	0.7	Negligible
29	River Dee and Bala Lake SAC and SSSI	0.1	11.8	0.3	Negligible
30	Inner Marsh Farm SSSI	0.2	10.3	0.7	Negligible
31	Dee Estuary SAC, Ramsar, SSSI and SPA	0.2	9.9	0.6	Negligible
32	Deeside and Buckley Newt sites SAC and SSSI	0.1	8.7	0.2	Negligible
33	Connah's Quay Ponds and Woodland SSSI and SAC	0.1	10.2	0.3	Negligible
34	Deeside and Buckley New sites SAC and SSSI	0.1	10.3	0.2	Negligible
35	Buckley Claypits and Common SSSI and SAC	0.1	11.0	0.2	Negligible
36	Mersey Estuary SSSI, Ramsar and SPA	<0.1	15.7	0.1	Negligible
37	Mersey Estuary SSSI, Ramsar and SPA	<0.1	21.7	0.1	Negligible
38	Mersey Estuary SSSI, Ramsar and SPA	<0.1	23.2	0.1	Negligible
39	Mersey Estuary Ramsar, SSSI and SPA	<0.1	28.1	0.1	Negligible
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	<0.1	7.1	0.1	Negligible
41	Halkyn Common and Holywell Grasslands SSSI	<0.1	5.9	0.1	Negligible
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	6.0	0.1	Negligible
43	Tyddyn-Dows Wood SAC and SSSI	<0.1	5.8	0.1	Negligible
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	5.4	0.1	Negligible
45	Alyn Valley Woods SAC and SSSI	<0.1	9.3	0.1	Negligible
46	Halkyn Common and Holywell Grasslands SSSI	<0.1	9.7	0.2	Negligible
47	Dee Estuary SAC, SSSI and Ramsar	<0.1	8.1	0.3	Negligible

ID	Location	NO_x annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_x)	% change relative to AQO ($30\mu g/m^3$)	Impact descriptor
48	Dee Estuary Ramsar, SSSI, SAC and SPA	0.1	7.4	0.2	Negligible
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	<0.1	11.8	0.1	Negligible
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	<0.1	15.0	0.1	Negligible

Table 8.62 Predicted Process Contributions at Ecological Receptors – Phase 1, 2 and 3

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
19	River Dee SAC SSSI	0.1	13.2	0.4	Negligible
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	0.1	10.9	0.3	Negligible
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	0.1	13.3	0.3	Negligible
22	The Dee Estuary SPA and Ramsar	0.1	9.7	0.2	Negligible
23	The Dee Estuary Ramsar SSSI, SAC, SPA	0.1	13.9	0.2	Negligible
24	Deeside and Buckley Newt Sites SAC and SSSI	<0.1	10.4	0.2	Negligible
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	<0.1	9.1	0.1	Negligible
26	The Gathering Grounds Wood SSSI and SAC	<0.1	10.3	0.1	Negligible
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	0.1	12.5	0.2	Negligible
28	River Dee and Bala Lake SAC and SSSI	<0.1	15.9	0.1	Negligible
29	River Dee and Bala Lake SAC and SSSI	0.1	11.8	0.3	Negligible
30	Inner Marsh Farm SSSI	0.1	10.2	0.2	Negligible
31	Dee Estuary SAC, Ramsar, SSSI and SPA	<0.1	9.7	0.1	Negligible
32	Deeside and Buckley Newt sites SAC and SSSI	<0.1	8.7	0.1	Negligible
33	Connah's Quay Ponds and Woodland SSSI and SAC	<0.1	10.2	0.1	Negligible
34	Deeside and Buckley New sites SAC and SSSI	<0.1	10.2	0.1	Negligible
35	Buckley Claypits and Common SSSI and SAC	<0.1	11.0	<0.1	Negligible

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
36	Mersey Estuary SSSI, Ramsar and SPA	<0.1	15.7	<0.1	Negligible
37	Mersey Estuary SSSI, Ramsar and SPA	<0.1	21.7	<0.1	Negligible
38	Mersey Estuary SSSI, Ramsar and SPA	<0.1	23.2	<0.1	Negligible
39	Mersey Estuary Ramsar, SSSI and SPA	<0.1	28.1	<0.1	Negligible
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	<0.1	7.0	<0.1	Negligible
41	Halkyn Common and Holywell Grasslands SSSI	<0.1	5.8	<0.1	Negligible
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	6.0	<0.1	Negligible
43	Tyddyn-Dows Wood SAC and SSSI	<0.1	5.8	<0.1	Negligible
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	5.3	<0.1	Negligible
45	Alyn Valley Woods SAC and SSSI	<0.1	9.3	0.1	Negligible
46	Halkyn Common and Holywell Grasslands SSSI	<0.1	9.7	0.1	Negligible
47	Dee Estuary SAC, SSSI and Ramsar	<0.1	8.1	0.1	Negligible
48	Dee Estuary Ramsar, SSSI, SAC and SPA	<0.1	7.4	<0.1	Negligible
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	<0.1	11.8	<0.1	Negligible
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	<0.1	15.0	<0.1	Negligible

Table 8.63 Predicted Process Contributions at Ecological Receptors – Phase 1 only

13.106. The background nitrogen deposition (kg N/ha/yr), minimum and maximum Critical Loads (CLs) obtained from the APIS website for each of the ecological receptor points are listed in Table 8.64. The calculated nitrogen deposition rates (kg N/ha/yr) (process contribution (PC)) for Phase 1 only and Phases 1, 2 and 3 are also listed. These have been calculated in accordance with the methodology outlined in Appendix 8.5. The proportion of the process contribution (PC) in relation to both the minimum and maximum Critical Loads (CLs) are also listed.

13.107. The change in nitrogen deposition for the for both Phase 1 only and Phase 1, 2 and 3 combined at each of the ecological receptor points is <1% of the corresponding minimum critical load (CL). A maximum of 0.71% PC to CL is predicted at receptor point 28 on the River Dee and Bala Lake SAC/ SSSI. The impact of the operation of the Application Site all ecological features

can therefore be screened out as insignificant. An in-combination assessment may be required to inform a Habitats Regulations Assessment (HRA). The values provided in Table 8.64 can be used to inform this assessment

ID	Location	Background Nitrogen Deposition (kg N/ha/yr)	Critical Load (CL) (k N/ha/yr)		Process Contribution (PC) (kg N/ha/yr)		Ratio of PC to CL (%) (Min CL)		Ratio of PC to CL (%) (Max CL)	
			Min	Max	Phase 1 only	Phases 1, 2 and 3	Phase 1 only	Phases 1, 2 and 3	Phase 1 only	Phases 1, 2 and 3
19	River Dee SAC SSSI	10.50	8	10	0.01	0.03	0.14	0.39	0.11	0.32
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	9.66	8	10	0.01	0.03	0.11	0.39	0.09	0.31
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	9.66	5	15	0.01	0.02	0.17	0.48	0.06	0.16
22	The Dee Estuary SPA and Ramsar	9.66	8	10	0.01	0.02	0.07	0.28	0.06	0.23
23	The Dee Estuary Ramsar SSSI, SAC, SPA	11.76	8	10	0.01	0.02	0.07	0.19	0.06	0.15
24	Deeside and Buckley Newt Sites SAC and SSSI	12.88	10	15	<0.01	0.02	0.05	0.17	0.03	0.11
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	11.76	3	10	<0.01	0.01	0.15	0.42	0.04	0.13
26	The Gathering Grounds Wood SSSI and SAC	12.88	3*	10*	<0.01	0.01	0.05	0.39	0.02	0.12
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	12.88	10	15	0.01	0.01	0.08	0.06	0.05	0.04
28	River Dee and Bala Lake SAC and SSSI	10.50	3	10	<0.01	0.02	0.08	0.71	0.02	0.21
29	River Dee and Bala Lake SAC and SSSI	10.22	3	10	0.01	0.01	0.26	0.29	0.08	0.09
30	Inner Marsh Farm SSSI	9.66	10	10*	0.01	0.02	0.07	0.22	0.03	0.11
31	Dee Estuary SAC, Ramsar, SSSI and SPA	9.66	8	10	<0.01	0.02	0.02	0.22	0.02	0.17
32	Deeside and Buckley Newt sites SAC and SSSI	12.88	10	15	<0.01	0.01	0.03	0.06	0.02	0.04
33	Connah's Quay Ponds and Woodland SSSI and SAC	12.88	3*	10*	<0.01	0.01	0.05	0.29	0.02	0.09
34	Deeside and Buckley New sites SAC and SSSI	12.88	10	15	<0.01	0.00	0.02	0.05	0.01	0.03

ID	Location	Background Nitrogen Deposition (kg N/ha/yr)	Critical Load (CL) (k N/ha/yr)		Process Contribution (PC) (kg N/ha/yr)		Ratio of PC to CL (%) (Min CL)		Ratio of PC to CL (%) (Max CL)	
			Min	Max	Phase 1 only	Phases 1, 2 and 3	Phase 1 only	Phases 1, 2 and 3	Phase 1 only	Phases 1, 2 and 3
35	Buckley Claypits and Common SSSI and SAC	12.88	10	15	<0.01	0.01	0.01	0.05	0.01	0.03
36	Mersey Estuary SSSI, Ramsar and SPA	12.04	5	10	<0.01	<0.01	0.03	0.07	0.01	0.04
37	Mersey Estuary SSSI, Ramsar and SPA	11.48	5	10	<0.01	<0.01	0.02	0.07	0.01	0.04
38	Mersey Estuary SSSI, Ramsar and SPA	12.04	5	10	<0.01	<0.01	0.02	0.06	0.01	0.03
39	Mersey Estuary Ramsar, SSSI and SPA	11.48	5	10	<0.01	<0.01	0.02	0.07	0.01	0.03
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	14.70	5	10	<0.01	<0.01	0.02	0.06	0.01	0.03
41	Halkyn Common and Holywell Grasslands SSSI	16.66	3*	10*	<0.01	<0.01	0.02	0.07	0.01	0.02
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	17.36	15	20	<0.01	<0.01	0.00	0.01	0.00	0.01
43	Tyddyn-Dows Wood SAC and SSSI	17.36	3*	10*	<0.01	<0.01	0.02	0.07	0.01	0.02
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	18.34	15	20	<0.01	<0.01	0.01	0.01	0.01	0.01
45	Alyn Valley Woods SAC and SSSI	14.70	15	20	<0.01	<0.01	0.01	0.02	0.01	0.02
46	Halkyn Common and Holywell Grasslands SSSI	11.76	10	15	<0.01	0.01	0.03	0.06	0.02	0.04
47	Dee Estuary SAC, SSSI and Ramsar	11.76	8	10	<0.01	0.01	0.02	0.11	0.02	0.09
48	Dee Estuary Ramsar, SSSI, SAC and SPA	10.22	8	10	<0.01	0.01	0.01	0.07	0.01	0.05
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	10.64	8	10	<0.01	<0.01	0.01	0.03	0.01	0.03
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	12.04	8	10	<0.01	<0.01	0.00	0.03	0.00	0.02

Notes: * lowest values used from other sites, in the absence of values on APIS, as there are reported to be no comparable habitat with established critical load estimate available.

Table 8.64 Predicted Process Contributions from on-site Combustion Plant at Ecological Receptors – Phase 1 and Phases 1, 2 and 3

Flue Height Sensitivity Testing

13.108. Sensitivity testing of flue heights has been carried out for the gas turbines (E3 and E10) for all phases. Due to the size and hours of operation these are the on-site combustion source with maximum potential for impact on operational emissions. The results for potential E3 and E10 stack heights of 29m and 30m including the combine impact of combustion plant and operational traffic emissions from all phases are shown in Table 8.67 in Appendix 8.8.

13.109. Increasing the flue height from 28.5m to 30m reduces the impact at nearby Receptor 9 from sight adverse to negligible and would therefore have an insignificant impact. As the ambient NO_2 concentrations in the wider area are low, the total concentrations predicted at Receptor 9 are well below the annual mean objective, regardless of the stack height.

13.110. The results from operational combustion plant emissions only, with an increased flue height of 30m for the main and by-pass units (E3 and E10) are listed in the following tables, for both Phase 1 only and Phase 1, 2 and 3 combined. Table 8.65 and Table 8.66 list the results for residential receptors and Table 8.67 and Table 8.68, for ecological receptors.

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
1	4 Glan Y Fferi	0.3	11.4	0.7	Negligible
2	Ysgol Gynradd Sealand Primary School	0.4	11.5	1.0	Negligible
3	2 Farm Road	0.4	11.5	1.0	Negligible
4	38 Welsh Road	0.4	11.5	1.0	Negligible
5	23 Welsh Road	0.5	11.7	1.4	Negligible
6	1 Welsh Road	0.8	11.9	2.1	Negligible
7	93 Welsh Road	0.9	11.9	2.2	Negligible
8	86 Sealand Avenue	1.5	10.7	3.7	Negligible
9	Plot 9 proposed residential	2.2	11.4	5.4	Negligible
10	Plot 6 proposed residential	1.6	10.9	4.1	Negligible
11	Plot 2 proposed residential	1.9	13.0	4.8	Negligible
12	Plot 8 proposed residential	1.9	11.2	4.8	Negligible

Table 8.65 Predicted Process Contributions at Residential Receptors – Phase 1, 2 and 3

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
1	4 Glan Y Fferi	0.1	11.2	0.3	Negligible
2	Ysgol Gynradd Sealand Primary School	0.1	11.2	0.3	Negligible
3	2 Farm Road	0.1	11.2	0.3	Negligible
4	38 Welsh Road	0.2	11.3	0.4	Negligible
5	23 Welsh Road	0.3	11.4	0.6	Negligible
6	1 Welsh Road	0.3	11.3	0.7	Negligible
7	93 Welsh Road	0.4	11.5	1.0	Negligible
8	86 Sealand Avenue	0.4	9.7	1.1	Negligible
9	Plot 9 proposed residential	1.0	10.3	2.6	Negligible
10	Plot 6 proposed residential	0.3	9.6	0.8	Negligible
11	Plot 2 proposed residential	1.1	12.2	2.8	Negligible
12	Plot 8 proposed residential	0.1	9.4	0.2	Negligible

Table 8.66 Predicted Process Contributions at Residential Receptors – Phase 1 only

ID	Location	NO_x annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_x)	% change relative to AQO ($30\mu g/m^3$)	Impact descriptor
19	River Dee SAC SSSI	0.3	13.4	1.0	Negligible
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	0.3	11.1	1.0	Negligible
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	0.2	13.5	0.8	Negligible
22	The Dee Estuary SPA and Ramsar	0.2	9.9	0.7	Negligible
23	The Dee Estuary Ramsar SSSI, SAC, SPA	0.1	14.0	0.5	Negligible
24	Deeside and Buckley Newt Sites SAC and SSSI	0.2	10.5	0.5	Negligible
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	0.1	9.2	0.4	Negligible
26	The Gathering Grounds Wood SSSI and SAC	0.1	10.4	0.4	Negligible
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	0.1	12.5	0.2	Negligible
28	River Dee and Bala Lake SAC and SSSI	0.2	16.1	0.7	Negligible
29	River Dee and Bala Lake SAC and SSSI	0.1	11.8	0.3	Negligible
30	Inner Marsh Farm SSSI	0.2	10.3	0.7	Negligible
31	Dee Estuary SAC, Ramsar, SSSI and SPA	0.2	9.9	0.6	Negligible

ID	Location	NO_x annual mean PC ($\mu g/m^3$)	Total concentration (plus 2022 background NO_x)	% change relative to AQO ($30\mu g/m^3$)	Impact descriptor
32	Deeside and Buckley Newt sites SAC and SSSI	0.1	8.7	0.2	Negligible
33	Connah's Quay Ponds and Woodland SSSI and SAC	0.1	10.2	0.3	Negligible
34	Deeside and Buckley New sites SAC and SSSI	<0.1	10.3	0.2	Negligible
35	Buckley Claypits and Common SSSI and SAC	<0.1	11.0	0.2	Negligible
36	Mersey Estuary SSSI, Ramsar and SPA	<0.1	15.7	0.1	Negligible
37	Mersey Estuary SSSI, Ramsar and SPA	<0.1	21.7	0.1	Negligible
38	Mersey Estuary SSSI, Ramsar and SPA	<0.1	23.2	0.1	Negligible
39	Mersey Estuary Ramsar, SSSI and SPA	<0.1	28.1	0.1	Negligible
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	<0.1	7.1	0.1	Negligible
41	Halkyn Common and Holywell Grasslands SSSI	<0.1	5.9	0.1	Negligible
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	6.0	0.1	Negligible
43	Tyddyn-Dows Wood SAC and SSSI	<0.1	5.8	0.1	Negligible
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	5.4	0.1	Negligible
45	Alyn Valley Woods SAC and SSSI	<0.1	9.3	0.1	Negligible
46	Halkyn Common and Holywell Grasslands SSSI	0.1	9.7	0.2	Negligible
47	Dee Estuary SAC, SSSI and Ramsar	0.1	8.1	0.3	Negligible
48	Dee Estuary Ramsar, SSSI, SAC and SPA	0.1	7.4	0.2	Negligible
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	<0.1	11.8	0.1	Negligible
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	<0.1	15.0	0.1	Negligible

Table 8.67 Predicted Process Contributions at Ecological Receptors – Phase 1, 2 and 3

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
19	River Dee SAC SSSI	0.1	13.2	0.4	Negligible

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	0.1	10.9	0.3	Negligible
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	0.1	13.3	0.3	Negligible
22	The Dee Estuary SPA and Ramsar	0.1	9.7	0.2	Negligible
23	The Dee Estuary Ramsar SSSI, SAC, SPA	0.1	13.9	0.2	Negligible
24	Deeside and Buckley Newt Sites SAC and SSSI	<0.1	10.4	0.2	Negligible
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	<0.1	9.1	0.1	Negligible
26	The Gathering Grounds Wood SSSI and SAC	<0.1	10.3	0.1	Negligible
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	0.1	12.5	0.2	Negligible
28	River Dee and Bala Lake SAC and SSSI	<0.1	15.9	0.1	Negligible
29	River Dee and Bala Lake SAC and SSSI	0.1	11.8	0.3	Negligible
30	Inner Marsh Farm SSSI	0.1	10.2	0.2	Negligible
31	Dee Estuary SAC, Ramsar, SSSI and SPA	<0.1	9.7	0.1	Negligible
32	Deeside and Buckley Newt sites SAC and SSSI	<0.1	8.7	0.1	Negligible
33	Connah's Quay Ponds and Woodland SSSI and SAC	<0.1	10.2	0.1	Negligible
34	Deeside and Buckley New sites SAC and SSSI	<0.1	10.2	0.1	Negligible
35	Buckley Claypits and Common SSSI and SAC	<0.1	11.0	<0.1	Negligible
36	Mersey Estuary SSSI, Ramsar and SPA	<0.1	15.7	<0.1	Negligible
37	Mersey Estuary SSSI, Ramsar and SPA	<0.1	21.7	<0.1	Negligible
38	Mersey Estuary SSSI, Ramsar and SPA	<0.1	23.2	<0.1	Negligible
39	Mersey Estuary Ramsar, SSSI and SPA	<0.1	28.1	<0.1	Negligible
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	<0.1	7.0	<0.1	Negligible
41	Halkyn Common and Holywell Grasslands SSSI	<0.1	5.8	<0.1	Negligible
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	6.0	<0.1	Negligible

ID	Location	NO_2 annual mean PC ($\mu g/m^3$)	Total concentration (plus background NO_2)	% change relative to AQO ($40\mu g/m^3$)	Impact descriptor
43	Tyddyn-Dows Wood SAC and SSSI	<0.1	5.8	<0.1	Negligible
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	<0.1	5.3	<0.1	Negligible
45	Alyn Valley Woods SAC and SSSI	<0.1	9.3	0.1	Negligible
46	Halkyn Common and Holywell Grasslands SSSI	<0.1	9.7	0.1	Negligible
47	Dee Estuary SAC, SSSI and Ramsar	<0.1	8.1	0.1	Negligible
48	Dee Estuary Ramsar, SSSI, SAC and SPA	<0.1	7.4	<0.1	Negligible
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	<0.1	11.8	<0.1	Negligible
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	<0.1	15.0	<0.1	Negligible

Table 8.68 Predicted Process Contributions at Ecological Receptors – Phase 1 only

Appendix 8.8 – Combined Impact – Operational Roads and On-site Combustion

Phase 1

13.111. Table 8.69 shows the combined impact of the operational traffic (all phases) and Phase 1 only on-site combustion plant at each of the modelled residential receptors near the Proposed Development for 2019 baseline and 2022 do-minimum (DM) and do-something (DS). The traffic flows are for Phases 1, 2 and 3, but emissions and backgrounds from 2022 have been retained, so there is an element of over conservatism within the modelled data set.

ID	Location	NO_2 Annual Mean Concentrations µg/m^3				
		Base 2019	DM 2022	DS 2022	Change	Impact descriptor
1	4 Glan Y Fferi	15.2	19.0	19.5	0.6	Negligible
2	Ysgol Gynradd Sealand Primary School	18.7	23.6	24.0	0.6	Negligible
3	2 Farm Road	28.1	35.7	36.1	0.6	Negligible
4	38 Welsh Road	35.4	36.6	36.9	0.5	Negligible
5	23 Welsh Road	18.8	26.1	26.8	0.9	Negligible
6	1 Welsh Road	15.8	22.8	23.6	1.1	Negligible
7	93 Welsh Road	14.2	14.9	15.3	0.8	Negligible
8	86 Sealand Avenue	11.0	10.3	10.3	0.5	Negligible
9	Plot 9 proposed residential	10.8	10.0	10.1	1.1	Negligible
10	Plot 6 proposed residential	10.7	10.1	10.4	0.6	Negligible
11	Plot 2 proposed residential	10.8	12.5	12.6	1.3	Negligible
12	Plot 8 proposed residential	10.7	10.1	10.2	0.2	Negligible

Table 8.69 NO_2 Annual Mean Concentrations at Modelled Receptors During the Operation Phase – Phase 1 only combustion plant

Phase 1, 2 and 3

13.112. Table 8.70 shows the combined impact of the operational traffic and on-site combustion plant for Phases 1, 2 and 3 at each of the modelled residential receptors near the Proposed Development for 2019 baseline and 2022 do-minimum (DM) and do-something (DS). The traffic flows are for Phases 1, 2 and 3, but emissions and backgrounds have been retained at 2022, so there is an element of over conservatism within the modelled data set.

ID	Location	NO_2 Annual Mean Concentrations µg/m³				
		Base 2019	DM 2022	DS 2022	Change	Impact descriptor
1	4 Glan Y Fferi	15.2	19.0	19.8	0.7	Negligible
2	Ysgol Gynradd Sealand Primary School	18.7	23.6	24.4	0.8	Negligible
3	2 Farm Road	28.1	35.7	36.6	0.9	Slight adverse
4	38 Welsh Road	35.4	36.6	37.3	0.7	Slight adverse
5	23 Welsh Road	18.8	26.1	27.4	1.2	Negligible
6	1 Welsh Road	15.8	22.8	24.4	1.6	Negligible
7	93 Welsh Road	14.2	14.9	16.2	1.3	Negligible
8	86 Sealand Avenue	11.0	10.3	11.9	1.6	Negligible
9	Plot 9 proposed residential	10.8	10.0	12.6	2.6	Slight adverse
10	Plot 6 proposed residential	10.7	10.1	12.2	2.0	Negligible
11	Plot 2 proposed residential	10.8	12.5	14.6	2.1	Negligible
12	Plot 8 proposed residential	10.7	19.0	19.8	0.7	Negligible

Table 8.70 Predicted Process Contributions at Residential Receptors – Phase 1, 2 and 3

Flue Height Sensitivity Testing

13.113. Sensitivity testing of flue heights has been carried out for the gas turbines (E3 and E10) for all phases. Due to the size and hours of operation these are the on-site combustion source with maximum potential for impact on operational emissions. The results for potential E3 and E10 stack heights of 29m and 30m including emissions from all phases are shown in Table 8.71. Increasing the flue height from 28.5m to 29m does not change the impact descriptor of slight adverse at Receptor 9, however the impact at receptor 9 is reduced to negligible if the stack height is increased to 30m, and would therefore have an insignificant impact As the ambient NO_2 concentrations in the wider area are low, the total concentrations predicted at Receptor 9 are all well below the annual mean objective, regardless of the stack height. A stack height of 30m still results in a slight adverse impact descriptor for receptors 3 and 4. This is due to the already elevated traffic flows in the area. Total concentrations remain below the annual objective. Increasing the flue height beyond 30m therefore has minimum impact and is therefore not considered necessary.

ID	NO_2 Annual Mean Concentrations µg/m³							
	Flue height 29m for units E10				Flue height 30m for units E10			
	DM2022	DS2022	Change	Impact descriptor	DM2022	DS2022	Change	Impact descriptor
1	19.0	19.8	0.7	Negligible	19.0	19.8	0.7	Negligible
2	23.6	24.4	0.8	Negligible	23.6	24.4	0.8	Negligible
3	35.7	36.6	0.9	Slight adverse	35.7	36.6	0.9	Slight adverse
4	36.6	37.3	0.7	Slight adverse	36.6	37.3	0.7	Slight adverse
5	26.1	27.3	1.2	Negligible	26.1	27.3	1.2	Negligible
6	22.8	24.4	1.6	Negligible	22.8	24.4	1.6	Negligible
7	14.9	16.2	1.3	Negligible	14.9	16.2	1.3	Negligible
8	10.3	11.9	1.6	Negligible	10.3	11.9	1.6	Negligible
9	10.0	12.4	2.4	Slight adverse	10.0	12.3	2.3	Negligible
10	10.1	12.1	2.0	Negligible	10.1	12.1	2.0	Negligible
11	12.5	14.6	2.1	Negligible	12.5	14.5	2.1	Negligible
12	19.0	12.2	2.2	Negligible	10.1	12.2	2.1	Negligible

Table 8.71 Sensitivity Testing of Flue Heights for E3 and E10

Ecological Receptors

13.114. Table 8.72 shows the combined impact of the predicted process contributions to long-term (annual mean) NOx concentrations associated with the operation of the combustion plant and operational traffic as part of Phases 1, 2 and 3 at each of the ecological receptors.

ID	Location	NOx Annual Mean Concentrations µg/m³			
		DM2022	DS2022	Change	Impact descriptor
19	River Dee SAC SSSI	13.1	13.5	0.3	Negligible
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	10.9	11.2	0.3	Negligible
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	13.3	13.5	0.2	Negligible
22	The Dee Estuary SPA and Ramsar	10.0	10.2	0.2	Negligible
23	The Dee Estuary Ramsar SSSI, SAC, SPA	13.8	14.0	0.2	Negligible
24	Deeside and Buckley Newt Sites SAC and SSSI	10.4	10.6	0.2	Negligible
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	9.1	9.2	0.1	Negligible

ID	Location	NOx Annual Mean Concentrations µg/m³			
		DM2022	DS2022	Change	Impact descriptor
26	The Gathering Grounds Wood SSSI and SAC	10.3	10.4	0.1	Negligible
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	12.5	12.5	0.1	Negligible
28	River Dee and Bala Lake SAC and SSSI	15.9	16.1	0.2	Negligible
29	River Dee and Bala Lake SAC and SSSI	11.7	11.8	0.1	Negligible
30	Inner Marsh Farm SSSI	10.1	10.3	0.2	Negligible
31	Dee Estuary SAC, Ramsar, SSSI and SPA	9.7	9.9	0.2	Negligible
32	Deeside and Buckley Newt sites SAC and SSSI	8.6	8.7	0.1	Negligible
33	Connah's Quay Ponds and Woodland SSSI and SAC	10.2	10.3	0.1	Negligible
34	Deeside and Buckley New sites SAC and SSSI	10.2	10.3	<0.1	Negligible
35	Buckley Claypits and Common SSSI and SAC	11.0	11.0	0.1	Negligible
36	Mersey Estuary SSSI, Ramsar and SPA	15.7	15.7	<0.1	Negligible
37	Mersey Estuary SSSI, Ramsar and SPA	21.7	21.7	<0.1	Negligible
38	Mersey Estuary SSSI, Ramsar and SPA	23.2	23.2	<0.1	Negligible
39	Mersey Estuary Ramsar, SSSI and SPA	28.1	28.1	<0.1	Negligible
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	7.1	7.1	<0.1	Negligible
41	Halkyn Common and Holywell Grasslands SSSI	5.9	5.9	<0.1	Negligible
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	6.0	6.0	<0.1	Negligible
43	Tyddyn-Dows Wood SAC and SSSI	5.8	5.8	<0.1	Negligible
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	5.3	5.4	<0.1	Negligible
45	Alyn Valley Woods SAC and SSSI	10.0	10.0	0.1	Negligible
46	Halkyn Common and Holywell Grasslands SSSI	9.7	9.8	0.1	Negligible
47	Dee Estuary SAC, SSSI and Ramsar	8.1	8.2	0.1	Negligible
48	Dee Estuary Ramsar, SSSI, SAC and SPA	7.4	7.5	0.1	Negligible
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	11.8	11.9	<0.1	Negligible
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	15.0	15.1	<0.1	Negligible

Table 8.72 Predicted Combined Process Contributions at Ecological Receptors – Phase 1, 2 and 3

13.115. The background nitrogen deposition (kg N/ha/yr), minimum and maximum Critical Loads (CLs) obtained from the APIS website for each of the ecological receptor points are listed in Table 8.73. The calculated nitrogen deposition rates (kg N/ha/yr) for the DM2022 and DS2022 scenarios and the change /process contribution (PC) are also listed. These have been calculated in accordance with the methodology outlined in Appendix 8.5. The proportion of the process contribution (PC) in relation to both the minimum and maximum Critical Loads (CLs) are also listed.

13.116. The change in nitrogen deposition for the 2022 scenario (process contribution (PC)) at each of the ecological receptor points is <1% of the corresponding minimum critical load (CL). A maximum of 0.58% PC to CL is predicted at receptor point 25 on the River Dee and Bala Lake SAC/ SSSI. The impact of the operation of the Application Site all ecological features can therefore be screened out as insignificant. An in-combination assessment may be required to inform a Habitats Regulations Assessment (HRA). The values provided in Table 8.73 can be used to inform this assessment.

ID	Location	Background Nitrogen Deposition (kg N/ha/yr)	Critical Load (CL) (k N/ha/yr)		Predicted Nitrogen Deposition Rates (kg N/ha/yr)		Process Contribution (PC) (kg N/ha/yr)	Proportion of PC to CL (%)	
			Min	Max	DM2022	DS2022		Min	Max
19	River Dee SAC SSSI	10.50	8	10	1.44	1.45	0.01	0.16	0.13
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	9.66	8	10	1.21	1.22	0.01	0.15	0.12
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	9.66	5	15	1.45	1.46	0.01	0.13	0.04
22	The Dee Estuary SPA and Ramsar	9.66	8	10	1.09	1.11	0.02	0.26	0.21
23	The Dee Estuary Ramsar SSSI, SAC, SPA	11.76	8	10	1.51	1.52	0.01	0.11	0.09
24	Deeside and Buckley Newt Sites SAC and SSSI	12.88	10	15	1.16	1.19	0.02	0.22	0.15
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	11.76	3	10	1.02	1.04	0.02	0.58	0.17
26	The Gathering Grounds Wood SSSI and SAC	12.88	3*	10*	1.15	1.16	0.01	0.19	0.06
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	12.88	10	15	1.38	1.39	0.01	0.09	0.06

ID	Location	Background Nitrogen Deposition (kg N/ha/yr)	Critical Load (CL) (k N/ha/yr)		Predicted Nitrogen Deposition Rates (kg N/ha/yr)		Process Contribution (PC) (kg N/ha/yr)	Proportion of PC to CL (%)	
			Min	Max	DM2022	DS2022		Min	Max
28	River Dee and Bala Lake SAC and SSSI	10.50	3	10	1.71	1.71	<0.01	0.16	0.05
29	River Dee and Bala Lake SAC and SSSI	10.22	3	10	1.30	1.30	0.01	0.17	0.05
30	Inner Marsh Farm SSSI	9.66	10	20	1.14	1.14	<0.01	0.04	0.02
31	Dee Estuary SAC, Ramsar, SSSI and SPA	9.66	8	10	1.09	1.10	<0.01	0.05	0.04
32	Deeside and Buckley Newt sites SAC and SSSI	12.88	10	15	0.98	0.99	<0.01	0.03	0.02
33	Connah's Quay Ponds and Woodland SSSI and SAC	12.88	3*	10*	1.14	1.15	<0.01	0.11	0.03
34	Deeside and Buckley New sites SAC and SSSI	12.88	10	15	1.15	1.15	<0.01	0.03	0.02
35	Buckley Claypits and Common SSSI and SAC	12.88	10	15	1.23	1.23	<0.01	0.02	0.01
36	Mersey Estuary SSSI, Ramsar and SPA	12.04	5	10	1.69	1.69	<0.01	0.04	0.02
37	Mersey Estuary SSSI, Ramsar and SPA	11.48	5	10	2.24	2.25	<0.01	0.04	0.02
38	Mersey Estuary SSSI, Ramsar and SPA	12.04	5	10	2.36	2.36	<0.01	0.04	0.02
39	Mersey Estuary Ramsar, SSSI and SPA	11.48	5	10	2.75	2.76	<0.01	0.07	0.03
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	14.70	5	10	0.81	0.82	0.01	0.12	0.06
41	Halkyn Common and Holywell Grasslands SSSI	16.66	3*	10*	0.68	0.69	0.01	0.30	0.09
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	17.36	15	20	0.69	0.70	0.01	0.04	0.03
43	Tyddyn-Dows Wood SAC and SSSI	17.36	3*	10*	0.67	0.67	<0.01	0.09	0.03
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	18.34	15	20	0.62	0.63	0.01	0.05	0.04
45	Alyn Valley Woods SAC and SSSI	14.70	15	20	1.05	1.09	0.03	0.21	0.16
46	Halkyn Common and Holywell Grasslands SSSI	11.76	10	15	1.09	1.12	0.03	0.31	0.21
47	Dee Estuary SAC, SSSI and Ramsar	11.76	8	10	0.92	0.94	0.02	0.30	0.24
48	Dee Estuary Ramsar, SSSI, SAC and SPA	10.22	8	10	0.84	0.87	0.02	0.28	0.23

ID	Location	Background Nitrogen Deposition (kg N/ha/yr)	Critical Load (CL) (k N/ha/yr)		Predicted Nitrogen Deposition Rates (kg N/ha/yr)		Process Contribution (PC) (kg N/ha/yr)	Proportion of PC to CL (%)	
			Min	Max	DM2022	DS2022		Min	Max
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	10.64	8	10	1.31	1.32	0.02	0.19	0.15
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	12.04	8	10	1.62	1.64	0.02	0.21	0.17
Notes: * lowest values used from other sites, in the absence of values on APIS, as there are reported to be no comparable habitat with established critical load estimate available.									

Table 8.73 Predicted Proportion of Combined Process Contributions to Critical Loads at Ecological Receptors – Phase 1, 2 and 3

Appendix 8.9 – Mitigation Measures for Construction

Primary measures are those that will be implemented at all times; Secondary measures will be implemented as necessary (in agreement with the local authority), while n/a measures are not required for a given level of risk.

Site Management		Low Risk	Medium Risk	High Risk
1.	Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary.	Primary		
2.	Display the head or regional office contact information.	Primary		
3.	Record and respond to all dust and air quality pollutant emissions complaints.	Primary		
4.	Make a complaint log available to the local authority.	Primary		
5.	Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the local authority.	Primary		
6.	Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions and dust are being carried out, and during prolonged dry, or windy conditions.	Primary		
7.	Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the logbook.	Primary		
8.	Develop and implement a **stakeholder communications plan** that includes community engagement before work commences on-site.	n/a		Primary
9.	Develop a **dust management plan**.	n/a		Primary
10.	Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.	n/a		Primary

Table 8.74: Construction Mitigation Measures- Site Management

Preparing and Maintaining the Site		Low Risk	Medium Risk	High Risk
11.	Plan site layout: machinery and dust causing activities will be located away from receptors.	Primary		
12.	Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on-site.	Primary		
13.	Avoid site runoff of water or mud.	Primary		
14.	Fully enclosure site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	Secondary	Primary	
15.	Keep site fencing, barriers, and scaffolding clean using wet methods.	Secondary	Primary	
16.	Remove materials from site as soon as possible.	Secondary	Primary	
17.	Cover, seed, or fence stockpiles to prevent wind whipping.	Secondary	Primary	
18.	Agree monitoring locations with the local authority.	n/a	Primary	
19.	Where possible, commence baseline monitoring at least three months before phase begins.	n/a	Primary	
20.	Put in place real-time dust and air quality pollutant monitors across the site and ensure they are checked regularly.	n/a	Primary	
21.	Carry out regular dust soiling checks of buildings within 100 m of site boundary and cleaning to be provided.	n/a	Secondary	Primary
22.	Install green walls, screens, or other green infrastructure to minimise the impact of dust and pollution.	n/a	Secondary	

Table 8.75: Construction Mitigation Measures- Preparing and Maintaining the Site

Operating Vehicle/Machinery and Sustainable Travel		Low Risk	Medium Risk	High Risk
23.	Ensure all non-road mobile machinery (NRMM) comply with the standards set within the SPG.	Primary		
24.	Ensure all vehicles switch off engines when stationary – no idling vehicles.	Primary		
25.	Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment.	Primary		
26.	Implement a **Travel Plan** that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	n/a	Secondary	Primary
27.	Produce a **Construction Logistics Plan** to manage the sustainable delivery of goods and materials.	n/a	Primary	
28.	Impose and signpost a maximum-speed-limit of 10 mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority).	Secondary		Primary

Table 8.76: Construction Mitigation Measures- Operating Vehicle/Machinery and Sustainable Travel

Operations		Low Risk	Medium Risk	High Risk
29.	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	Primary		
30.	Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water).	Primary		
31.	Use enclosed chutes, conveyors, and covered skips.	Primary		
32.	Minimise drop heights from conveyors, loading shovels, hoppers, and other loading, or handling equipment, and use fine water sprays on such equipment.	Primary		
33.	Ensure equipment is readily available on-site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	n/a	Primary	

Table 8.77: Construction Mitigation Measures- Operations

Waste Management		Low Risk	Medium Risk	High Risk
34.	Reuse and recycle waste to reduce dust from waste materials	Primary		
35.	Avoid bonfires and burning of waste materials.	Primary		

Table 8.78: Construction Mitigation Measures- Waste Management Activities

Measurement Specific to Demolition	Low Risk	Medium Risk	High Risk
36. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	Secondary		Primary
37. Ensure effective water suppression is used during demolition operations.	Primary		
38. Avoid explosive blasting, using appropriate manual or mechanical alternatives.	Primary		
39. Bag and remove any biological debris or damp down such material before demolition.	Primary		

Table 8.79: Construction Mitigation Measures- Demolition Activities

Measurement Specific to Earthworks	Low Risk	Medium Risk	High Risk
40. Consider re-vegetating earthworks and exposed areas/soil stockpiles to stabilise surfaces.	n/a	Secondary	Primary
41. Consider the use of hessian, mulches, or trackifiers where it is not possible to re-vegetate or cover with topsoil.	n/a	Secondary	Primary
42. Only remove secure covers in small areas during work and not all at once.	n/a	Secondary	Primary

Table 8.80: Construction Mitigation Measures- Earthworks Activities

Measurement Specific to Construction	Low Risk	Medium Risk	High Risk
43. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	Secondary	Primary	
44. Avoid scabbling (roughening of concrete surfaces) if possible	Secondary		Primary
45. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	n/a	Secondary	Primary
46. For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.	n/a	Secondary	

Table 8.81: Construction Mitigation Measures- Construction Activities

Measures Specific to Trackout		Low Risk	Medium Risk	High Risk
47.	Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.	Secondary	Primary	
48.	Avoid dry sweeping of large areas.	Secondary	Primary	
49.	Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport.	Secondary	Primary	
50.	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site).	Secondary	Primary	
51.	Record all inspections of haul routes and any subsequent action in a site logbook.	Secondary	Primary	
52.	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems and regularly cleaned.	n/a	Primary	
53.	Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;	n/a	Primary	
54.	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size, and layout permits.	n/a	Primary	
55.	Access gates to be located at least 10 m from receptors where possible.	n/a	Primary	
56.	Apply dust suppressants to locations where a large volume of vehicles enter and exit the construction site.	n/a	Secondary	Primary

Table 8.82: Construction Mitigation Measures- Trackout Activities