Air Quality Assessment

Bartley Power, Plas Bennion Road, Ruabon

Presented to: Welsh Power Group Limited

Issued: July 2023

Delta-Simons Project No: 87658.544924

Protecting people
and planet

Report Details

Client	Welsh Power Group Limited
Report Title	Air Quality Assessment
Site Address	Bartley Power, Plas Bennion Road in Ruabon, Wrexham, LL14 1TP
Project No.	87658.544924
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Executive Summary

Site and Report Context	Delta-Simons Limited ('Delta-Simons'), has been instructed by Welsh Power Group Limited (the 'Client') to undertake an Air Quality Assessment to inform a Medium Combustion Plant (MCP) permit application for the existing plants, located at Bartley Power, Plas Bennion Road in Ruabon, Wrexham, LL14 1TP (the 'Site'). Accordingly, the operation of the generators have the potential to affect existing pollutant levels at nearby sensitive human and ecological receptors, as a result of the flue gas emissions. Therefore, an Air Quality Assessment is required to determine baseline conditions at the Site and to assess the potential impacts associated with the operation of the Site. A baseline desk study indicated that there are a number of statutory designated sites within the relevant screening distances. These include the River Dee Site of Special Scientific Interest (SSSI) located approximately 1.6km south-east of the Site. Furthermore, the River Dee and Bala Lake Special Area of Conservation (SAC), Johnstown Newt Sites SAC and Berwyn and South Clwyd Mountains SAC are located approximately 1.6km south-east, 1.9km north-east and 3.5km north- west of the Site, respectively. Therefore, the main potential impacts associated with the operations at the Site are identified as those affecting these nearby sensitive ecological receptors and residential receptors located within approximately 10km of the Site. This report presents the findings of the assessment, which addresses the potential air quality impacts during the operations at the Site. The type, source and significance of potential impacts were identified and the measures that should be employed to minimise these described.
Summary	The predicted effects associated with the emissions from the generators have been assessed based on detailed dispersion modelling. In order to represent a worst-case scenario in relation to likely operational impacts, it has been assumed that all of the generators will operate continuously for 8,760-hours per year. The results of the dispersion modelling assessment show that, the predicted overall effects, in line with the relevant Environment Agency guidance criteria, are **not significant** at sensitive receptor locations and there is no risk of exceedance of the relevant Environmental Assessment Levels (EALs). The predicted annual mean acid deposition rates, utilising the APIS Critical Load Function Tool show no exceedances of the relevant CLs, at the most significantly affected ecological receptor locations within each ecological designations with established acidity critical load estimates. As such, it is considered, that operation of the Site would result in a **not significant** effect on the integrity of these ecological designations.
Conclusions and Recommendations	Based on the results of the assessment, it is considered that, the operation of the generators does not result in any significant effects at sensitive receptor locations. Therefore, there are no air quality constraints considered to restrict permitting consent.
This is intended as a summary only. Further detail and limitations of the assessment are provided within the main body of the report.	

Table of Contents

1.0 INTRODUCTION 1
1.1 Appointment 1
1.2 Site Location and Context 1
2.0 SCOPE AND METHODOLOGY 2
2.1 Scope 2
2.2 Methodology 2
2.3 Significance Criteria 6
3.0 BASELINE 10
3.1 Introduction 10
3.2 Local Air Quality Management 10
3.3 Local Emission Sources 10
3.4 Air Quality Monitoring 10
3.5 Predicted Background Pollutant Concentrations 10
4.0 ASSESSMENT 13
4.1 Introduction 13
4.2 Operational Phase Assessment 13
5.0 SUMMARY AND CONCLUSIONS 15

Figures

Figure 1 - Site Location and Assessment Extents

Appendices

Appendix A - Limitations
Appendix B - Glossary
Appendix C - Relevant UK Air Quality Strategy Objectives and Environmental Assessment Levels
Appendix D - Dispersion Model Details
Appendix E - Wind Roses for Shawbury(2018 - 2022)
Appendix F - Dispersion Modelling Results

1.0 Introduction

1.1 Appointment

1.1.1 Delta-Simons Limited ('Delta-Simons'), was instructed by Welsh Power Group Limited (the 'Client') to undertake an Air Quality Assessment to inform a Medium Combustion Plant (MCP) permit application for the existing plants, located at Bartley Power, Plas Bennion Road in Ruabon, Wrexham, LL14 1TP (the 'Site').

1.2 Site Location and Context

1.2.1 The main potential impacts associated with the flue gas emissions during operation of the existing plants are those affecting sensitive human and ecological receptors, as a result of the flue gas emissions. Therefore, an Air Quality Assessment is required to determine baseline conditions at the Site and to assess the potential impacts associated with the operation of the existing plants, in accordance with the requirements of the National Planning Policy Framework (NPPF)[1].

1.2.2 A baseline desk study indicated that there are a number of statutory designated sites within the relevant screening distances. These include, the River Dee Site of Special Scientific Interest (SSSI) located approximately 1.6km south-east of the Site. Furthermore, the River Dee and Bala Lake Special Area of Conservation (SAC), Johnstown Newt Sites SAC and Berwyn and South Clwyd Mountains SAC are located approximately 1.6km south-east, 1.9km north-east and 3.5km north- west of the Site, respectively. Therefore, the main potential impacts associated with the operations at the Site are identified as those affecting these nearby sensitive ecological receptors and residential receptors located within approximately 10km of the Site.

1.2.3 In order to represent a worst-case scenario in relation to likely operational impacts, it has been assumed that the generator will operate continuously for 8,760-hours per year.

1.2.4 This report presents the findings of the assessment, which addresses the potential air quality impacts during the operational phase of the Existing Plants. The type, source and significance of potential impacts were identified and the measures that should be employed to minimise these described.

1.2.5 Reference should be made to **Figure 1** for a map of the Site and surrounding area.

1.2.6 The standard limitations associated with this assessment are presented in **Appendix A**.

1.2.7 A glossary of terms used in this report is provided in **Appendix B**.

[1] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework.

2.0 Scope and Methodology

2.1 Scope

2.1.1 The scope of the assessment has been determined in the following way:

- Baseline Assessment - review of the latest available Air Quality Annual Status Report (ASR) from the North Wales Authorities Collaborative Project[2], includes which air quality monitoring data for multiple counties in North Wales, including Wrexham County Borough Council (WCBC) and air quality data for the area surrounding the Site, including data from WCBC, Defra[3] and the Environment Agency (EA)[4];
- Preparation of a desk study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality as a result of the operations at the Site. This included a review of information on ecological receptors from the Multi-Agency Geographic Information for the Countryside (MAGIC) on-line mapping website[5] and APIS[6];
- Review of the emission parameters provided by the Project's Energy Consultant;
- Dispersion Modelling - prediction of ambient pollutant concentrations through dispersion modelling of atmospheric emissions from the operations at the Site; and
- Impact Assessment - comparison of predicted concentrations with the relevant criteria, detailed in **Appendix C**.

2.1.2 The scope of the assessment includes consideration of the potential impacts on local air quality resulting from emissions to air from the operation of the Existing Plant at the Site.

2.2 Methodology

Selection of Dispersion Model

2.2.1 Emissions associated with the operation of the generators at the Site have the potential to cause increases in pollutant concentrations in the vicinity of the Site. These have been quantified through dispersion modelling in accordance with the methodology outlined in the following sections.

2.2.2 Dispersion modelling was undertaken using the ADMS[7] software package, which was developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions.

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2 North Wales Authorities Collaborative Project (2022) 2022 Air Quality Progress Report [Online] Available at: https://www.conwy.gov.uk/en/Resident/Environmental-problems/assets-Air-Quality/documents/North-Wales-Authorities-Collaborative-Project-2022-Air-Quality-Progress-Report-v2-Final-Issue00001-C02.pdf [Accessed on 06/07/2023].

3 Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management (LAQM) Support Pages [Online] Available at: http://laqm.defra.gov.uk/ [Accessed on 06/07/2023].

4 Environment Agency (2022) Pollution Inventory [Online] Available at: https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory [Accessed on 06/07/2023].

5 Multi-Agency Geographic Information for the Countryside. [Online] Available at: https://magic.defra.gov.uk/MagicMap.aspx [Accessed on 06/07/2023].

6 UK Air Pollution Information System (APIS) [Online] Available at: http://www.apis.ac.uk/ [Accessed on 06/07/2023].

7 ADMS-Roads Extra Version 5.0.1.3.

2.2.3 The model takes into account the effects of significant buildings which surround the emission source. It is a limitation of the ADMS model that buildings can only be represented as having cuboid (or cylindrical) shape and, as such, all buildings have been approximated as having rectangular footprints. It is important to note that, as a result, the dimensions of the buildings are set to assess their impact on dispersion rather than to be representative of their exact dimensions.

2.2.4 Full details of the model input parameters are provided in **Appendix D**.

Assessment Extents

2.2.5 Impacts have been considered at selected sensitive receptors reflecting potential exposure. Reference should be made to **Figure 1**, for a graphical representation of the assessment extents.

Selection of Sensitive Receptors

2.2.6 Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from the operation of the existing plants.

Human Receptors

2.2.7 To complete the assessment of operational phase impacts, a number of 'receptors' representative of locations of relevant public exposure were identified at which pollutant concentrations were predicted.

2.2.8 The locations of the assessment receptors are shown on **Figure 1** and listed in **Table 1** below.

Table 1 - Human Receptor Locations Used in the Assessment

Receptor	Description / Address	Grid Reference		Distance from Point Source Location (m)	Height above Ground Level (m)
		X (m)	Y (m)		
R1	42 Aled, Wrexham, LL14 3HB	329001.5	343623.6	180	1.5
R2	10 Hampden Way, Wrexham, LL14 3HB	329073.2	343594.4	160	1.5
R3	19 Hampden Way, Wrexham, LL14 3US	329096.5	343578.0	170	1.5
R4	1 Idwal, Wrexham, LL14 3EY	329127.7	343482.5	260	1.5
R5	Cottages (South of Site)	329225.9	343212.3	540	1.5
R6	Tyn y Maes	329392.1	343153.4	650	1.5
R7	Wynn Offa	329442.7	343408.1	460	1.5
R8	6 Mabon, Wrexham, LL14 6EG	329550.3	343612.9	440	1.5
R9	155 Pont Adam Cresent, Wrexham, LL14 6EH	329525.4	343709.7	400	1.5
R10	107 Pont Adam Cresent, Wrexham, LL14 6EF	329606.1	343870.0	490	1.5
R11	Ysgol Rhiwabon High School, Wrexham, LL14 6BT	329687.2	343994.1	610	1.5
R12	Property on Lower School Drive, Wrexham, LL14 6RP	329736.8	344122.5	710	1.5
R13	Property on Tatham Road, Wrexham	329745.3	344340.2	860	1.5
R14	Plas-y-coed Pont Adam, Wrexham	329499.7	344310.3	670	1.5
R15	Rock House	329284.8	344403.5	680	1.5
R16	Swn-y-coed, Plas Bennion Road, LL14 1TR	328958.4	344536.3	810	1.5
R17	Property on The Grange, Plas Bennion Road	329026.2	343972.0	250	1.5
R18	28 Rhuddlan Road, Wrexham, LL14 3LJ	328376.5	343537.0	780	1.5
R19	Cheshire Cottage, Delph Road, Wrexham	328248.4	343675.9	880	1.5
R20	Westland House, Delph Road, Wrexham	328244.7	343871.2	890	1.5

Ecological Receptors

2.2.9 Atmospheric emissions from the operation of the existing plants have the potential to impact on receptors of ecological sensitivity within the vicinity of the Site. A study was undertaken to identify any statutory designated sites of ecological or nature conservation importance as follows:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites, within 10km of the Site; and

- Sites of Special Scientific Interest (SSSIs), local nature sites (ancient woods, local wildlife sites and national and local nature reserves), within 2km of the Site.

2.2.10 The study was completed using the MAGIC web-based interactive mapping service[5], which draws together information on key environmental schemes and designations. A summary of the identified ecological receptors is provided in **Table 2**.

Table 2 – Ecological Receptor Locations Used in the Assessment

Receptor	Description / Address	Grid Reference		Distance from Point Source Location (m)	Height above Ground Level (m)
		X (m)	Y (m)		
ER1	River Dee SSSI	328812.1	341882.6	1,890	0.0
ER2	River Dee SSSI	329371.9	342130.9	1,630	0.0
ER3	River Dee SSSI	329594.9	342061.8	1,750	0.0
ER4	Johnstown Newt Sites SAC	329709.3	345626.6	1,970	0.0
ER5	Johnstown Newt Sites SAC	329893.6	345489.2	1,900	0.0
ER6	Johnstown Newt Sites SAC	330100.3	345420.2	1,940	0.0
ER7	Johnstown Newt Sites SAC	330592.3	345531.3	2,310	0.0
ER8	Johnstown Newt Sites SAC	330561.0	345309.7	2,120	0.0
ER9	Johnstown Newt Sites SAC	330522.0	345079.4	1,930	0.0
ER10	Johnstown Newt Sites SAC	330629.9	345067.4	2,000	0.0
ER11	Berwyn and South Clwyd Mountains SAC	327326.8	349689.8	6,210	0.0
ER12	Berwyn and South Clwyd Mountains SAC	327011.9	349056.3	5,720	0.0
ER13	Berwyn and South Clwyd Mountains SAC	326855.6	347929.5	4,760	0.0
ER14	Berwyn and South Clwyd Mountains SAC	326395.6	347330.8	4,510	0.0
ER15	Berwyn and South Clwyd Mountains SAC	326397.0	346975.9	4,230	0.0
ER16	Berwyn and South Clwyd Mountains SAC	326296.0	346316.8	3,830	0.0
ER17	Berwyn and South Clwyd Mountains SAC	325896.7	345615.1	3,730	0.0
ER18	Berwyn and South Clwyd Mountains SAC	325734.0	345132.2	3,670	0.0
ER19	Berwyn and South Clwyd Mountains SAC	325721.6	344829.0	3,580	0.0
ER20	Berwyn and South Clwyd Mountains SAC	325316.3	344663.1	3,920	0.0
ER21	Berwyn and South Clwyd Mountains SAC	324471.5	344442.1	4,710	0.0
ER22	Berwyn and South Clwyd Mountains SAC	324366.2	343891.4	4,770	0.0
ER23	Berwyn and South Clwyd Mountains SAC	324765.6	343385.3	4,380	0.0
ER24	Berwyn and South Clwyd Mountains SAC	324873.4	342784.9	4,360	0.0
ER25	River Dee and Bala Lake SAC	324243.5	342241.0	5,110	0.0
ER26	River Dee and Bala Lake SAC	324436.1	341884.9	5,050	0.0
ER27	River Dee and Bala Lake SAC	324500.7	341326.1	5,220	0.0
ER28	River Dee and Bala Lake SAC	325352.8	341294.6	4,500	0.0
ER29	River Dee and Bala Lake SAC	326937.6	342110.2	2,730	0.0
ER30	River Dee and Bala Lake SAC	327256.7	341986.6	2,570	0.0
ER31	River Dee and Bala Lake SAC	327425.4	341743.7	2,630	0.0
ER32	River Dee and Bala Lake SAC	328035.5	341360.3	2,620	0.0
ER33	River Dee and Bala Lake SAC	330338.6	340932.0	3,060	0.0
ER34	River Dee and Bala Lake SAC	331216.4	340070.7	4,230	0.0
ER35	River Dee and Bala Lake SAC	332243.5	340356.8	4,600	0.0
ER36	River Dee and Bala Lake SAC	332666.3	340541.5	4,770	0.0
ER37	River Dee and Bala Lake SAC	333525.0	340745.5	5,320	0.0
ER38	River Dee and Bala Lake SAC	334158.7	340807.7	5,830	0.0
ER39	River Dee and Bala Lake SAC	334276.0	341322.2	5,690	0.0
ER40	River Dee and Bala Lake SAC	334616.2	341777.7	5,830	0.0

2.2.11 Reference should be made to **Figure 1** for a graphical representation of sensitive receptor locations.

Meteorological Data

2.2.12 The model utilises hourly meteorological data to define conditions for plume rise, dispersion and diffusion. It estimates the pollutant concentration from each source at each receptor combination for every hour of input meteorology and calculates user-selected long-term and short-term averages.

2.2.13 Meteorological data for the modelling was taken from Shawbury recording station, which is considered to be representative of likely meteorological conditions within the assessment extents. Inter-annual variability testing of the model results was undertaken for the years 2018 to 2022. Wind roses for each meteorological year are provided in **Appendix E**. The predominant wind direction over the 5-years was westerly.

Pollutants and Atmospheric Chemistry

2.2.14 The gas powered engine will be fired on natural gas. For the combustion of natural gas, the most significant emissions to air, in terms of local air quality impacts, are likely to be oxides of nitrogen (NO_X). This takes into account the potential contribution from the combustion source and likely existing pollutant concentrations. NO_2 and nitric oxide (NO) are both oxides of nitrogen and together are referred to as NO_X. In ambient air, NO is oxidised to form NO_2, and it is NO_2 which has the more significant impact on human health. Therefore, this assessment considers the impacts of emissions on ambient concentrations of NO_2.

2.2.15 NO_X concentrations output by the dispersion model have been converted to NO_2 following best practice guidance. To determine a 'worst case' scenario, in line with the advice provided by the EA[8], 70% conversion from NO_X to NO_2 has been applied for the annual mean and 35% for the 1-hour mean concentrations.

2.2.16 For the assessment, one scenario was modelled, as follows:

- Operation of existing plants.

Selection of Background Concentrations

Human Receptors

2.2.17 Background pollutant data for the operational phase assessment have for sensitive human receptors been taken from the national maps provided on the Defra website[9], where background concentrations of those pollutants included within the AQS have been mapped at a grid resolution of 1x1km for the whole of the UK. Estimated background concentrations are available for all years between 2018 and 2030, with previous years still accessible for assessment purposes utilising older resources.

2.2.18 The maps assume that background concentrations will improve (i.e. reduce) over time, in line with the predicted reduction in vehicle emissions, and emissions from other sources. Due to the uncertainty in this prediction, and in line with the findings of many local authorities that measured concentrations have not reduced as anticipated, 2023 background concentrations for NO_x and NO_2, have been utilised in this assessment. This provided a robust assessment and is likely to overestimate pollutant concentrations during the future operation of the existing plants.

Ecological Receptors

2.2.19 The predicted background deposition fluxes have been determined from APIS website[10].

[8] Environment Agency (2023) Guidance on Specified Generators: Dispersion Modelling Assessment (2019) [Online] Available at: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment [Accessed on 06/07/2023].

[9] Department for Environment, Food and Rural Affairs (Defra) (2022) Background Concentrations [Online] Available at: https://uk-air.defra.gov.uk/data/laqm-background-home [Accessed on 06/07/2023].

[10] UK Air Pollution Information System (APIS) [Online] Available at: http://www.apis.ac.uk/ [Accessed on 06/07/2023].

2.3 Significance Criteria

Human Receptors

2.3.1 The consideration of whether the effect of the operation of the existing plants is significant depends on the magnitude of impact, the importance of the affected resource or receptors, and the background pollutant levels. Even a small impact on a sensitive receptor, such as surrounding residential properties, may give rise to significant effects, particularly where background pollutant levels are already high.

2.3.2 Environmental Protection UK (EPUK) and IAQM guidance[11] significance criteria have been adopted for the assessment, and are based on professional judgement, where the overall air quality effect of the scheme is described as either 'significant' or 'not significant'. The judgement should be made by a suitably qualified person. When using professional judgement to come to a conclusion, the guidance states the following factors should be taken into account:

- The existing and future air quality in the absence of the 'Proposed Development';
- The extent of current and future population exposure to impacts;
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- The potential for cumulative impacts; several impacts that are described as 'slight' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a 'moderate' or 'substantial' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- The judgment on significance relates to the consequences of the impacts (the effects); e.g., will they have an effect on human health that could be considered as significant. In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

2.3.3 To assist with the significance determination, the EPUK/IAQM guidance provides advice on the description of impacts at individual receptors (Table 6.3 in the guidance document).

2.3.4 For the assessment of annual mean impacts, the impact description is based on both the magnitude of the impact and the total pollutant concentration (including the process contribution, if an adverse impact).

2.3.5 This guidance recommends that the degree of an impact is described by expressing the magnitude of incremental change in pollutant concentration as a proportion of the relevant assessment level and examining this change in the context of the new total concentration and its relationship with the assessment criterion, as summarised in **Table 3**.

[11] Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017) Land Use Planning & Development Control: Planning for Air Quality.

Table 3 - Emissions - Significance of Impact

Long Term Average Concentration at Receptors in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level (AQAL)			
	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

Notes to Table 3

AQAL = air quality assessment level, which for this assessment related to the UK Air Quality Strategy objectives.

Where the %change in concentrations is <0.5%, the change is described as 'Negligible' regardless of the concentration.

When defining the concentration as a percentage of the AQAL, 'without scheme' concentration should be used where there is a decrease in pollutant concentration and the 'with scheme;' concentration where there is an increase.

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

2.3.6 The matrix shown in **Table 3** is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which makes it clearer which cell the impact falls within. It should be noted that changes of 0%, i.e., less than 0.5%, are described as negligible.

2.3.7 The EPUK/IAQM guidance states that an assessment must reach a conclusion on the likely significance of the predicted impact. It should be noted that this is a binary judgement of either it is significant, or it is not significant.

Ecological Receptors

Critical Loads and Levels

2.3.8 A critical load (CL) is defined by the UK APIS as:

> 'A quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The exceedance of a critical load is defined as the atmospheric deposition of the pollutant above the critical load.'

2.3.9 A critical level is defined as:

> 'Threshold for direct effects of pollutant concentrations according to current knowledge. Exceedance of a critical level is defined as the atmospheric concentration of the pollutant above the critical level.'

2.3.10 A CL refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

2.3.11 When pollutant loads (or concentrations) exceed the CL or level it is considered that there is a risk of harmful effects. The excess over the CL or level is termed the exceedance. A larger exceedance is often considered to represent a greater risk of damage.

2.3.12 Maps of CLs and levels and their exceedances have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the CL is seen as means for preventing the risk of damage. However, even a decrease in the exceedance may infer that less damage will occur.

2.3.13 CLs have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS website[10] was undertaken in order to identify the most suitable habitat description and associated CL for the area of each designation considered within the model. This was undertaken using the 'Search by Location' and 'Site Relevant Critical Loads' functions within APIS.

2.3.14 The habitat types within each designation are listed in accordance with the UK Biodiversity Action Plan (BAP) criteria, which are then split further by the European Nature Information System (EUNIS) habitat type. These were reviewed, along with the habitat maps available through MAGIC, to define the relevant classification at each of the receptor locations. It should be noted that separate habitat types are often listed for European and National designations, although the geographical areas covered are the same. When this was the case the most suitable classification for the area of interest was selected.

2.3.15 Site relevant CLs and levels are presented in **Table 4**.

Table 4 – Critical Loads and Levels

Receptor	Ecological Designation	Acidity CL (keq/ha/yr)			NO_x Critical Level (µg/m³)	
		ClminN	ClmaxN	ClmaxS	Annual Mean	24-Hour Mean
ER1-E3	River Dee SSSI*	-	-	-	30	75
ER4	Johnstown Newt Sites SAC	0.357	3.126	2.769		
ER5		0.357	3.129	2.769		
ER6		0.142	1.734	1.592		
ER7		0.142	1.734	1.592		
ER8		0.142	1.734	1.592		
ER9		0.142	1.734	1.592		
ER10		0.142	1.734	1.592		
ER11	Berwyn and South Clwyd Mountains SAC	0.142	1.955	1.813		
ER12		0.140	1.960	1.810		
ER13		0.500	1.986	1.486		
ER14		0.500	1.986	1.486		
ER15		0.142	1.964	1.822		
ER16		0.142	1.964	1.822		
ER17		0.500	2.004	1.504		
ER18		0.500	2.004	1.504		
ER19		0.357	3.129	2.772		
ER20		0.357	3.129	2.772		
ER21		0.285	1.309	1.024		
ER22		0.285	1.305	1.020		
ER23		0.285	1.305	1.020		
ER24		0.285	1.594	1.309		
ER25-E40	River Dee and Bala Lake SAC*	-	-	-		

* No comparable habitat with established acidity critical load estimate available

2.3.16 Regarding the potential for ecological impacts on local wildlife sites, as advised by the EA's Air Emissions Risk Assessment guidance[12], impacts are insignificant where the process contribution (PC) is <100% of the long-term or short-term environmental standard.

2.3.17 Guidance on national or European sites by the EA states that, regardless of the baseline environmental conditions, a process can be considered as insignificant if:

[12] Environment Agency (2022) Guidance on Air Emissions Risk Assessment for Your Environmental Permit [Online] Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [Accessed on 06/07/2022].

- the long-term (annual mean) process contribution is <1% of the long-term environmental standard; and
- the short-term (15-minute, 1-hour, 24-hour mean) process contribution is <10% of the short-term environmental standard.

2.3.18 It should be noted that these criteria determine when an impact can be screened out as being insignificant. They do not imply that impacts will necessarily be significant above one or both of these criteria, merely that there is a potential for significant impacts to occur that should be considered using a detailed assessment methodology, such as this detailed dispersion modelling assessment.

2.3.19 The second stage in the EA's screening process for long-term contributions is to add the PC to the local background concentration to calculate the predicted environmental concentration (PEC). For short-term contributions the PC is compared against the short-term environmental standard minus twice the long-term background concentration. The emissions are considered to be insignificant if:

- the long-term PEC is less than 70% of the long-term environmental standard; and
- the short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration.

2.3.20 The EA guidance also states that, no further action is required if resulting PECs do not exceed environmental standards.

2.3.21 The 1% (long-term) and 10% (short-term) criteria are thus routinely used to screen out the potential for significant impacts on sensitive habitats from a range of sources. For the purposes of this assessment, wherever the detailed modelling shows that concentrations and fluxes are below the critical level or CL, it is considered that there will be no significant impacts. Additionally, where the operation of a site will increase concentrations or fluxes by less than 1% (long-term) or 10% (short-term) of the relevant critical level or CL, the potential for significant impacts can be discounted.

3.0 Baseline

3.1 Introduction

3.1.1 Existing air quality conditions representative of the Site were identified in order to provide a baseline for consideration. These are detailed in the following sections.

3.2 Local Air Quality Management

3.2.1 According to the latest available Air Quality ASR[2], there are currently no AQMAs designated and as such, potential effects associated with the operation of the existing plants have not been considered at sensitive receptors within AQMA.

3.3 Local Emission Sources

3.3.1 The Site is located in an area where air quality is mainly influenced by emissions from road transport using the local road network. There are potential commercial sources identified in the vicinity of the Site, that may also influence the local air quality, however, these would be characteristic of the mixed use area in which the Site is located.

3.4 Air Quality Monitoring

3.4.1 Monitoring of pollutant concentrations is undertaken throughout SSC's area of jurisdiction utilising non-automatic (passive) and automatic (continuous) methods. The most recent diffusion tube monitoring results available, recorded in the closest proximity to the Site, are shown in **Table 5**. The closest monitoring location, diffusion tube 36, is approximately 1.6km south-west of the Site.

Table 5 – Diffusion Tube Monitoring Results

Monitoring Site			**Monitored NO_2 Concentration (µg/m³)**				
ID	**Location**	**Type**	**2017**	**2018**	**2019**	**2020**	**2021**
30	Rhostyllen Rbt	Roadside	33.1	34.9	31.7	26.3	29.5
36	Acrefair	Roadside	19.5	17.3	17.7	12.2	14.3
43	Hightown	Roadside	18.4	19.3	17.0	14.4	16.5
51	Ysgol Yr Hafod	Suburban	-	-	16.8	13.6	15.5
53	Froncysyllte	Roadside	-	-	20.1	16.6	18.4

3.4.2 As shown in **Table 5**, annual mean NO_2 concentrations did not exceed the relevant AQO at any of the monitoring sites during the most recent monitoring years, 2017 to 2021.

3.4.3 There are no automatic monitors in the vicinity of the Site.

3.4.4 Reference should be made to **Figure 1** for a map of the diffusion tube and automatic monitoring locations.

3.5 Predicted Background Pollutant Concentrations

Human Receptors

3.5.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by Defra for the entire of the UK to assist Local Authorities in their Review and Assessment of air quality. Data for the assessment extents were downloaded from the Defra website for the purpose of the project. These data are summarised in **Table 6**.

Table 6 - Background Pollutant Concentrations by Grid Square

OS Grid Reference		Background Pollutant Concentrations (µg/m³)	
X (m)	**Y (m)**	**NO_2**	**NO_X**
329500	343500	6.5	8.2
329500	344500	5.4	6.8
328500	344500	4.8	6.0
328500	343500	5.8	7.3
328500	341500	5.9	7.4
329500	342500	6.1	7.7
329500	345500	5.4	6.8
330500	345500	6.9	8.8
327500	349500	4.3	5.4
326500	347500	4.1	5.1
326500	346500	4.1	5.1
325500	345500	4.0	5.0
325500	344500	4.1	5.1
324500	344500	4.0	4.9
324500	343500	4.3	5.3
324500	342500	5.2	6.5
324500	341500	4.7	5.8
325500	341500	5.5	7.0
326500	342500	5.4	6.8
327500	341500	6.7	8.5
330500	340500	5.7	7.2
331500	340500	5.0	6.3
332500	340500	4.7	5.9
333500	340500	4.6	5.7
334500	340500	4.9	6.2
334500	341500	4.6	5.7

3.5.2 As shown in **Table 6**, the predicted background concentrations for all pollutants were below the relevant AQOs across the assessment extents.

Ecological Receptors

3.5.3 Critical loads have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS website[6] was undertaken in order to identify the most suitable habitat description and associated critical load for the area of each designation considered within the model. This was undertaken using the 'site relevant critical loads' and 'search by location' functions within APIS.

3.5.4 The habitat types within each designation are listed in accordance with the UK Biodiversity Action Plan (BAP) criteria, which are then split further by the European Nature Information System (EUNIS) habitat type. These were reviewed, along with the habitat maps available through MAGIC, to define the relevant classification at each of the receptor locations. It should be noted that separate habitat types are often listed for European and National designations, although the geographical areas covered are the same. When this was the case the most suitable classification for the area of interest was selected.

3.5.5 Site relevant Critical Loads and Levels and background deposition rates are presented in **Table 7**.

Table 7 – Background Pollutant and Deposition Rates

Receptor	Designation	Grid Square	Nitrogen Deposition (kg N/ha/yr)	Acid Deposition (keq/ha/yr)		Average NO_x Concentration ($\mu g/m^3$)
				Nitrogen	Sulphur	
ER1	River Dee SSSI	328341	19.92	1.42	0.19	1.32
ER2		329342	19.92	1.42	0.19	1.32
ER3		329342	19.92	1.42	0.19	1.32
ER4	Johnstown Newt Sites SAC	329345	30.90	2.21	0.24	7.54
ER5		329345	30.90	2.21	0.24	7.54
ER6		330345	35.40	2.53	0.16	9.57
ER7		330345	35.40	2.53	0.16	9.57
ER8		330345	35.40	2.53	0.16	9.57
ER9		330345	35.40	2.53	0.16	9.57
ER10		330345	35.40	2.53	0.16	9.57
ER11	Berwyn and South Clwyd Mountains SAC	327349	30.90	2.21	0.24	5.44
ER12		327349	30.90	2.21	0.24	5.44
ER13		326347	30.90	2.21	0.24	5.11
ER14		326347	30.90	2.21	0.24	5.11
ER15		326346	30.90	2.21	0.24	5.20
ER16		326346	30.90	2.21	0.24	5.20
ER17		325345	30.90	2.21	0.24	5.01
ER18		325345	30.90	2.21	0.24	5.01
ER19		325344	31.43	2.25	0.23	5.24
ER20		325344	31.43	2.25	0.23	5.24
ER21		324344	26.44	1.89	0.19	4.95
ER22		324343	26.44	1.89	0.19	5.36
ER23		324343	26.44	1.89	0.19	5.36
ER24		324342	26.44	1.89	0.19	6.51
ER25	River Dee and Bala Lake SAC	324342	17.50	1.25	0.15	6.51
ER26		324341	17.50	1.25	0.15	5.79
ER27		324341	17.50	1.25	0.15	5.79
ER28		325341	19.92	1.42	0.19	6.94
ER29		326342	19.92	1.42	0.19	7.31
ER30		327341	19.92	1.42	0.19	8.59
ER31		327341	19.92	1.42	0.19	8.59
ER32		328341	19.92	1.42	0.19	8.08
ER33		330340	21.72	1.55	0.16	7.89
ER34		331340	21.72	1.55	0.16	6.86
ER35		332340	21.72	1.55	0.16	6.36
ER36		332340	21.72	1.55	0.16	6.36
ER37		333340	21.72	1.55	0.16	6.10
ER38		334340	21.72	1.55	0.16	6.41
ER39		334341	21.72	1.55	0.16	6.03
ER40		334341	21.72	1.55	0.16	6.03

4.0 Assessment

4.1 Introduction

4.1.1 There is the potential for air quality impacts as a result of the operation of the existing plants. These are assessed in the following sections.

4.2 Operational Phase Assessment

4.2.1 It is reiterated that the impacts are assessed with the generators operating continuously for 8,760-hours per year at full load. Additionally, in accordance with the EA guidance[8] NO_X to NO_2 conversion is considered to be 70% for the annual mean and 35% for the 1-hour mean concentrations. This represents a worst-case scenario in relation to likely operational impacts.

4.2.2 For the purposes of this assessment, predicted impacts on annual mean NO_2 concentrations associated with the operation of the existing plants are based on the 5-year average maximum concentrations utilising meteorological data for 2018 to 2022. Full results of the dispersion modelling are presented in **Appendix F** and a summary is provided below.

Human Receptors

Nitrogen Dioxide (NO_2) - Annual Mean

4.2.3 Annual mean NO_2 concentrations were predicted to be below the AQO of 40µg/m^3 at all sensitive receptor locations. The maximum overall PEC (including background pollutant concentration) was 19.1µg/m^3 at receptor R17 'Property on The Grange, Plas Bennion Road'.

4.2.4 The maximum PC as a result of the operation of the existing plants was 12.7µg/m^3 at receptor R17 'Property on The Grange, Plas Bennion Road'. While this PC in isolation may not be screened out as being insignificant, the overall resulting effects, when considering the total PEC and that there is a substantial headroom without the risk of exceedance of the relevant AQO, are considered to be **not significant**, in accordance with the EA guidance.

Nitrogen Dioxide (NO_2) – 1-hour Mean

99.79th %-ile

4.2.5 The AQS objective for 1-hour mean NO_2 concentrations is 200µg/m^3. The maximum overall PEC (including background pollutant concentration) was 111.2µg/m^3 at receptor R2 '10 Hampden Way, Wrexham, LL14 3HB', without the risk of exceedance of the AQO. The overall effect of the operation of the operation of the existing plants on hourly mean NO_2 concentrations at existing sensitive receptors is therefore, considered to be **not significant**.

4.2.6 The maximum PC as a result of the operation of the existing plants was 98.2µg/m^3 at receptor R2 '10 Hampden Way, Wrexham, LL14 3HB'. Based on the EA guidance, a change of this magnitude may not be screened out in isolation as being insignificant, however as the total predicted PEC has substantial headroom without the risk of exceedance of the relevant AQO, the overall resulting effects are considered to be **not significant**.

100th %-ile

4.2.7 While there is no absolute hourly limit environmental standard for the acute exposure to NO_2, there can be effects on health over a certain threshold. To understand the potential health effects and the amount of risk to members of the public, the EA guidance[12] requires the inclusion of 100th %-ile NO_2 concentrations within the dispersion modelling assessment, accordingly, these are reported for completeness.

4.2.8 The results indicated that the maximum PEC (including background pollutant concentration) of 122.2µg/m^3 was predicted at R2 '10 Hampden Way, Wrexham, LL14 3HB'.

4.2.9 The maximum PC as a result of the operation of the existing plants was 109.3µg/m^3 at receptor R2 '10 Hampden Way, Wrexham, LL14 3HB'.

Ecological Receptors

4.2.10 Full results of the dispersion modelling are presented in **Appendix F** and a summary is provided below.

Nitrogen Oxides (NO_x)

4.2.11 Predicted annual and 24-hour mean NO_X concentrations are summarised in **Table F6**.

4.2.12 As presented in **Table F6**, the predicted annual mean NO_x PCs for the ecological sites are below the screening criteria (1%), without the risk of exceedance. Where the 1% screening criteria is exceeded, the total PECs were below 70% of the EAL, and as such, no further consideration of annual mean NO_x impacts is required at these designations.

4.2.13 The 24-hour mean NO_x PCs are also below the relevant assessment criteria (10%), resulting in a **not significant** effect, and therefore no further assessment is required.

4.2.14 The impacts of the operation of the existing plants in respect to annual and 24-hour mean NO_X concentrations are therefore considered to be **not significant** at these designations.

Annual Mean Nitrogen and Acid Deposition

4.2.15 Predicted annual mean nitrogen and acid deposition rates are summarised in **Table F7** and **Table F8** respectively.

4.2.16 As shown in **Table F9**, the predicted annual mean acid deposition rates, utilising the APIS Critical Load Function Tool show no exceedances of the relevant CLs, at the most significantly affected ecological receptor locations within each ecological designations with established acidity critical load estimates.

4.2.17 As such, it is considered, that continuous operation of the generators (8,760-hours per year at full load) would result in a **not significant** effect on the integrity of these ecological designations.

Summary

4.2.18 The assessment concluded that, the operation of the existing plants is considered to result in a **not significant** impact. Additional mitigation measures are not required. Therefore, there are no air quality constraints to the operation of the generators at the Site.

5.0 Summary and Conclusions

5.1.1 Delta-Simons has been appointed to prepare an Air Quality Assessment to inform an MCP permit application for the existing plants, located at Bartley Power, Plas Bennion Road in Ruabon, Wrexham, LL14 1TP.

5.1.2 In order to represent a robust assessment approach, the potential effect are assessed with all generators operating continuously for 8,760 hours per year at full load.

5.1.3 The assessment concluded that when considering the total PECs and the substantial headroom(s) without the risk of exceedances of the relevant AQOs, the overall effects of the operation of the Site at existing sensitive human receptors are established to be **not significant**, in accordance with the relevant EA guidance criteria.

5.1.4 The predicted annual mean acid deposition rates, utilising the APIS Critical Load Function Tool show no exceedances of the relevant CLs, at the most significantly affected ecological receptor locations within each ecological designations with established acidity critical load estimates.

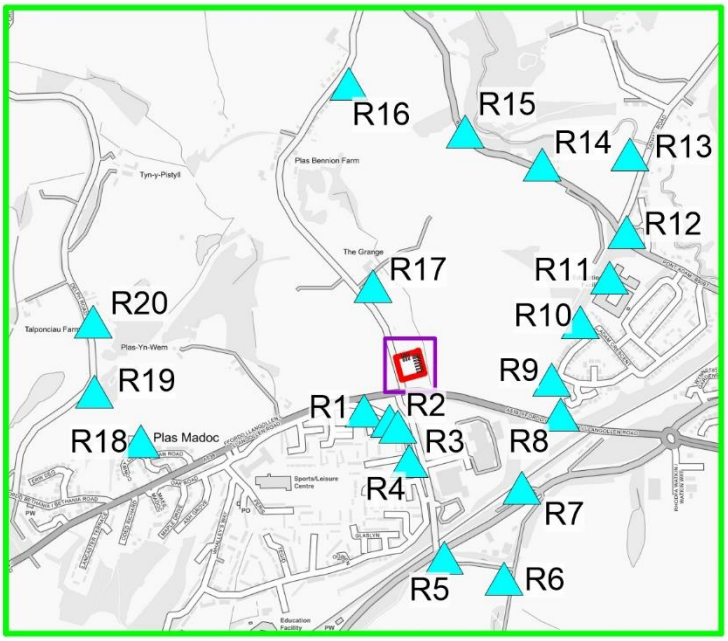
5.1.5 As such, it is considered, that operation of the Site would result in a **not significant** effect on the integrity of these ecological designations.

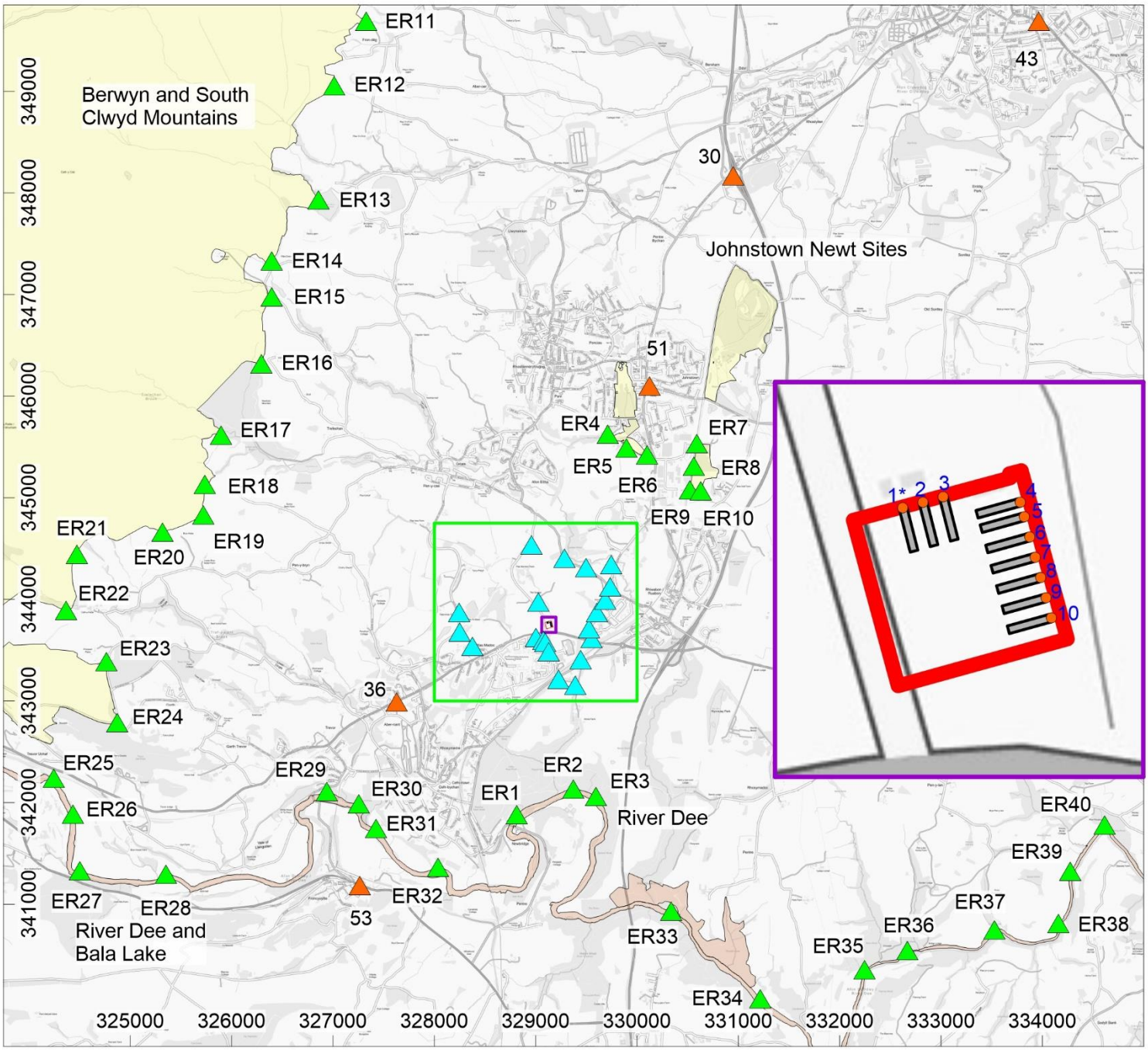
5.1.6 Therefore, air quality is not a constraint to the application for the environmental permit.

Figures

LEGEND

- Diffusion Tube Location
- Sensitive Human Receptor Location
- Sensitive Ecological Receptor Location
- Modelled Point Source Location
- Modelled Building Layout
- Site of Special Scientific Interest
- Special Area of Conservation
- Site Boundary





DeltaSimons	TITLE: Site Location and Assessment Extents	DRAWN BY: GD / SCALE: NTS	PROJECT NO: 87658.544924
		CHECKED BY: GA / REVISION: -	FIGURE NO: 1
		DATE: 13th July 2023	

Appendices

Appendix A - Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons' professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons' conclusions, opinions and recommendations have been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Please note that Air Quality Assessment reports are generally considered valid for a period of two years, or potentially less, if the baseline on which the report is based changes significantly. Accordingly, reliance on this report beyond this period is not afforded.

Appendix B - Glossary

Glossary

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area
AQO	Air Quality Objective
CL	Critical Load
CO	Carbon Monoxide
Defra	Department for Environment, Food and Rural Affairs
EPUK	Environmental Protection (UK)
Exceedance	A period of time where the concentration of a pollutant is greater than the appropriate air quality standard.
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
PC	Process Contribution
PEC	Predicted Environmental Concentration
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
SAC	Special Areas Of Conservation
SSSI	Site of Special Scientific Interest
$\mu g/m^3$ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
VOC	Volatile Organic Compound
WCBC	Wrexham County Borough Council

Appendix C - Relevant UK Air Quality Strategy Objectives and Environmental Assessment Levels

Relevant UK Air Quality Strategy Objectives

National Air Quality Objectives and European Directive Limit Values for the Protection of Human Health						
Pollutant	**Applies To**	**Objective**	**Measured As**	**Date to be achieved by and maintained thereafter**	**European Obligations**	**Date to be achieved by and maintained thereafter**
Nitrogen dioxide (NO_2)	UK	40µg/m^3	annual mean	31 December 2005	40µg/m^3	1 January 2010
	UK	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31 December 2005	200µg/m^3 not to be exceeded more than 18 times a year	1 January 2010

µg/m^3 = microgram per cubic metre

National Air Quality Objectives and European Directive Limit Values for the Protection of Vegetation and Ecosystems						
Pollutant	**Applies To**	**Objective**	**Measured As**	**Date to be achieved by and maintained thereafter**	**European Obligations**	**Date to be achieved by and maintained thereafter**
Nitrogen oxides	UK	30µg/m^3	annual mean	31 December 2000	30µg/m^3	19 July 2001

Critical Levels for Vegetation and Ecosystems as defined by the World Health Organisation (WHO, 2000)		
Pollutant	**Time Period**	**Critical Level**
Nitrogen Oxides (expressed as NO_2)	24-hour Mean	75µg/m^3

This critical level is not an objective and therefore has different legal standing.

Appendix D - Dispersion Model Details

Model Input Parameters

Table D1 - Dispersion Model Input Parameters

Parameter	Value							
Meteorology	Hourly Sequential from Shawbury meteorological station for the period of 2018 to 2022 (5-years).							
Receptors	Individual sensitive receptor locations surrounding the Site, representative of relevant human or ecological exposure.							
Building Downwash	**Building**		**NGR (m)**		**Height (m)**	**Length/ Diameter (m)**	**Width (m)**	**Angle (°)**
	Id	**Description**	**X**	**Y**				
	1	Generator 1	329110.8	343768.8	10	3.0	16.6	255.7
	2	Generator 2	329118.4	343770.9	10	3.0	16.6	255.7
	3	Generator 3	329126.1	343773.0	10	3.0	16.6	255.7
	4	Generator 4	329144.8	343777.0	10	16.6	3.0	254.4
	5	Generator 5	329146.4	343771.5	10	16.6	3.0	254.4
	6	Generator 6	329148.5	343763.8	10	16.6	3.0	254.4
	7	Generator 7	329150.5	343756.1	10	16.6	3.0	254.4
	8	Generator 8	329152.6	343748.4	10	16.6	3.0	254.4
	9	Generator 9	329154.7	343740.7	10	16.6	3.0	254.4
	10	Generator 10	329156.7	343733.1	10	16.6	3.0	254.5
Model Scenario	Full load, 24 hours of operation per day for 8,760 hours per year							
Pollutants	Nitrogen Oxides. Emissions provided by the Client.							
Outputs	Annual Mean, 1-Hour Mean.							
NO_X to NO_2	70% conversion for annual mean and 35% conversion for 1-hour mean.							

Roughness Length

The roughness length (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents at the Site and 0.2m for the meteorological site. The values of z_0 are considered appropriate for the morphology of these areas and are suggested within ADMS as being suitable for 'Parkland, open suburbia' and 'Agricultural areas (min)' respectively.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 10m was used to describe both the modelling extents and meteorological site. This value is considered appropriate for the nature of both areas and are suggested within ADMS as being suitable for 'Small towns <50,000'.

Terrain Data

Inclusion of terrain data is recommended within the ADMS-Roads user guide[13] if the gradient within a modelling area varies by more than 10% (1 in 10). Assessment of changes in elevation throughout the modelling extents using Google Earth indicated the average gradient was approximately 3%. As such, terrain data was not included within the model.

[13] CERC (2020) ADMS-Roads User Guide [Online] Available at: http://cerc.co.uk/environmental-software/assets/data/doc_userguides/CERC_ADMS-Roads5.0_User_Guide.pdf [Accessed on 06/07/2023].

Exhaust Parameters

Table D2 - Exhaust Parameters

Parameter	Value
Flue Height (above ground level; m)	10
Stack Location (NGR; m)	Generator 1 329108.56, 343777.21 Generator 2 329116.26, 343779.31 Generator 3 329123.94, 343781.39 Generator 4 329153.23, 343779.33 Generator 5 329154.77, 343773.83 Generator 6 329156.83, 343766.15 Generator 7 329158.90, 343758.42 Generator 8 329160.98, 343750.74 Generator 9 329163.04, 343743.05 Generator 10 329165.07, 343735.43
Flue Gas Temperature (°C)	416°C
Flue Gas Exit Velocity (Actual) m/s	23.4
Flue Diameter (m)	0.6 m
Normalised Flow Rate per engine (Nm^3/s)	2.06
NOx Emission Concentration (mg/Nm^3)	500
Mass Emission Rate for NOx (g/s)*	1.03g/s

Modelling Uncertainty

Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and
- Variability - randomness of measurements used.

Potential uncertainties in the model results were minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

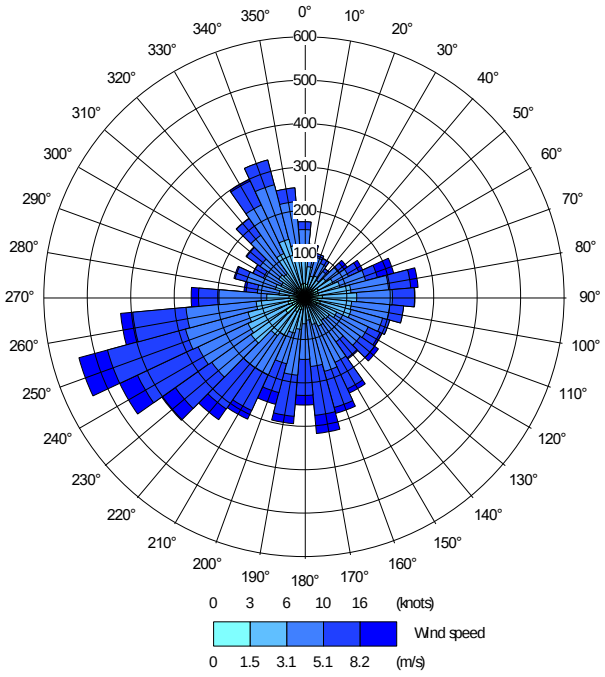
- Choice of model - ADMS is a commonly used atmospheric dispersion model and results have been tested through a large number of verification and inter-comparison studies to ensure predictions are as accurate as possible;
- Meteorological - Modelling was undertaken using five meteorological datasets from the closest observation site to the Site to take account of local conditions. The assessment was based on the worst-case year for each averaging period to ensure maximum concentrations were considered;
- Surface characteristics - The z_0 and Monin-Obukhov length were determined for both the dispersion and meteorological sites based on the surrounding land uses and guidance provided by CERC;
- Plant operating conditions - Operational parameters were provided by the Client. As such, these are considered to be representative of likely operating conditions;
- Emission rates - Emission rates for the generator set were based on operational parameters provided by the Client. As such, these are considered to represent a realistic assessment scenario;
- Baseline concentrations - Background pollutant levels were obtained from the Defra mapping study. Values for assessment of short-term averaging periods were doubled in accordance with the relevant guidance;

- Receptor locations - Receptor points were included at sensitive locations to provide consideration of these areas; and
- Variability - All model inputs were as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

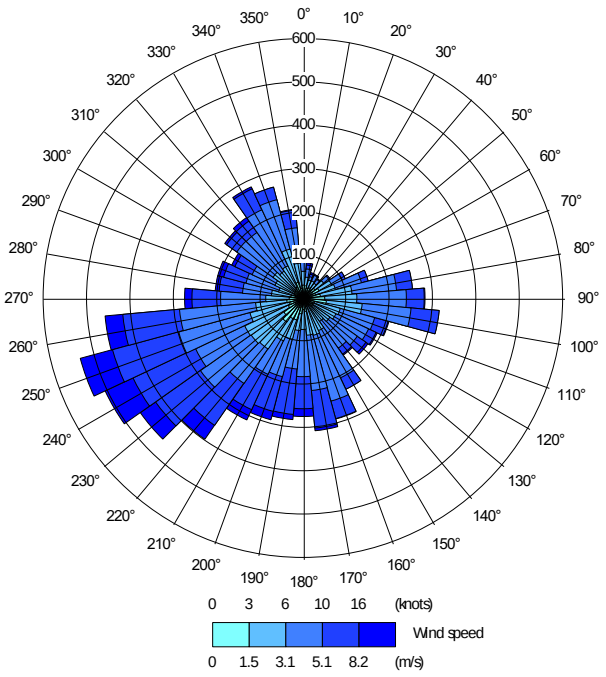
Results were considered in the context of the relevant EALs. It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

Appendix E - Wind Roses for Shawbury(2018 - 2022)

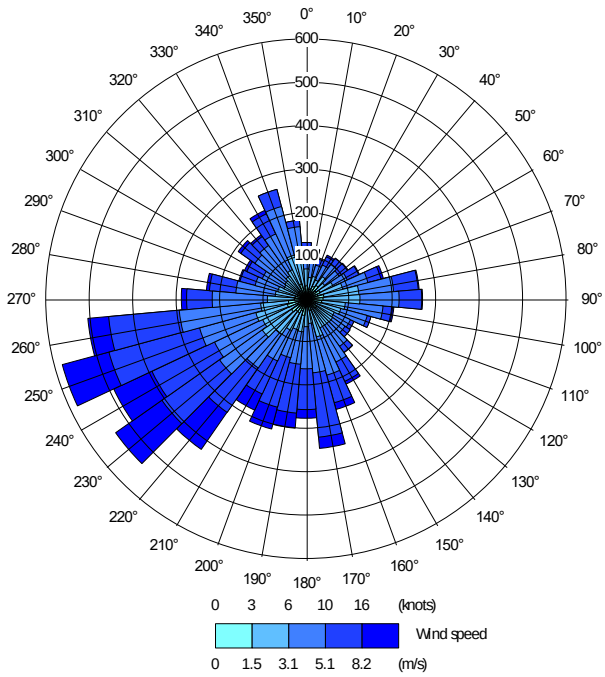
Wind Roses for Shawbury (2018 - 2022)



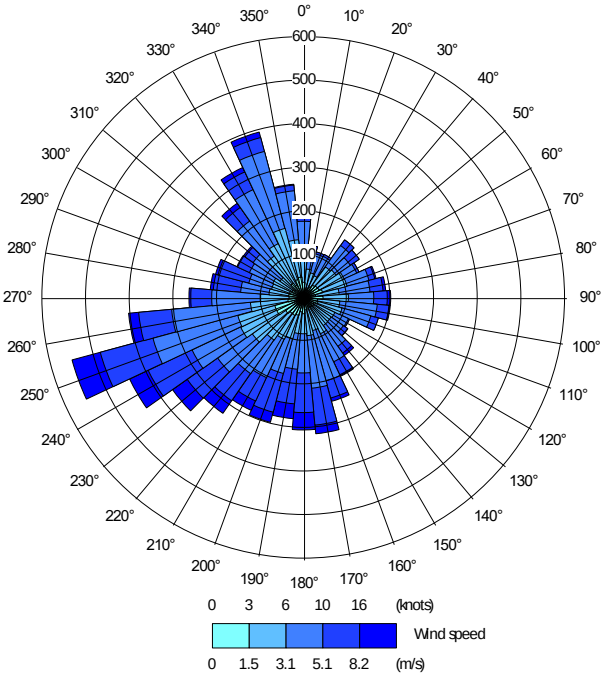
2018



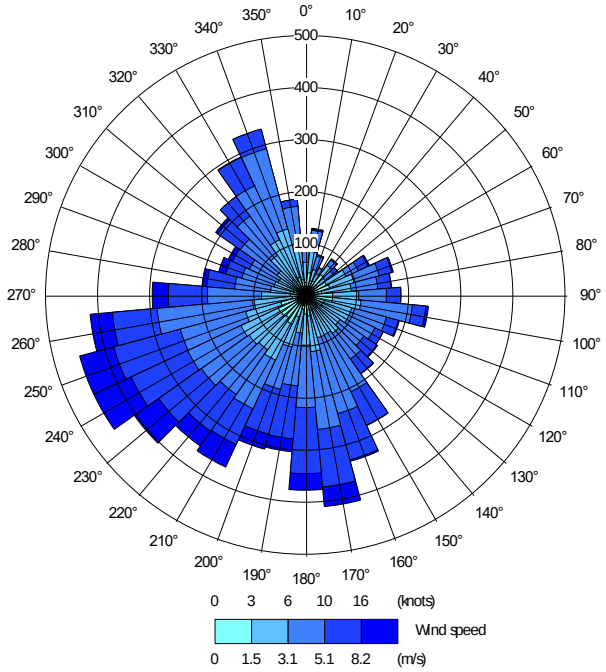
2019



2020



2021


0°
10°
20°
30°
40°
50°
60°
70°
80°
90°
100°
110°
120°
130°
140°
150°
160°
170°
180°
190°
200°
210°
220°
230°
240°
250°
260°
270°
280°
290°
300°
310°
320°
330°
340°
350°
500
400
300
200
100
0 3 6 10 16 (knots)
Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

2022

Appendix F - Dispersion Modelling Results

Human Receptors

Table F1 - Annual Mean NO_2 Concentrations (µg/m³)

Receptor	2017	2018	2019	2020	2021	5-year Maximum
R1	5.5	2.5	5.9	5.8	3.3	5.9
R2	5.2	2.5	5.5	6.6	3.2	6.6
R3	5.7	3.1	5.4	6.7	3.8	6.7
R4	4.8	3.3	4.0	5.4	3.6	5.4
R5	2.7	2.1	2.1	2.9	2.2	2.9
R6	3.1	2.6	2.2	3.4	2.7	3.4
R7	4.2	4.4	3.6	4.5	4.3	4.5
R8	3.0	3.9	3.5	3.8	3.7	3.9
R9	4.5	5.6	5.7	5.4	5.4	5.7
R10	6.9	7.4	8.0	6.9	6.8	8.0
R11	5.7	5.9	6.4	5.5	5.2	6.4
R12	4.4	4.7	5.0	4.1	4.0	5.0
R13	2.9	3.3	3.4	2.6	2.8	3.4
R14	3.4	3.7	3.8	3.2	3.6	3.8
R15	2.9	3.0	3.2	3.0	3.4	3.4
R16	2.4	2.4	2.5	2.3	3.1	3.1
R17	11.4	10.2	10.1	9.3	12.7	12.7
R18	1.7	1.5	1.6	1.3	1.2	1.7
R19	1.5	1.6	1.6	1.2	1.1	1.6
R20	1.5	1.7	1.3	1.2	1.2	1.7

Table F2 - Annual Mean NO_2 Concentration

Receptor	Baseline PEC (µg/m³)	PEC inlc. PC (µg/m³)	% of AQAL	Change (µg/m³)	% of AQO
R1	6.5	12.4	31.0	5.9	14.9
R2	6.5	13.0	32.6	6.6	16.5
R3	6.5	13.2	33.0	6.7	16.9
R4	6.5	11.9	29.6	5.4	13.5
R5	6.5	9.4	23.5	2.9	7.3
R6	6.5	9.8	24.5	3.4	8.4
R7	6.5	11.0	27.5	4.5	11.4
R8	6.5	10.4	25.9	3.9	9.8
R9	6.5	12.1	30.3	5.7	14.2
R10	6.5	14.4	36.1	8.0	20.0
R11	6.5	12.9	32.2	6.4	16.1
R12	5.4	10.4	26.0	5.0	12.6
R13	5.4	8.8	22.0	3.4	8.5
R14	5.4	9.2	23.0	3.8	9.5
R15	5.4	8.8	22.0	3.4	8.5
R16	4.8	7.9	19.7	3.1	7.7
R17	6.5	19.1	47.8	12.7	31.6
R18	5.8	7.4	18.6	1.7	4.1
R19	5.8	7.4	18.5	1.6	4.0
R20	5.8	7.5	18.8	1.7	4.4

Note: Predicted impacts are based on the 5-year maximum process contribution.
* Non-residential receptors are marked with an asterisck

Table F3 - 99.79th %-ile 1-hour Mean NO_2 Process Contribution (µg/m³)

Receptor	2017	2018	2019	2020	2021	5-year Maximum
R1	89.1	79.7	90.7	91.2	85.5	91.2
R2	94.7	83.6	98.2	97.3	85.6	98.2
R3	94.2	84.3	94.6	95.2	83.9	95.2
R4	66.6	65.2	66.0	65.7	63.2	66.6
R5	31.0	29.3	31.0	30.8	30.9	31.0
R6	28.8	27.1	28.1	30.2	29.7	30.2
R7	40.2	40.2	40.3	40.2	40.0	40.3
R8	41.6	42.9	42.3	43.4	43.6	43.6
R9	49.8	51.1	51.7	50.6	51.3	51.7
R10	40.2	40.1	41.3	40.6	41.1	41.3
R11	33.0	31.8	32.3	32.7	32.7	33.0
R12	28.4	27.9	27.3	27.8	26.8	28.4
R13	23.8	24.5	23.0	23.1	25.0	25.0
R14	27.0	27.7	26.1	27.1	27.2	27.7
R15	26.5	27.8	27.0	26.4	26.5	27.8
R16	22.5	23.0	23.2	22.7	22.9	23.2
R17	86.8	86.3	87.0	84.9	88.4	88.4
R18	21.1	21.9	21.4	20.7	24.4	24.4
R19	19.8	19.0	22.3	19.4	19.1	22.3
R20	20.4	20.9	19.2	18.3	19.2	20.9

* Non-residential receptors are marked with an asterisck

Table F4 - 99.79th %-ile 1-hour Mean NO_2 Concentration

Receptor	Baseline PEC (µg/m³)	PEC inlc. PC (µg/m³)	% of AQAL	Change (µg/m³)	% of AQO
R1	12.9	104.1	52.1	91.2	45.6
R2	12.9	111.2	55.6	98.2	49.1
R3	12.9	108.1	54.0	95.2	47.6
R4	12.9	79.5	39.8	66.6	33.3
R5	12.9	43.9	22.0	31.0	15.5
R6	12.9	43.1	21.5	30.2	15.1
R7	12.9	53.2	26.6	40.3	20.2
R8	12.9	56.5	28.3	43.6	21.8
R9	12.9	64.6	32.3	51.7	25.9
R10	12.9	54.2	27.1	41.3	20.6
R11	12.9	45.9	23.0	33.0	16.5
R12	10.7	39.1	19.6	28.4	14.2
R13	10.7	35.8	17.9	25.0	12.5
R14	10.7	38.5	19.2	27.7	13.9
R15	10.7	38.6	19.3	27.8	13.9
R16	9.5	32.8	16.4	23.2	11.6
R17	12.9	101.3	50.6	88.4	44.2
R18	11.6	36.0	18.0	24.4	12.2
R19	11.6	33.8	16.9	22.3	11.1
R20	11.6	32.5	16.2	20.9	10.4

Note: Predicted impacts are based on the 5-year maximum process contribution.

Table F5 - 100th %-ile 1-hour Mean NO_2 Process Contribution (µg/m³)

Receptor	2017	2018	2019	2020	2021	5-year Maximum
R1	97.7	98.7	97.5	98.2	96.2	98.7
R2	101.7	109.3	107.1	104.0	100.9	109.3
R3	99.1	101.3	101.2	99.7	100.1	101.3
R4	71.7	70.3	72.2	71.3	72.1	72.2
R5*	35.1	35.7	37.5	36.8	37.7	37.7
R6	33.5	33.5	33.5	33.5	33.4	33.5
R7	45.3	43.4	45.4	45.0	44.9	45.4
R8	50.0	45.6	49.0	48.7	48.9	50.0
R9	55.5	55.2	55.0	55.5	57.7	57.7
R10	43.4	43.3	43.2	43.1	43.1	43.4
R11	36.2	35.9	35.4	36.2	35.5	36.2
R12	32.1	32.3	31.7	31.5	32.3	32.3
R13	30.0	29.9	28.7	30.1	30.1	30.1
R14	31.9	33.0	31.3	32.2	32.8	33.0
R15	32.4	33.0	32.9	31.2	32.8	33.0
R16	30.2	30.0	29.8	29.0	29.3	30.2
R17	89.9	89.5	97.3	91.4	94.6	97.3
R18	30.9	30.4	29.1	30.0	30.1	30.9
R19	27.4	27.0	28.6	28.8	27.5	28.8
R20	28.5	26.1	28.9	27.6	28.9	28.9

Ecological Receptors

Table F6 - Predicted NO_x Concentrations

Receptor	Designation	Predicted Annual Mean NO_x				Predicted 24hr Mean NO_x			
		Concentration ($\mu g/m^3$)		Proportion of EQS (%)		Concentration ($\mu g/m^3$)		Proportion of EQS (%)	
		PC	PEC	PC	PEC	PC	PEC	PC	PEC
ER1	River Dee SSSI	0.4	1.8	1.5	5.9	10.9	13.6	14.6	18.1
ER2		1.0	2.3	3.4	7.8	15.3	17.9	20.4	23.9
ER3		1.2	2.6	4.1	8.5	14.5	17.1	19.3	22.8
ER4	Johnstown Newt Sites SAC	1.1	8.6	3.7	28.8	11.5	26.6	15.3	35.4
ER5		1.2	8.7	4.0	29.1	10.9	26.0	14.5	34.6
ER6		1.3	10.8	4.2	36.1	10.1	29.2	13.4	38.9
ER7		1.1	10.7	3.8	35.7	8.6	27.8	11.5	37.0
ER8		1.3	10.9	4.5	36.4	9.7	28.9	13.0	38.5
ER9		1.6	11.2	5.3	37.2	11.5	30.6	15.3	40.9
ER10		1.6	11.2	5.3	37.2	11.3	30.4	15.0	40.5
ER11	Berwyn and South Clwyd Mountains SAC	0.3	5.7	1.0	19.1	3.3	14.2	4.4	19.0
ER12		0.3	5.7	1.0	19.1	3.5	14.4	4.6	19.2
ER13		0.3	5.4	1.1	18.1	3.8	14.0	5.1	18.7
ER14		0.3	5.4	1.0	18.0	5.5	15.7	7.4	21.0
ER15		0.3	5.5	1.0	18.3	5.8	16.2	7.7	21.6
ER16		0.3	5.5	1.1	18.4	4.8	15.2	6.4	20.2
ER17		0.4	5.4	1.2	17.9	5.8	15.8	7.7	21.1
ER18		0.4	5.4	1.2	17.9	6.2	16.2	8.3	21.6
ER19		0.4	5.7	1.4	18.8	6.5	16.9	8.6	22.6
ER20		0.4	5.6	1.4	18.8	6.3	16.8	8.4	22.3
ER21		0.4	5.3	1.2	17.7	4.8	14.7	6.4	19.6
ER22		0.4	5.8	1.3	19.2	5.4	16.2	7.2	21.5
ER23		0.4	5.8	1.4	19.2	6.4	17.1	8.5	22.8
ER24		0.4	6.9	1.3	23.0	6.3	19.3	8.4	25.7
ER25	River Dee and Bala Lake SAC	0.3	6.8	1.0	22.7	5.3	18.3	7.1	24.4
ER26		0.3	6.0	0.9	20.2	4.1	15.7	5.4	20.9
ER27		0.2	6.0	0.8	20.1	4.2	15.8	5.6	21.0
ER28		0.3	7.2	0.8	24.0	4.4	18.3	5.9	24.4
ER29		0.4	7.7	1.3	25.6	6.6	21.2	8.8	28.2
ER30		0.4	9.0	1.3	29.9	8.0	25.2	10.6	33.5
ER31		0.4	9.0	1.2	29.9	8.1	25.3	10.8	33.7
ER32		0.3	8.4	1.0	27.9	8.8	24.9	11.7	33.2
ER33		0.8	8.7	2.7	29.0	9.4	25.2	12.5	33.5
ER34		0.6	7.4	1.9	24.7	6.8	20.5	9.0	27.3
ER35		0.4	6.7	1.2	22.4	4.8	17.5	6.4	23.3
ER36		0.3	6.7	1.0	22.2	4.3	17.0	5.7	22.7
ER37		0.2	6.3	0.8	21.1	3.5	15.7	4.7	20.9
ER38		0.2	6.6	0.7	22.0	3.4	16.2	4.5	21.6
ER39		0.2	6.2	0.7	20.8	3.0	15.0	4.0	20.1
ER40		0.2	6.2	0.6	20.7	3.0	15.1	4.0	20.1

Table F7 - Predicted Annual Mean Nitrogen Deposition Rates

Receptor	Designation	Predicted Annual Mean Nitrogen Deposition Rate (kgN/ha/yr)		Proportion of the			
				Lower Critical Load (%)		Higher Critical Load (%)	
		PC	PEC	PC	PEC	PC	PEC
ER1	River Dee SSSI	0.06	19.98	1.29	399.69	0.26	79.94
ER2		0.15	20.07	2.92	401.32	0.58	80.26
ER3		0.18	20.10	3.57	401.97	0.71	80.39
ER4	Johnstown Newt Sites SAC	0.32	31.22	3.16	312.16	1.58	156.08
ER5		0.34	31.24	3.44	312.44	1.72	156.22
ER6		0.36	35.76	3.62	357.62	1.81	178.81
ER7		0.33	35.73	3.27	357.27	1.64	178.64
ER8		0.39	35.79	3.86	357.86	1.93	178.93
ER9		0.46	35.86	4.62	358.62	2.31	179.31
ER10		0.46	35.86	4.56	358.56	2.28	179.28
ER11	Berwyn and South Clwyd Mountains SAC	0.08	30.98	0.83	309.83	0.41	154.91
ER12		0.09	30.99	0.87	309.87	0.43	154.93
ER13		0.10	31.00	0.96	309.96	0.48	154.98
ER14		0.08	30.98	0.85	309.85	0.42	154.92
ER15		0.09	30.99	0.88	309.88	0.44	154.94
ER16		0.09	30.99	0.95	309.95	0.47	154.97
ER17		0.10	31.00	1.01	310.01	0.51	155.01
ER18		0.11	31.01	1.05	310.05	0.53	155.03
ER19		0.12	31.55	1.19	315.49	0.59	157.74
ER20		0.12	31.55	1.18	315.48	0.59	157.74
ER21		0.11	26.55	1.08	265.48	0.54	132.74
ER22		0.11	26.55	1.14	265.54	0.57	132.77
ER23		0.12	26.56	1.17	265.57	0.59	132.79
ER24		0.11	26.55	1.10	265.50	0.55	132.75
ER25	River Dee and Bala Lake SAC	0.04	17.54	0.85	350.85	0.17	70.17
ER26		0.04	17.54	0.74	350.74	0.15	70.15
ER27		0.03	17.53	0.67	350.67	0.13	70.13
ER28		0.04	19.96	0.73	399.13	0.15	79.83
ER29		0.06	19.98	1.11	399.51	0.22	79.90
ER30		0.06	19.98	1.13	399.53	0.23	79.91
ER31		0.05	19.97	1.06	399.46	0.21	79.89
ER32		0.04	19.96	0.83	399.23	0.17	79.85
ER33		0.12	21.84	2.34	436.74	0.47	87.35
ER34		0.08	21.80	1.61	436.01	0.32	87.20
ER35		0.05	21.77	1.04	435.44	0.21	87.09
ER36		0.04	21.76	0.84	435.24	0.17	87.05
ER37		0.03	21.75	0.66	435.06	0.13	87.01
ER38		0.03	21.75	0.58	434.98	0.12	87.00
ER39		0.03	21.75	0.58	434.98	0.12	87.00
E40		0.03	21.75	0.55	434.95	0.11	86.99

Table F8 - Predicted Annual Mean Acid Deposition Rates

Receptor	Designation	Predicted Annual Mean Acid Deposition Rate (keq/ha/yr)		Proportion of Critical Loads (%)	
				CLMinN	
		PC	PEC	PC	PEC
ER1	River Dee SSSI*	<0.001	1.42	-	-
ER2		<0.001	1.42	-	-
ER3		<0.001	1.42	-	-
ER4	Johnstown Newt Sites SAC	<0.001	2.21	0.27	619.31
ER5		0.001	2.21	0.29	619.34
ER6		0.001	2.53	0.76	1782.45
ER7		<0.001	2.53	0.69	1782.38
ER8		0.001	2.53	0.82	1782.51
ER9		0.001	2.53	0.98	1782.67
ER10		0.001	2.53	0.96	1782.65
ER11	Berwyn and South Clwyd Mountains SAC	<0.001	2.21	0.18	1556.51
ER12		<0.001	2.21	0.19	1578.76
ER13		<0.001	2.21	0.06	442.06
ER14		<0.001	2.21	0.05	442.05
ER15		<0.001	2.21	0.18	1556.52
ER16		<0.001	2.21	0.20	1556.54
ER17		<0.001	2.21	0.06	442.06
ER18		<0.001	2.21	0.06	442.06
ER19		<0.001	2.25	0.10	630.35
ER20		<0.001	2.25	0.10	630.35
ER21		<0.001	1.89	0.11	663.27
ER22		<0.001	1.89	0.12	663.28
ER23		<0.001	1.89	0.12	663.28
ER24		<0.001	1.89	0.12	663.27
ER25	River Dee and Bala Lake SAC*	<0.001	1.25	-	-
ER26		<0.001	1.25	-	-
ER27		<0.001	1.25	-	-
ER28		<0.001	1.42	-	-
ER29		<0.001	1.42	-	-
ER30		<0.001	1.42	-	-
ER31		<0.001	1.42	-	-
ER32		<0.001	1.42	-	-
ER33		<0.001	1.55	-	-
ER34		<0.001	1.55	-	-
ER35		<0.001	1.55	-	-
ER36		<0.001	1.55	-	-
ER37		<0.001	1.55	-	-
ER38		<0.001	1.55	-	-
ER39		<0.001	1.55	-	-
E40		<0.001	1.55	-	-

* No comparable habitat with established acidity critical load estimate available

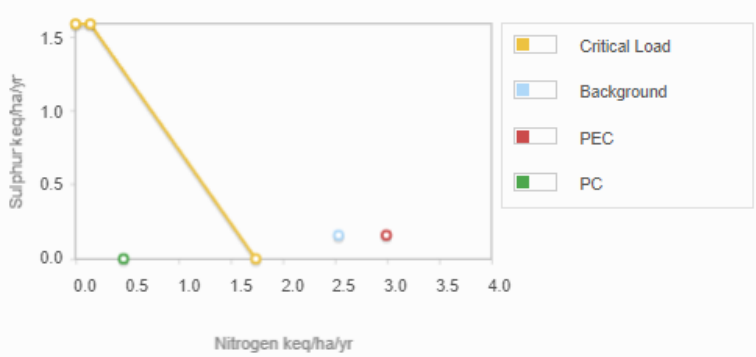
Table F9 - Predicted Annual Mean Acid Deposition Rates

E9 **Johnstown Newt Sites SAC**

Critical Load Function	
CLmaxS	1.592
CLminN	0.142
CLmaxN	1.734

Source	**Deposition rate keq/ha/yr**		
	Sulphur	**Nitrogen**	**Total (S+N)**
Process Contribution (PC)	0	0.46	0.46
Background	0.16	35.40	35.56
Predicted Environmental Concentration (PEC)	0	35.86	36.02

Source	Exceedance (keq/ha/yr)	% of CL function*
Process Contribution (PC)	no exceedance of CL function	26.5
Background	0.96	155.1
Predicted Environmental Concentration (PEC)	1.42	181.7



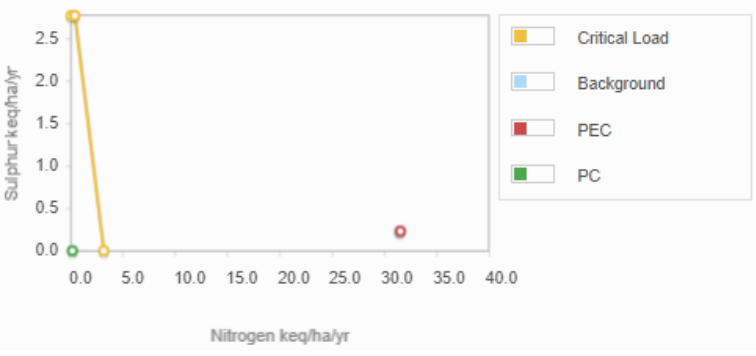
* % of CL function is calculated after the value of PEC relative to CLminN is taken into account.

E19 **Berwyn and South Clwyd Mountains SAC**

Critical Load Function	
CLmaxS	2.772
CLminN	0.357
CLmaxN	3.129

Source	**Deposition rate keq/ha/yr**		
	Sulphur	**Nitrogen**	**Total (S+N)**
Process Contribution (PC)	0	0.12	0.12
0.23	31.43	31.66	35.56
0.23	31.55	31.78	36.02

Source	Exceedance (keq/ha/yr)	% of CL function*
Process Contribution (PC)	no exceedance of CL function	3.8
Background	28.53	1011.8
Predicted Environmental Concentration (PEC)	28.65	1015.7



* % of CL function is calculated after the value of PEC relative to CLminN is taken into account.