ICT Paper Mill

Air Quality Modelling

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

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Principal author	Checked by	Verified by

Contents

1.0

Introduction

1.0 Introduction

1.1 Scope and Previous Work

In 2021, Cundall prepared an Air Quality, Odour and Dust Technical Paper[1] on behalf of Industrie Cartarie Tronchetti (ICT) UK Limited and Crag Hill Estates Ltd (CHEL) as part of an Environmental Statement (ES) to accompany the planning application for the proposed ICT Paper Mill in Flintshire. The ES Technical Paper[1] described 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.

The assessment work carried out as part of the ES Technical Paper included detailed modelling of the operational traffic and the on-site combustion plant. The results of combustion plant modelling have been used to inform the permit application. Subsequent consultation with the permitting team indicated an additional requirement to model the impact of dust emissions from the on-site dust management systems, trimming presses and trimming silos. A separate report[2] was produced in March 2022 to present the methodology and findings of a detailed assessment of emissions from the dust handling plant.

In February 2023 Cundall were appointed to provide a report detailing the methodology of findings of the assessment of emissions from the on-site combustion plant and the dust handling plant associated with Phase 1 and Phase 2 of the development proposals. This report has therefore been produced to support the application of an Environmental Permit associated with the operation of Phases 1 and 2.

[1] Cundall (2021) Paper Mill Facility, Plot C, Airfields, Northern Gateway, Environmental Statement Part 2 – Air Quality, Odour & Dust Technical Chapter Paper 8, Revision P04, 24 November 2021

[2] Cundall (2022) ICT Paper Mill, Air Quality Modelling of Dust Emissions, Ref: ICT-CDLL-XX-RP-AQ-040, Revision P02, 10 March 2022

2.0

Proposed Development

2.0 Proposed Development

2.1 Proposed Development

The paper mill is to be developed over three phases, with the following build out timescales currently envisaged for each phase:

- Phase 1 of the Paper Mill Facility: 2022 (Q3) - 2024 (Q1)
- Phase 2 of the Paper Mill Facility: 2024 (Q4) - 2026 (Q2)
- Phase 3 of the Paper Mill Facility: 2034 (Q1) - 2035 (Q3)

Phase 1 will comprise the construction of pulp storage, bale handling, paper manufacture hall, jumbo rolls storage, converting area, raw materials storage, high bale warehouse, dispatch, water treatment plant, chemical storage, CHP plant and 2 boilers.

Phase 2 will comprise the construction of pulp storage, bale handling, paper manufacture hall, jumbo rolls storage, and CHP plant.

Phase 3 will comprise the construction of pulp storage, bale handling, paper manufacture hall, jumbo rolls storage, converting area, high bale warehouse and CHP plant and 2 boilers.

Whilst planning permission for all three phases was consented March 2022, only Phases 1 and 2 are being permitted at this time as there will be a significant delay prior to implantation of Phase 3, which will follow approximately 8 years later. This assessment therefore considered the impacts from the operation of Phase 1 and also the cumulative effects from operation of Phases 1 and 2.

The Proposed Development/Application Site boundary is shown in Figure 2-1.

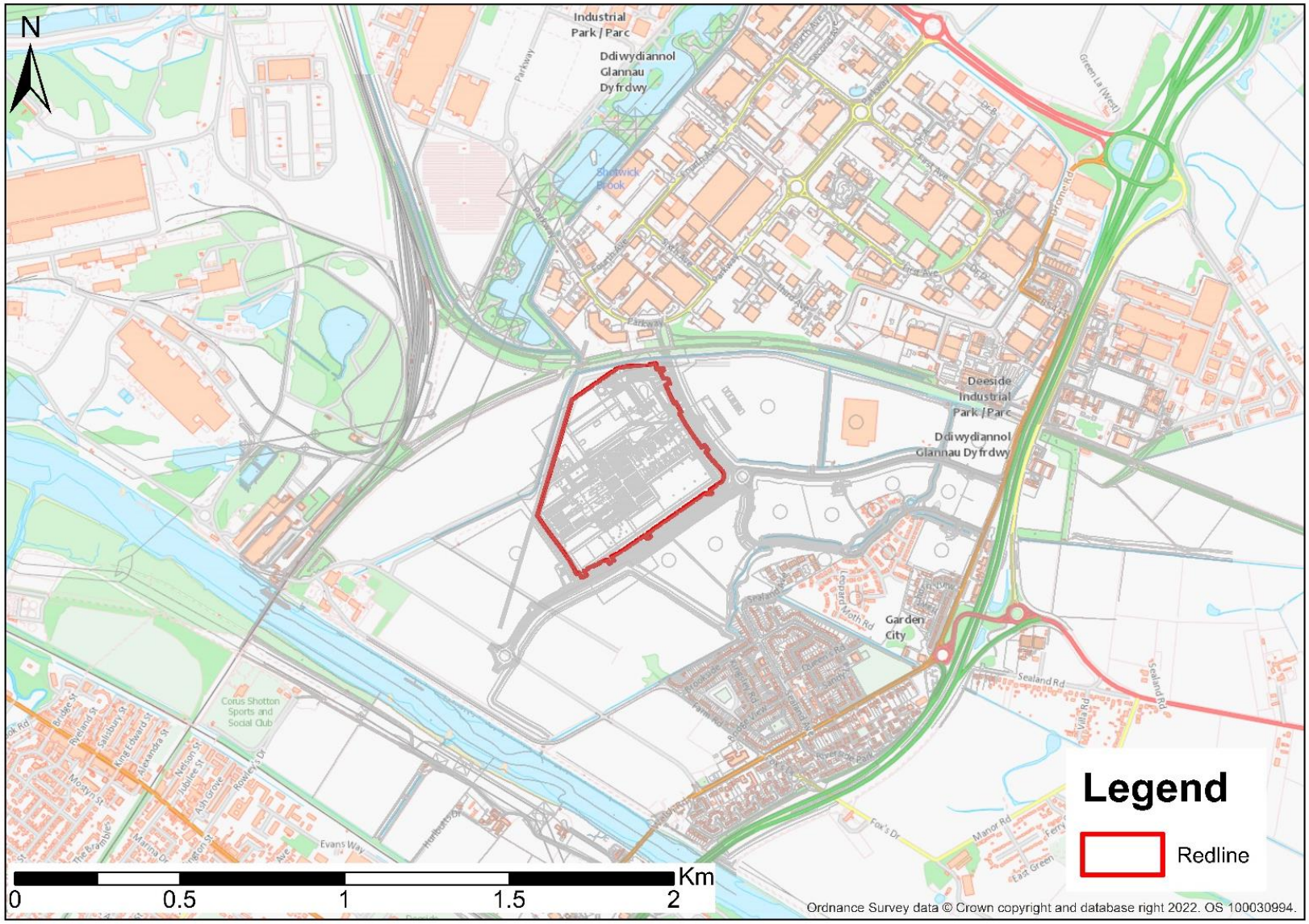

Figure 2-1: Proposed Development

2.2 Process Conditions

2.2.1 Combustion Plant

ICT have provided information on the proposed on-site combustion plant. For each of the Phases 1 and 2, 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 Phase 1.

The individual process conditions for each of these units are listed in Table 2-1. The locations of the modelled flues are also shown in Figure 2-2.

Parameter	Unit	Cogeneration main stack (E10)	Cogeneration by-pass stack (E3)	Gas boiler (E1, E2)
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	
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	ºC	220	519	120
Flue diameter	m	1.8	1.8	0.45
Emission limit value (ELV)* **	mg/Nm^3	50	50	100
NOx emission rate**	g/s	2.5	3.1	0.09***
Stack height	m	28.5	28.5	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)[Error! Bookmark not defined.] 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

Table 2-1: Process Conditions for on-site combustion plant

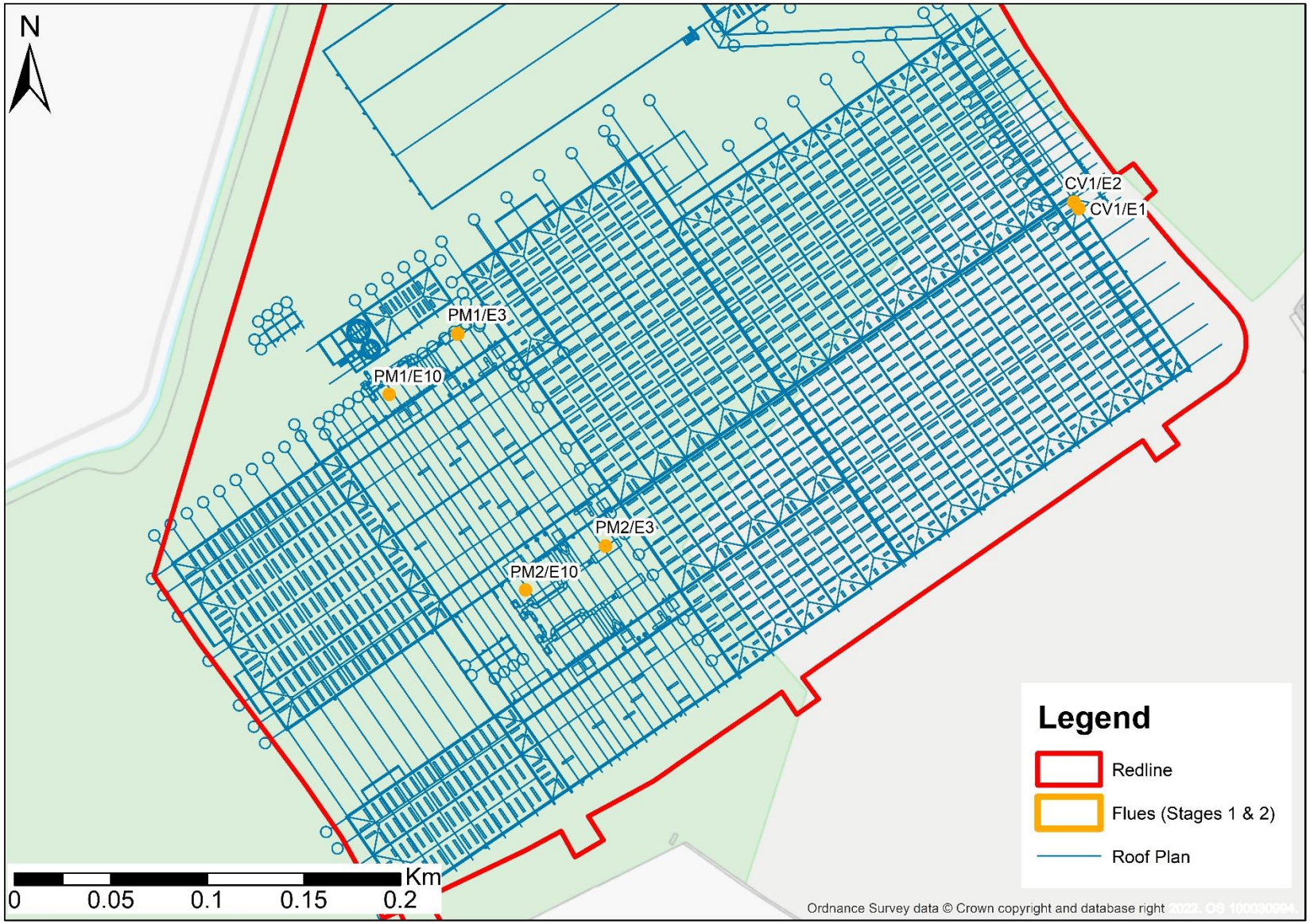

Figure 2-2: Modelled Flue Locations

2.2.2 Dust Generating Processes

ICT have also provided information on the proposed on-site equipment. This includes dust removal systems, trimming presses and trimming silos which all produce dust emissions. For each of the Phases 1 and 2, there will be dust removal systems (E15) and trimming silos (E16). There will also be a set of dust removal systems (E4-E11) and trimming presses (E12) to be installed as part of the Phase 1 design, and also a dust removal system (E36), to be installed as part of Phase 1 only.

The locations of the modelled units are shown in Figure 2-3 and listed in Table 2-2.

Emission Source		NGR	
		x	y
Dust removal system (E15)	PM1/E15	332063.4	369776.9
	PM2/E15	332125.8	369688.1
Trimming silos (E16)	PM1/E16	332022.8	369739.0
	PM2/E16	33204882	369645.7
Dust removal systems (E4, E5, E6, E7, E8, E9, E10, E11)	CV1/E4	332350.8	369871.2
	CV1/E5	332318.2	369848.4
	CV1/E6	332286.1	369826.4
	CV1/E7	332252.8	369805.0
	CV1/E8	332280.6	369902.1
	CV1/E9	332248.2	369879.6
	CV1/E10	332215.8	369857.0
	CV1/E11	332183.2	369834.3
Trimming presses (E12)	CV1/E12	332212.7	369880.9
Dust removal system (E36)	RW1/E36	332065.7	369816.5

Table 2-2: Location of Modelled PM_{10} Sources

The individual process conditions for each of these units are listed in Table 2-3. The process conditions listed are based on post embedded mitigation measures. The dust removal systems E15 and E36 will be fitted with wet scrubbers and the remaining units listed are to have dry filters. Monitoring data for a similar site in Italy has been provided by ICT and shows that the PM_{10} emissions after the application of wet scrubbers were recorded to be between 0.6mg/m^3 and 1.4mg/m^3. An estimate limit value of 2mg/m^3 is therefore considered to be achievable for the units with wet scrubbers, but emissions of 5mg/m^3 have also been modelled as a worst case. PM_{10} emission limit values (ELV) for the dry filters are based on assumptions provided by the manufacturers that they can guarantee to achieve emission of 5mg/m^3 for 90% of the year and 10mg/m^3 for the remaining 10% of the year, when the filters are nearing replacement. This is considered to be a conservative and robust assumption.

Parameter	Unit	Dust removal system (E15)		Trimming silos (E16)		Dust removal systems (E4, E5, E6, E7, E8, E9, E10, E11)		Trimming presses (E12)		Dust removal system (E36)	
Phase 1	-	PM1/E15		PM1/E16		CV1/E4; CV1/E5; CV1/E6; CV1/E7; CV1/E8; CV1/E9; CV1/E10; CV1/E11;		CV1/E12		RW1/E36	
Phase 2	-	PM2/E15		PM2/E16		-		-		-	
Operating hours	hr/yr	8760		8760		6240		6240		6240	
Exhaust flow	m^3/h	82,000		3,500		60,000		28,000		60,000	
Exhaust velocity*	m/s	7.25		13.75		14.74		15.47		6.55	
Exhaust temperature	ºC	Ambient		25		25		25		Ambient	
Flue diameter	m	2		0.3		1.2		0.8		1.8	
Emission limit value (ELV)**	mg/m^3	2	5	5	10	5	10	5	10	2	5
PM_{10} emission rate***	g/s	0.046	0.114	0.005	0.010	0.083	0.167	0.039	0.078	0.033	0.083
Stack height	m	28.5		20		22		13		24	
Mitigation	-	Wet scrubber		Dry filter		Dry filter		Dry filter		Wet scrubber	

Notes: * Exhaust velocity calculated as flow rate m^3/s divided by area in m^2

** PM_{10} emission limit values (ELV) for the dry filters are based on assumptions provided by the manufacturers that they can guarantee to achieve emission of $5mg/m^3$ for 90% of the year and $10mg/m^3$ for the remaining 10% of the year when the filters are close to needing replacement. For the units with wet scrubbers the emission limits of $2mg/m^3$ and $5mg/m^3$ have been modelled to demonstrate a worst-case range of results. ICT have provided data from another site that shows that post wet scrubber emissions can be expected to be $<1mg/m^3$. An estimate limit value $2mg/m^3$ is therefore considered to be achievable but emission of $5mg/m^3$ have also been modelled as a worst case.

*** PM_{10} emission rate calculated as flow rate m^3/s multiplied by ELV in mg/m^3

Table 2-3: Process Conditions of on-site sources of PM_{10}

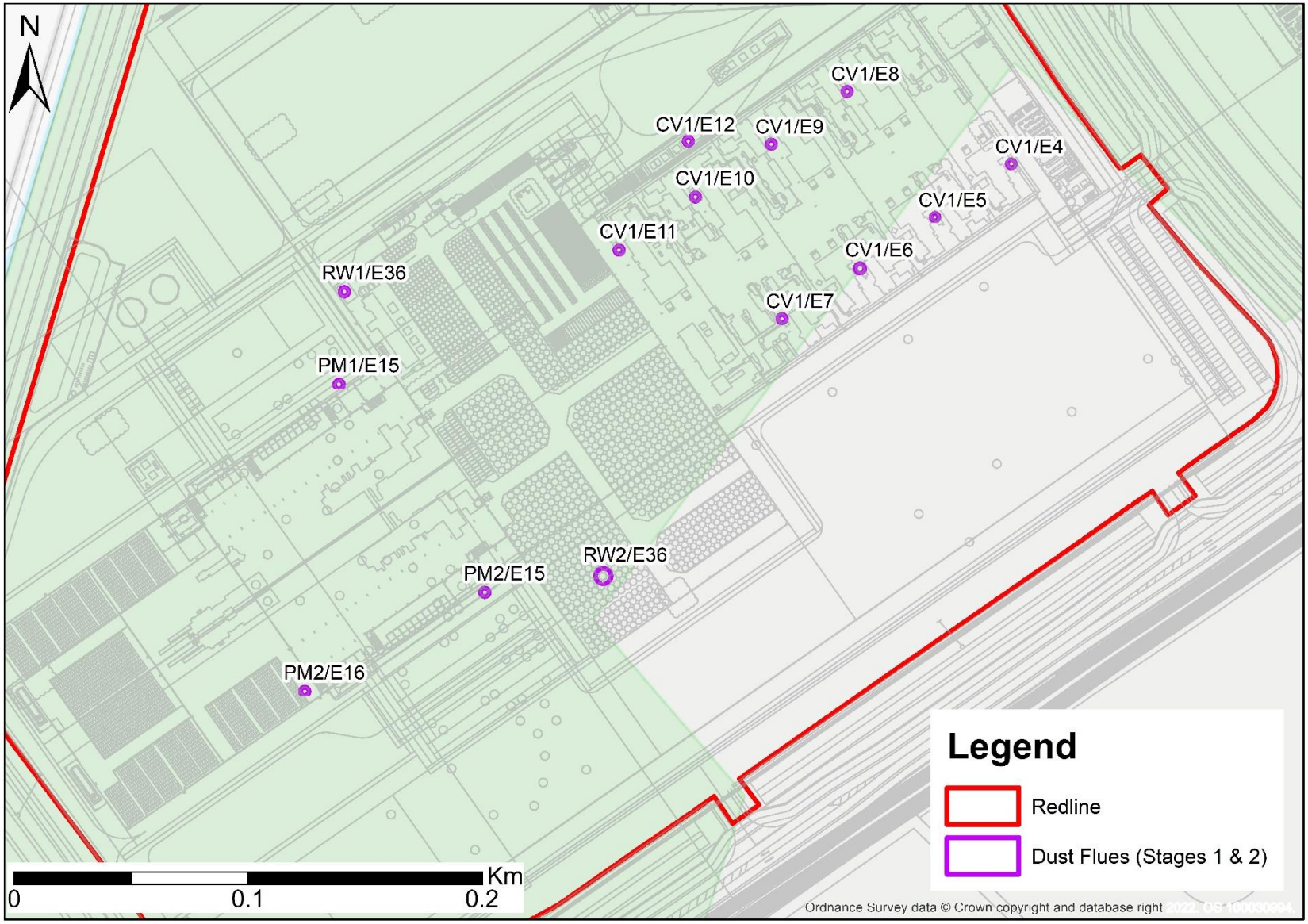

Figure 2-3: Modelled PM_{10} Emission Sources

3.0

Environment Agency Screening Assessment

3.0 Environment Agency Screening Assessment

3.1 Environment Agency Risk Assessment Methodology

Plant emissions were calculated using the methodology from the Department for Environment, Food & Rural Affairs (Defra) and Environment Agency (EA)'s air emission risk assessment[3]. The concentration of pollutant released into the air as a result of the on-site operational processes is known as the process contribution (PC).

The short-term and long-term PCs to air were calculated following the EA's risk assessment methodology. PC to air is measured in micrograms per cubic meter, µg/m^3. To calculate the PC to air, the dispersion factors, in micrograms per cubic metre per gram per second, are multiplied by the release rate, in grams per second. Calculations are based on (i) the operation of Phase 1 only and (ii) the cumulative effects of Phase 1 and 2.

The assumptions listed in section 2.2 have been applied, such as the dry filters achieving 5mg/m^3 for 90% of the year and 10mg/m^3 for the remaining 10%, and the wet scrubbers achieving 2mg/m^3. The operational factors have been applied to the relevant units based on the annual operating hours listed in Table 2-1 and Table 2-3.

As the stack heights range from 13m to 28.5m, effective heights of release of 10m, 20m and 30m have been selected. The dispersion factors for these effective heights of release are presented in Table 3-1.

Effective height of release	Annual Dispersion Factor (µg/m^3/g/s)	Hourly Dispersion Factor (µg/m^3/g/s)
10m	32	580
20m	4.6	161
30m	1.7	77

*Table 3-1:*Dispersion Factor

3.2 Particulate Matter (PM_{10})

The process contribution (PC) was calculated by multiplying the dispersion factors (µg/m^3/g/s) listed in Table 3-1 by the release rate (g/s). The estimations of PM_{10} PC are presented in Table 3-2 for Phase 1 only and Table 3-3 for Phase 1 and 2 combined. The EA spreadsheet-based results show that the PC for PM_{10} is likely to above the long-term and short-term criteria for release heights of 10m, 20m and 30m.

Release height (m)	Averaging period	Max PM_{10} PC (µg/m^3)	Threshold Criteria (µg/m^3) (% AQO in brackets)	PC screening
10m	**LT**	8.8	0.4 (1% AQAL)	Above threshold criteria
	ST	160.2	5 (10% AQO)	Above threshold criteria
20m	**LT**	1.27	0.4 (1% AQO)	Above threshold criteria
	ST	44.5	5 (10% AQO)	Above threshold criteria
30m	**LT**	0.5	0.4 (1% AQO)	Above threshold criteria
	ST	21.3	5 (10% AQO)	Above threshold criteria

Table 3-2: PM_{10} PC Screening Calculation results – Phase 1 only

[3] Defra / Environment Agency, Air emissions risk assessment for your environmental permit https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#calculate-pc-to-air

Release height (m)	Averaging period	Max PM_{10} PC ($\mu g/m^3$)	Threshold Criteria ($\mu g/m^3$) (% AQO in brackets)	PC screening
10m	LT	12.7	0.4 (1% AQO)	Above threshold criteria
	ST	229.5	5 (10% AQO)	Above threshold criteria
20m	LT	1.8	0.4 (1% AQO)	Above threshold criteria
	ST	63.7	5 (10% AQO)	Above threshold criteria
30m	LT	0.67	0.4 (1% AQO)	Above threshold criteria
	ST	30.5	5 (10% AQO)	Above threshold criteria

Table 3-3: PM_{10} PC Screening Calculation results – Phase 1 and 2

The Predicted Environmental Concentrations (PECs) were estimated by combining the maximum PC for long-term and short-term with the background concentration, based on Defra PM_{10} background concentrations for the opening year of Phase 1 (2024) ($10.5\mu g/m^3$)[4]. For short-term concentrations, it is assumed the short-term background is twice the long-term background. The calculated PECs along with the results of screening are listed in Table 3-4 for Phase 1 and Table 3-5 for Phases 1 and 2. The screened long-term (LT) results meet the EA screening threshold criteria for 'insignificant', however, the short-term (ST) predicted concentrations exceed the threshold criteria for 'insignificant'. Detailed dispersion modelling of PM_{10} emissions has therefore been carried out.

Release height (m)	Averaging period	Max PM_{10} PC ($\mu g/m^3$)	PEC ($\mu g/m^3$)	Threshold Criteria ($\mu g/m^3$) (% AQO in brackets)	PEC screening
10m	LT	8.8	19.3	28 (70% of AQO)	Below threshold criteria
	ST	160.2	181.2	6.1 (20% of AQO – twice LT background)	Above threshold criteria
20m	LT	1.27	11.8	28 (70% of AQO)	Below threshold criteria
	ST	44.5	65.5	6.1 (20% of AQO – twice LT background)	Above threshold criteria
30m	LT	0.47	11.0	28 (70% of AQO)	Below threshold criteria
	ST	21.3	42.3	6.1 (20% of AQO – twice LT background)	Above threshold criteria

Table 3-4: PM_{10} PEC Screening Calculation results – Phase 1

Release height (m)	Averaging period	Max PM_{10} PC ($\mu g/m^3$)	PEC ($\mu g/m^3$)	Threshold Criteria ($\mu g/m^3$) (% AQO in brackets)	PEC screening
10m	LT	12.7	23.2	28 (70% of AQO)	Below threshold criteria
	ST	229.5	250.5	6.1 (20% of AQO – twice LT background)	Above threshold criteria
20m	LT	1.8	12.3	28 (70% of AQO)	Below threshold criteria
	ST	63.7	84.7	6.1 (20% of AQO – twice LT background)	Above threshold criteria
30m	LT	0.67	11.2	28 (70% of AQO)	Below threshold criteria
	ST	30.5	51.5	6.1 (20% of AQO – twice LT background)	Above threshold criteria

Table 3-5: PM_{10} PEC Screening Calculation results – Phase 1 and 2

[4] Highest Defra 2024 for the proposed development site (grid square 331500, 369500)

3.3 Nitrogen Dioxide NO_2

The process contribution (PC) was calculated by multiplying the dispersion factors (µg/m^3/g/s) listed in Table 3-1 by the NOx release rate (g/s). These were then converted to NO_2 based on the conversion of 70% long-term and 35% short-term, in accordance with Environment Agency guidance, as outlined in section 2.8.2. The estimations of NO_2 PC are presented in Table 3-6 for Phase 1 only and Table 3-7 for Phase 1 and 2 combined. The results show that the PC for NO_2 is likely to above the long-term (LT) and short-term (ST) criteria for release heights of 10m, 20m and 30m.

Release height (m)	Averaging period	Max NO_2 PC (µg/m^3)	Threshold Criteria (µg/m^3) (% AQO in brackets)	PC screening
10m	**LT**	60.0	0.4 (1% AQO)	Above threshold criteria
	ST	543.4	20 (10% AQO)	Above threshold criteria
20m	**LT**	8.6	0.4 (1% AQO)	Above threshold criteria
	ST	150.8	20 (10% AQO)	Above threshold criteria
30m	**LT**	3.2	0.4 (1% AQO)	Above threshold criteria
	ST	72.1	20 (10% AQO)	Above threshold criteria

Table 3-6: NO_2 PC Screening Calculation results – Phase 1 only

Release height (m)	Averaging period	Max NO_2 PC (µg/m^3)	Threshold Criteria (µg/m^3) (% AQO in brackets)	PC screening
10m	**LT**	117.5	0.4 (1% AQO)	Above threshold criteria
	ST	1,065.1	20 (10% AQO)	Above threshold criteria
20m	**LT**	16.9	0.4 (1% AQO)	Above threshold criteria
	ST	295.6	20 (10% AQO)	Above threshold criteria
30m	**LT**	6.2	0.4 (1% AQO)	Above threshold criteria
	ST	141.4	20 (10% AQO)	Above threshold criteria

Table 3-7: NO_2 PC Screening Calculation results – Phase 1 and 2

The Predicted Environmental Concentrations (PECs) were estimated by combining the maximum NOx PC for long-term and short-term with the background concentration, based on Defra NO_2 background concentrations for the opening year of Phase 1 (2024) (9.5µg/m^3)[5]. For short-term concentrations, it is assumed the short-term background is twice the long-term background. The calculated PECs along with the results of screening are listed in Table 3-8 for Phase 1 and Table 3-9 for Phase 1 and 2.

Release height (m)	Averaging period	Max NO_2 PC (µg/m^3)	PEC (µg/m^3)	Threshold Criteria (µg/m^3) (% AQO in brackets)	PEC screening
10m	**LT**	60.0	69.5	28 (70% of AQO)	Above threshold criteria
	ST	543.4	562.4	35.2 (20% of AQO – twice LT background)	Above threshold criteria
20m	**LT**	8.6	18.1	28 (70% of AQO)	Below threshold criteria
	ST	150.8	169.8	35.2 (20% of AQO – twice LT background)	Above threshold criteria
30m	**LT**	3.2	12.7	28 (70% of AQO)	Below threshold criteria
	ST	72.1	91.1	35.2 (20% of AQO – twice LT background)	Above threshold criteria

[5] Highest Defra 2024 for the proposed development site (grid square 331500, 369500)

Table 3-8: NO_2 PEC Screening Calculation results – Phase 1

Release height (m)	Averaging period	Max NO_2 PC ($\mu g/m^3$)	PEC ($\mu g/m^3$)	Threshold Criteria ($\mu g/m^3$) (% AQO in brackets)	PEC screening
10m	LT	117.5	127.0	28 (70% of AQO)	Above threshold criteria
	ST	1,065.1	1,084.1	35.2 (20% of AQO – twice LT background)	Above threshold criteria
20m	LT	16.9	26.4	28 (70% of AQO)	Above threshold criteria
	ST	295.6	314.7	35.2 (20% of AQO – twice LT background)	Above threshold criteria
30m	LT	6.2	15.7	28 (70% of AQO)	Below threshold criteria
	ST	141.4	160.4	35.2 (20% of AQO – twice LT background)	Above threshold criteria

Table 3-9: NO_2 PEC Screening Calculation results – Phase 1 and 2

The screened long-term (LT) results meet the EA screening threshold criteria for 'insignificant' based on release heights of 30m, however, release heights of 20m or 10m for LT and the short-term (ST) concentrations exceed the threshold criteria for 'insignificant'. Detailed dispersion modelling to determine NO_2 emissions has therefore been carried out.

3.4 Nitrogen Oxides (NOx)

The process contribution (PC) was calculated by multiplying the dispersion factors ($\mu g/m^3/g/s$) listed in Table 3-1 by the NOx release rate (g/s). The estimations of NO_x PC are presented in Table 3-10 for Phase 1 only and Table 3-11 for Phase 1 and 2 combined. The results show that the PC for NO_x is likely to above the long-term and short-term criteria for release heights of 10m, 20m and 30m.

Release height (m)	Averaging period	Max NO_x PC ($\mu g/m^3$)	Threshold Criteria ($\mu g/m^3$) (% AQO in brackets)	PC screening
10m	LT	85.7	0.3 (1% AQO)	Above threshold criteria
	ST	1,552.6	75 (10% AQO)	Above threshold criteria
20m	LT	12.3	0.3 (1% AQO)	Above threshold criteria
	ST	431.0	75 (10% AQO)	Above threshold criteria
30m	LT	4.6	0.3 (1% AQO)	Above threshold criteria
	ST	206.1	75 (10% AQO)	Above threshold criteria

Table 3-10: NO_2 PC Screening Calculation results – Phase 1 only

Release height (m)	Averaging period	Max NO_x PC ($\mu g/m^3$)	Threshold Criteria ($\mu g/m^3$) (% AQO in brackets)	PC screening
10m	LT	167.9	0.3 (1% AQO)	Above threshold criteria
	ST	3,043.0	75 (10% AQO)	Above threshold criteria
20m	LT	24.1	0.3 (1% AQO)	Above threshold criteria
	ST	844.7	75 (10% AQO)	Above threshold criteria
30m	LT	8.9	0.3 (1% AQO)	Above threshold criteria
	ST	404.0	75 (10% AQO)	Above threshold criteria

Table 3-11: NO_2 PC Screening Calculation results – Phase 1 and 2

The Predicted Environmental Concentrations (PECs) were estimated by combining the maximum NOx PC for long-term and short-term with the background concentration, based on Defra NO_x background concentrations for the opening year of Phase 1 (2024) (12.6µg/m^3)[6]. For short-term concentrations, it is assumed the short-term background is twice the long-term background. The calculated PECs along with the results of screening are listed in Table 3-12 for Phase 1 and Table 3-12 for Phases 1 and 2.

Release height (m)	Averaging period	Max NO_x PC (µg/m^3)	PEC (µg/m^3)	Threshold Criteria (µg/m^3) (% AQO in brackets)	PEC screening
10m	LT	85.7	98.3	22.5 (70% of AQO)	Above threshold criteria
	ST	1,552.6	1,577.8	7.5 (10% of AQO)	Above threshold criteria
20m	LT	12.3	24.9	22.5 (70% of AQO)	Above threshold criteria
	ST	431.0	456.2	7.5 (10% of AQO)	Above threshold criteria
30m	LT	4.6	17.2	22.5 (70% of AQO)	Below threshold criteria
	ST	206.1	231.3	7.5 (10% of AQO)	Above threshold criteria

Table 3-12: NO_x PEC Screening Calculation results – Phase 1

Release height (m)	Averaging period	Max NO_x PC (µg/m^3)	PEC (µg/m^3)	Threshold Criteria (µg/m^3) (% AQO in brackets)	PEC screening
10m	LT	167.9	180.5	22.5 (70% of AQO)	Above threshold criteria
	ST	3,043.0	3,068.2	7.5 (10% of AQO)	Above threshold criteria
20m	LT	24.1	36.7	22.5 (70% of AQO)	Above threshold criteria
	ST	844.7	870.0	7.5 (10% of AQO)	Above threshold criteria
30m	LT	8.9	21.5	22.5 (70% of AQO)	Below threshold criteria
	ST	404.0	429.2	7.5 (10% of AQO)	Above threshold criteria

Table 3-13: NOx PEC Screening Calculation results – Phase 1 and 2

The screened long-term (LT) results meet the EA screening threshold criteria for 'insignificant' based on release heights of 30m, however, release heights of 20m or 10m for LT and the short-term (ST) concentrations exceed the threshold criteria for 'insignificant'. Detailed dispersion modelling to assess the impact of NO_x emissions on nearby ecological receptors has therefore been carried out.

[6] Highest Defra 2024 for the proposed development site (grid square 331500, 369500)

4.0

Assessment Methodology

4.0 Assessment Methodology

4.1 Dispersion Model

Detailed dispersion modelling of NO_x, PM_{10} and $PM_{2.5}$ emissions has been carried out using the latest version of ADMS-Roads Extra (version 5.0.1.3), which is an internationally recognised new generation dispersion model developed by Cambridge Environmental Research Consultants (CERC). ADMS uses advanced algorithms to describe the boundary layer structure, turbulence and stability. The methodology for this is detailed in the following sections.

4.2 Meteorological Data

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.

Defra's LAQM (TG22)[7] guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 85%. Unusable hours include missing hours and calm hours[8]. The 2016, 2017, 2018, 2019 and 2020 Liverpool Airport datasets have been checked for usability. The percentage of usable hourly data for each year is 100%, which is well above the 85% threshold, the data is considered to be adequate for dispersion modelling, in accordance with LAQM (TG22) guidance[7].

Figure 4-1 shows the data as a windrose for each of the datasets from 2016 to 2020. It can be seen that the predominant wind direction varies between west and south.

[7] Defra (2022) Local Air Quality Management Technical Guidance TG(22), August 2022 https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

[8] 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.

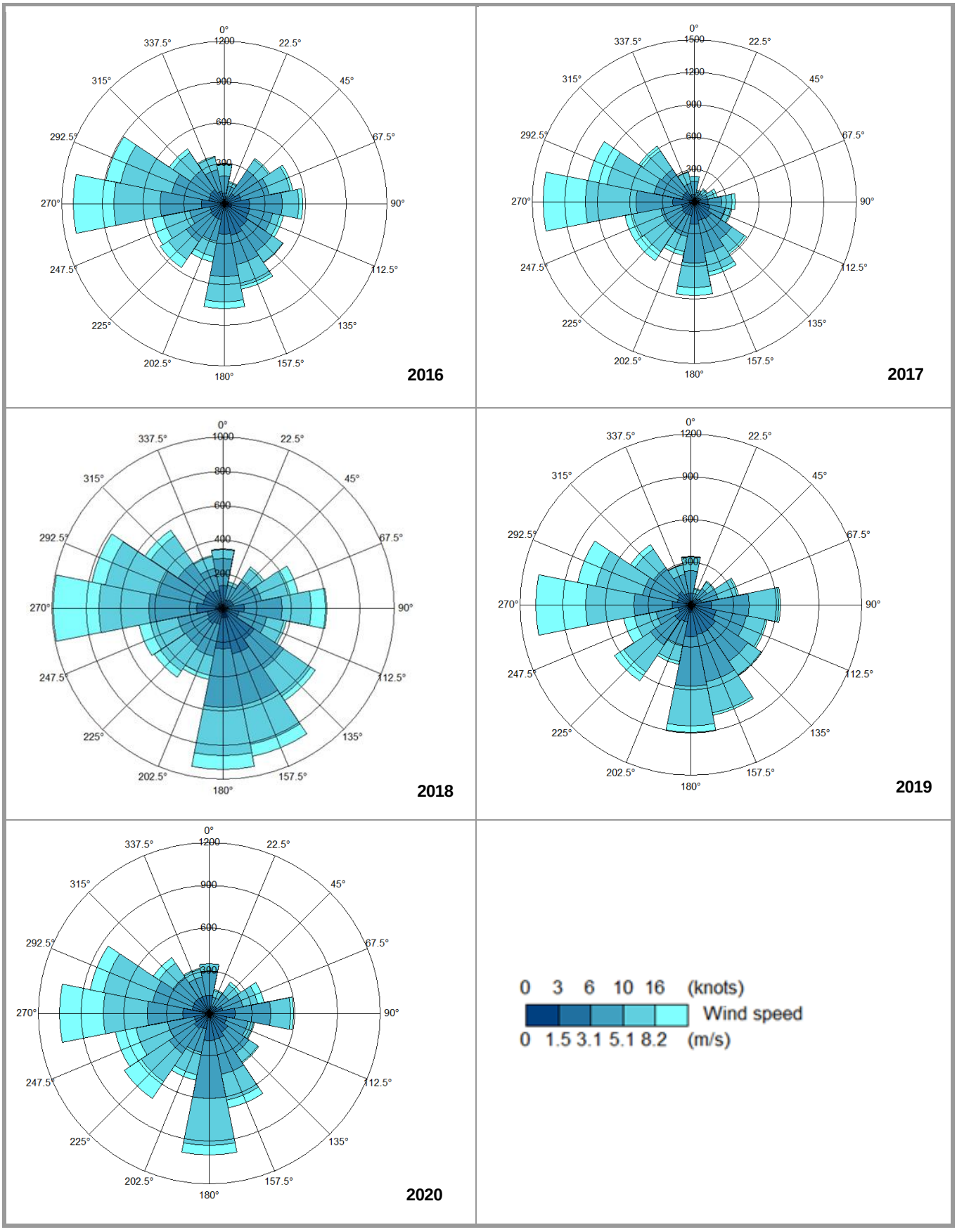

Figure 4-1: Windroses for Liverpool Airport, 2016 to 2020

4.3 Building Effects

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.

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.

Figure 4-2 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 4-1.

ID	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
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 4-1: Modelled Buildings

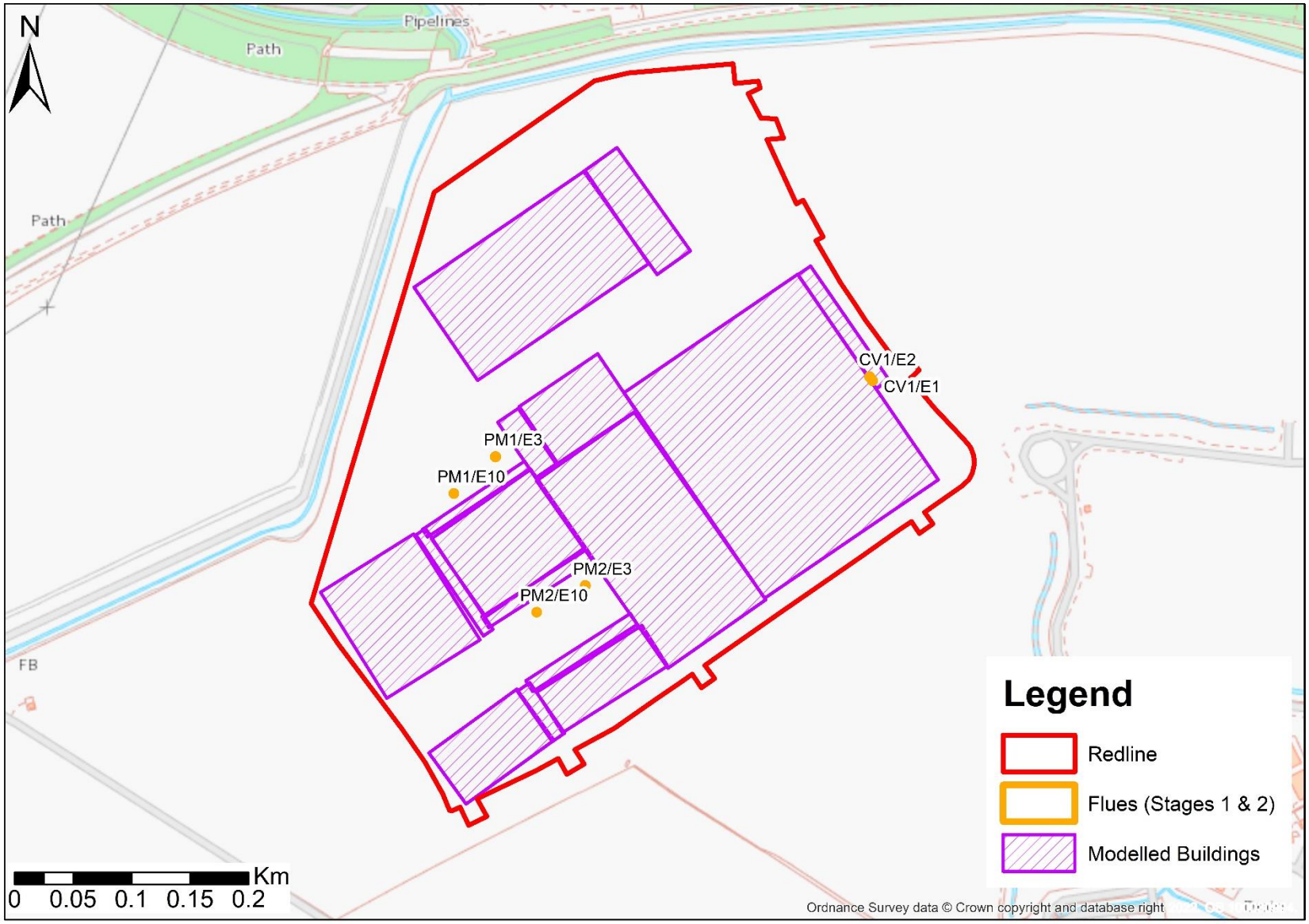

Figure 4-2: Modelled Buildings

4.4 Topography and Terrain

Surface roughness is a component of surface texture. Air travelling over the surface is affected by the surface roughness, rough surfaces would result in higher roughness values than 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)'.

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).

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.

4.5 Receptors

4.5.1 Modelled Residential Receptors

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 PM_{10} and NO_x emissions associated with on-site units, residential receptors have been selected including worst case residential properties closest to the proposed flues (receptors 9 and 12). The positions of the modelled residential receptors in relation to the modelled flues are shown in Figure 4-3 and Table 4-2. A height of 1.5m corresponds to a ground floor property.

Receptor ID	Receptor Address	Easting	Northing	Modelled Height (m)
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 4-2: Modelled Receptors

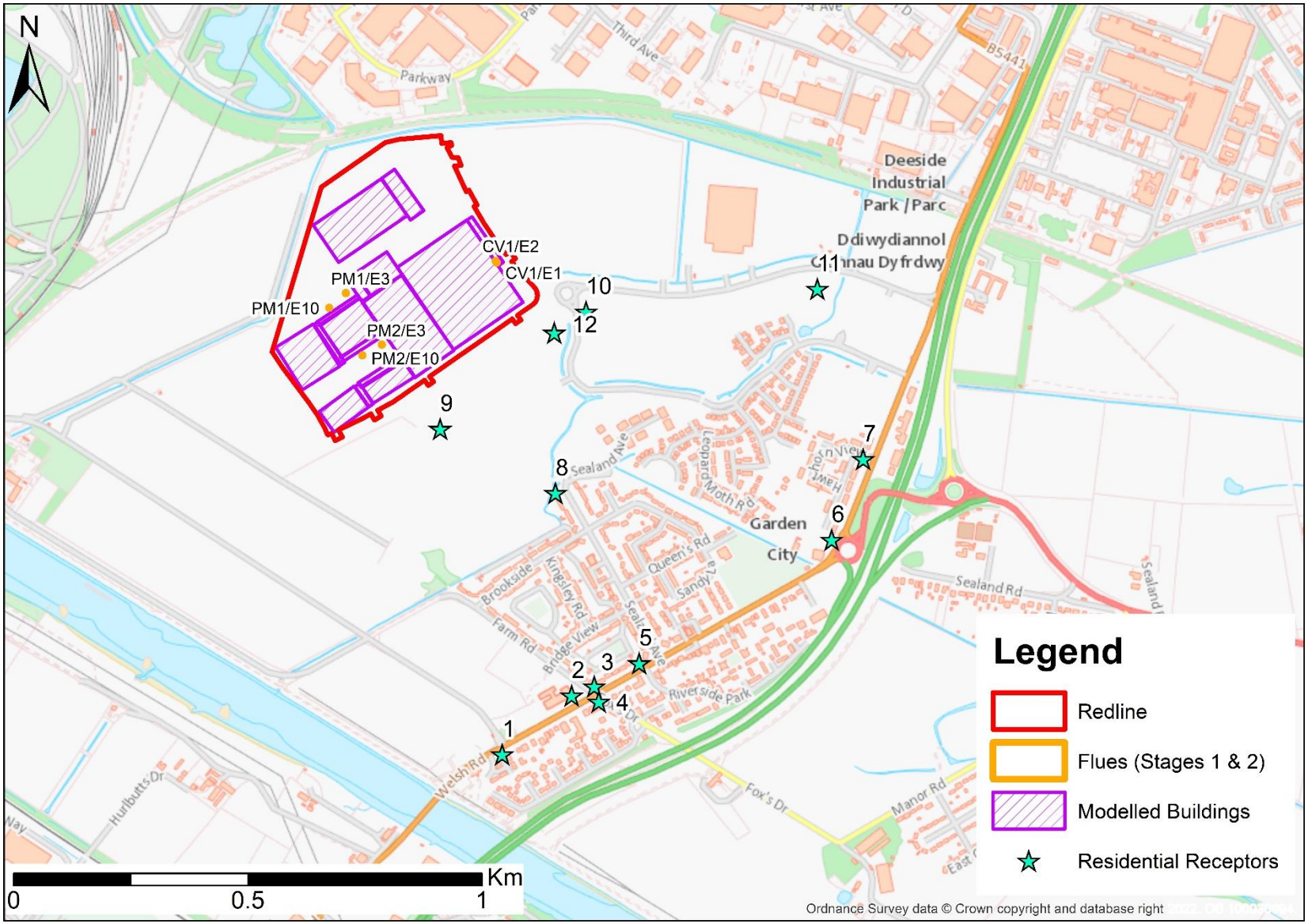

Figure 4-3: Modelled Receptor Locations

4.5.2 Modelled Ecological Receptors

As the combined thermal input of the proposed on -site gas-fired combustion plant is >50MW, protected conservation areas within15km of the Proposed development have been considered in this assessment. These conservation sites within 15km have been labelled as receptors 19 to 50[9] and have been modelled at ground level (0m) to represent worst-case for ecological receptors. The modelled residential receptors are shown in Figure 4-4 and listed in Table 4-3.

Receptor ID	Ecological Site	Easting	Northing	Modelled Height (m)
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
40	Alyn Valley Woods and Alyn Gorge Caves SAC	319870	366297	0

[9] Receptor numbers align with those reported in the Technical Chapter of the Environmental Statement. Receptors 13 to 18 related to residential receptors close to the road network. As this report relates to emissions generated on-site and not operational traffic emissions, receptors 13 to 18 are not of relevance to this assessment.

Receptor ID	Ecological Site	Easting	Northing	Modelled Height (m)
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 4-3: Modelled Ecological Receptors

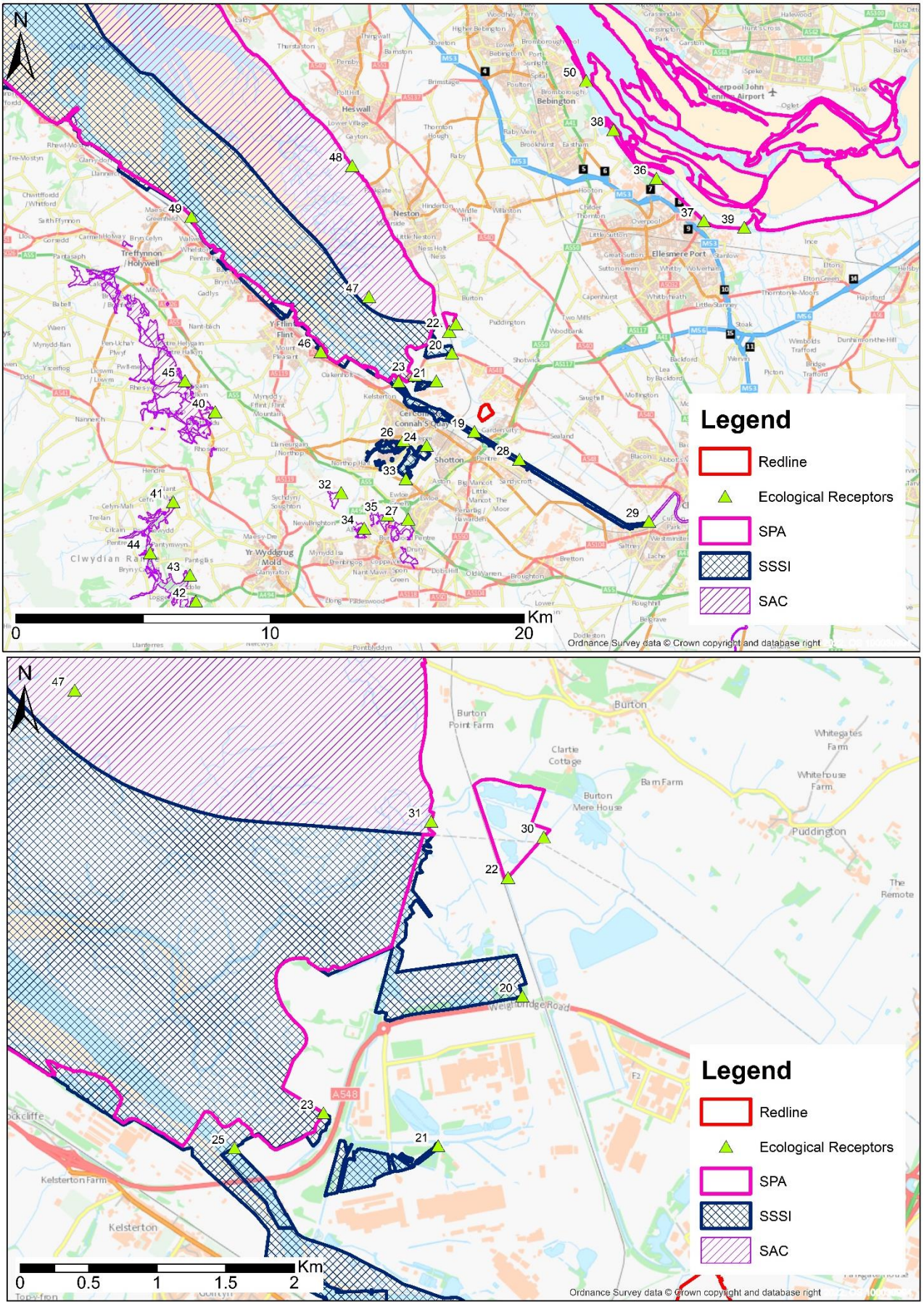

Figure 4-4: Modelled Ecological Receptors

4.5.3 Model Domain

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 in Figure 4-5.

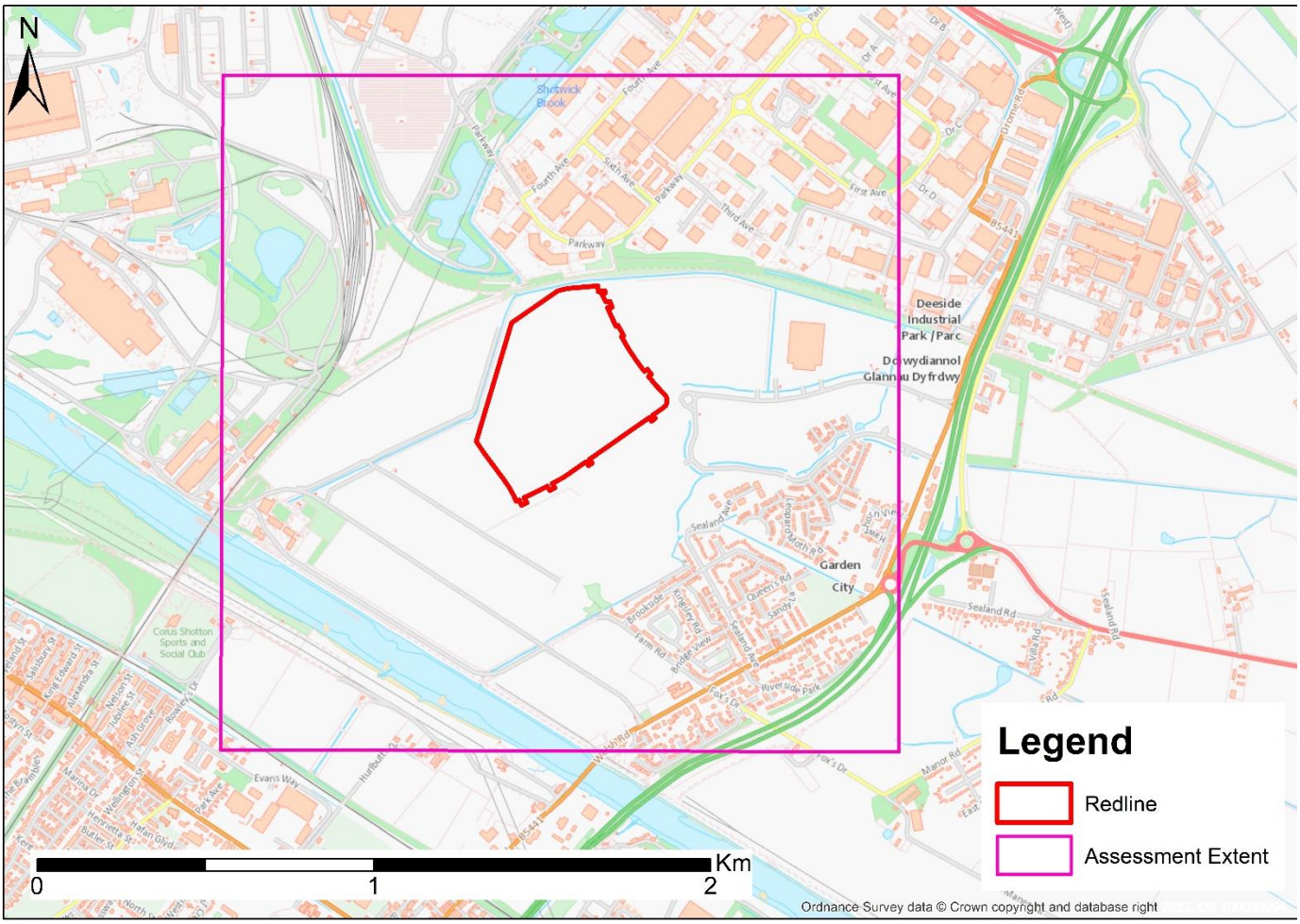

Figure 4-5: Assessment Extent

4.6 Results Processing

4.6.1 Atmospheric Chemistry

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.

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.

For the on-site combustion plant, Environment Agency guidance[10] 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 therefore be conservative.

4.6.2 Background Pollutant Concentrations

The modelled process contributions calculated using ADMS and 2024 annual mean Defra background concentrations[11] were added together to give total concentrations associated with operation of the proposed paper mill. This is to enable a comparison to be made with the air quality objectives, as discussed in section 4.7.2. As Phase 2 is not proposed to be operational until 2026, the use of 2024 backgrounds was considered to be a conservative approach.

4.6.3 Ecological Assessment

In order to assess the operational impact of the Application Site on sensitive habitats within 15km, the following calculations have been made:

- The Air Pollution Information System (APIS)[12]has been used to obtain source background levels and loads and Critical Level and Critical Loads for relevant habitats /ecological designations.
- The dry deposition flux (µg/m^2/sec) has been calculated by multiplying the process contribution NO_2 concentrations (µg/m^3) from the operational on-site combustion plant 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 Guidance on detailed modelling approach for an appropriate assessment for emissions to air[13].
- The dry deposition flux (µg/m^2/sec) has then been multiplied by a conversion factor of 9614 to derive the process contribution (PC) nitrogen dry deposition in kg N/ha/yr.
- Background values for the corresponding grids in which the ecological receptors lie has been obtained from the mapping on the APIS website[12], and range from 9.66 kg N/ha/yr to 18.34 kg N/ha/yr[15].
- The background nitrogen deposition (kg N/ha/yr) has been added to the results to determine the total dry deposition.

[10] Environment Agency (2021), Environmental permitting: air dispersion modelling reports, last updated 19th January 2021 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports
[11] Defra, Background Maps https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc.
[12] Air Pollution Information System (APIS), Site Relevant Critical Loads and Source Attribution, http://www.apis.ac.uk/srcl
[13] Air Quality Advisory Group (2014), AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air.
[14] (14/46 x 3600 x 24 x 365 x 10-9)/0.001
[15] These are 2018 backgrounds, which align with the values used in the assessment for the Environmental Statement.

4.7 Assessment of Significance

4.7.1 Key Legislation

The results of dispersion modelling at sensitive residential receptors have been compared to relevant national air quality objectives for the protection of human health listed in the Environment Act 2021[16].

The air quality UK Air Quality Objectives (AQOs) which apply to this assessment are shown in Table 4-4 and are the environmental standards applicable to this risk assessment, as listed on the Environment Agency/Defra website[17]. 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.

Pollutant	Averaging Period	Objective Threshold (µg/m^3)
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)
Oxides of nitrogen (NOx) as NO_2 (for protection of vegetation and ecosystems)	Annual mean	30
	Daily mean	75
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)

Table 4-4: UK Air Quality Objectives / Environmental standard

4.7.2 Screening Assessment

In accordance with the Environmental Agency/Defra risk assessment methodology[17], calculated process contributions (PC) are to be screened in accordance with the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard
-
- The long-term PC is less than 1% of the long-term environmental standard

Should this criteria be met, there is no requirement for any further assessment. Should criteria be exceeded, a second stage of screening is required to determine the impact of the predicted environmental concentration (PEC). The PEC is calculated by adding the PC to the concentration of the substance that's already present in the environment - the background concentration (listed in section 4.6.2 of this report). Short-term background concentrations are assumed to be twice the long-term (annual mean) background concentrations.

In the second stage of screening the following criteria is to be considered:

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

[16] HMSO (2021) Environment Act 2021, November 2021, https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[17] Environment Agency/ Defra, Guidance: Air emissions risk assessment for your environmental permit, https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions

Should this criteria be met, there is no requirement for any further assessment. If either of these criteria is not met, detailed modelling of emissions is required.

4.7.3 Determining Significance of Impact

The total concentrations predicted as a result of detailed dispersion modelling are to be compared to the UK Air Quality Limits/environmental standard. Should no exceedance be predicted, the impact can be determined to be not significant with respect to Environment Agency/Defra air quality risk assessment for permit applications[10].

Should an exceedance be predicted, a framework for describing the impacts is set out in EPUK/IAQM guidance[19] The guidance contains a two-stage process for determining the likely significant effects of the impacts on air quality:

A description of the impact is given based on the magnitude of change as a percentage of a relevant Air Quality Assessment Level (AQAL). Account must also be taken of predicted pollutant concentrations and their relationship to the Air Quality Objective for the pollutants of concern. 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.

Table 4-5 summarises the impact descriptors for annual mean concentrations. The impact descriptors may be adverse or beneficial depending upon whether concentrations are predicted to increase or decrease. Changes of <1%, i.e., 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 (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Table 4-5: Indicative Threshold for Requiring an Air Quality Assessment

The descriptors presented in Table 2-14 denote the impacts at individual sensitive receptor locations, however they do not provide a definitive conclusion on the significance of a specific effect. Usually, a major or moderate impact on air quality will be considered to have a significant effect, and a slight or negligible impact on air quality will not be considered as having a significant effect. However, the guidance makes it clear that the assessment of significance of the overall effect should be based on professional judgement, as is the case in this assessment.

The relevant impacts for short-term concentrations provided in IAQM guidance[18] are summarised in Table 4-6.

% Change in concentration relative to Air Quality Assessment Level (AQAL)	Impact Descriptor
<=10% of AQAL	Negligible
11-20% of AQAL	Minor
21-50% of AQAL	Moderate
>51%of AQAL	Major

Table 4-6: Impact Descriptors for Individual Receptors (Short Term Concentrations)

The descriptors presented in Table 4-5 and Table 4-6 denote the impacts at individual sensitive receptor locations, however they do not provide a definitive conclusion on the significance of a specific effect. Usually, a major or moderate impact on air quality will be considered to have a significant effect, and a minor or negligible impact on air quality will not be considered as having a significant effect. However, the guidance makes it clear that the assessment of significance of the overall effect should be based on professional judgement, as is the case in this assessment

5.0

Impact Evaluation

5.0 Impact Evaluation

To assess the operational impact of particulate matter (PM_{10}) and NO_2 emissions from the on-site processes, dispersion modelling was undertaken following the methodology outlined in section 2.0. The results have been reported for operation of Phase 1 only and combined impact of Phases 1 and 2.

5.1 Particulate Matter (PM_{10})

5.1.1 Long-term PM_{10}

The predicted process contributions (PC) to long-term (annual mean) PM_{10} and predicted environmental concentrations (PEC) associated with the operation of the dust emitting plant at each of the residential receptors along with the Defra background concentrations for the opening year (2024) are listed in Table 5-1 as part of Phase 1 only and Table 5-2 for Phase 1 and 2.

The process contributions from the on-site dust emission sources are based on the process conditions listed in section 2.2, including the assumptions that the dry filters will achieve 5mg/m^3 for 90% of the year and 10mg/m^3 for the remain 10% of the year. The results listed are based on wet scrubbers associated with achieving 2mg/m^3 or 5mg/m^3, to demonstrate the reduced impact associated with a low emission limit for this units.

ID	Defra background 2024 (µg/m^3)	Dry filters[20] & wet scrubber 2mg/m^3					Dry filters[Error! Bookmark not defined.] & wet scrubber 5mg/m^3				
		PC (µg/m^3)	PC as % of AQAL	Impact descriptor	PEC (µg/m^3)	PEC> AQAL (40 µg/m^3)?	PC (µg/m^3)	PC as % of AQAL	Impact descriptor	PEC- With (µg/m^3)	PEC> AQAL (40 µg/m^3)?
1	11.9	0.1	0.2	Negligible	11.9	No	0.1	0.3	Negligible	12.0	No
2	11.9	0.1	0.3	Negligible	12.0	No	0.1	0.4	Negligible	12.0	No
3	11.9	0.1	0.3	Negligible	12.0	No	0.1	0.4	Negligible	12.0	No
4	11.9	0.1	0.3	Negligible	12.0	No	0.1	0.4	Negligible	12.0	No
5	11.9	0.2	0.3	Negligible	12.0	No	0.2	0.4	Negligible	12.0	No
6	11.4	0.2	0.5	Negligible	11.6	No	0.2	0.6	Negligible	11.6	No
7	11.4	0.3	0.6	Negligible	11.6	No	0.3	0.7	Negligible	11.7	No
8	10.1	0.3	0.7	Negligible	10.4	No	0.4	0.9	Negligible	10.5	No
9	10.1	0.4	0.7	Negligible	10.4	No	0.4	1.0	Negligible	10.5	No
10	10.1	1.2	2.9	Negligible	11.3	No	1.3	3.2	Negligible	11.4	No
11	11.4	0.3	0.8	Negligible	11.7	No	0.4	0.9	Negligible	11.8	No
12	10.1	1.2	2.8	Negligible	11.2	No	1.3	3.2	Negligible	11.4	No

Table 5-1: Predicted PM_{10} concentrations (µg/m^3) at modelled receptors, Phases 1 only, wet scrubbers achieving emission limits of 2mg/m^3 or 5mg/m^3

[20] Units with dry filters assumed to emit at 5mg/m^3 for 90% of the year and 10mg/m^3 for 10% of the year

ID	Defra background 2024 (µg/m³)	Dry filters[21] & wet scrubber 2mg/m³					Dry filters[Error! Bookmark not defined.] & wet scrubber 5mg/m³				
		PC (µg/m³)	PC as % of AQAL	Impact descriptor	PEC (µg/m³)	PEC> AQAL (40 µg/m³)?	PC (µg/m³)	PC as % of AQAL	Impact descriptor	PEC- With (µg/m³)	PEC> AQAL (40 µg/m³)?
1	11.9	0.1	0.4	Negligible	12.0	No	0.1	0.2	Negligible	12.0	No
2	11.9	0.1	0.5	Negligible	12.0	No	0.2	0.3	Negligible	12.0	No
3	11.9	0.1	0.5	Negligible	12.0	No	0.2	0.3	Negligible	12.0	No
4	11.9	0.1	0.5	Negligible	12.0	No	0.2	0.3	Negligible	12.0	No
5	11.9	0.2	0.5	Negligible	12.0	No	0.2	0.4	Negligible	12.1	No
6	11.4	0.2	0.7	Negligible	11.6	No	0.3	0.6	Negligible	11.7	No
7	11.4	0.3	0.8	Negligible	11.7	No	0.3	0.6	Negligible	11.7	No
8	10.1	0.3	1.2	Negligible	10.4	No	0.5	0.8	Negligible	10.6	No
9	10.1	0.4	1.4	Negligible	10.5	No	0.5	0.9	Negligible	10.6	No
10	10.1	1.2	3.6	Negligible	11.3	No	1.4	3.1	Negligible	11.5	No
11	11.4	0.3	1.0	Negligible	11.7	No	0.4	0.8	Negligible	11.8	No
12	10.1	1.2	3.7	Negligible	11.3	No	1.5	3.0	Negligible	11.6	No

Table 5-2: Predicted PM_{10} concentrations (µg/m³) at modelled receptors, combined impact of Phases 1 and 2, wet scrubbers achieving emission limits of 2mg/m³ or 5mg/m³

Based on the total predicted PM_{10} concentrations and the magnitude of change, the impact due to the operation of Phase 1 of the Proposed Development is *negligible* at all sensitive receptors. The predicted environmental concentrations (PEC) including 2024 Defra backgrounds and are all well below the PM_{10} annual mean objective (40µg/m³), with a maximum calculated concentration of 12.0µg/m³. As the predicted environmental concentrations (PEC) concentrations are less than the PM_{10} annual mean objective (40µg/m³), and the maximum percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The impact of PM_{10} emissions associated with the operation of Phase 1 is therefore not considered to be significant.

Based on the total predicted PM_{10} concentrations and the magnitude of change, the impact due to the operation of Phase 1 and 2 of the Proposed Development is *negligible* at all sensitive receptors. The predicted environmental concentrations (PEC) including 2024 Defra backgrounds and are all well below the PM_{10} annual mean objective (40µg/m³), with a maximum of 12.0µg/m³ predicted. As the predicted environmental concentrations (PEC) are less than the PM_{10} annual mean objective (40µg/m³), and the maximum percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The impact of PM_{10} emissions associated with the combined operation of Phases 1 and 2 is therefore not considered to be significant.

5.1.2 Short-term PM_{10}

The predicted short-term environmental concentrations (PECs) of PM_{10} released into the air as a result of the on-site operational processes[22] at each modelled residential receptor are listed in Table 5-3 for associated with Phase 1 only and Table 5-4 for Phase 1 and 2. These are based on the 90.4th percentile of 24-hour means for comparison with the PM_{10} short-term objective (50 µg/m³ 24-hour mean). The Defra background concentrations for 2024

[21] Units with dry filters assumed to emit at 5mg/m³ for 90% of the year and 10mg/m³ for 10% of the year

[22] Emission from the site, does not include off-site traffic emissions

(10.5µg/m^3) has been included in the model runs. The process contributions (PC) have also been listed, for comparison with the short-term AQAL (50 µg/m^3).

The results are based on worst case conditions, assuming all units will operation all year 24 hours per day and the emission limits for the dry filters will be 10mg/m^3, when in reality the dry filters are expected to emit 5mg/m^3 for 90% of the year. Results are listed for the wet scrubbers emitting 5mg/m^3, as a worse case, or a more likely 2mg/m^3.

ID	Defra background 2024 (µg/m^3)	Dry filters 10mg/m^3, wet scrubbers 2mg/m^3				Dry filters 10mg/m^3, wet scrubbers 5mg/m^3			
		90.4th percentile (µg/m^3)	PC (µg/m^3)	PC % of AQAL	Impact descriptor	90.4th percentile (µg/m^3)	PC (µg/m^3)	PC % of AQAL	Impact descriptor
1	11.9	11.2	0.1	0.2	Negligible	11.5	0.1	0.2	Negligible
2	11.9	11.4	0.1	0.2	Negligible	11.8	0.1	0.3	Negligible
3	11.9	11.4	0.1	0.2	Negligible	11.8	0.1	0.3	Negligible
4	11.9	11.4	0.1	0.2	Negligible	11.8	0.1	0.3	Negligible
5	11.9	11.5	0.2	0.3	Negligible	11.9	0.2	0.3	Negligible
6	11.4	12.0	0.2	0.4	Negligible	12.4	0.2	0.5	Negligible
7	11.4	12.2	0.3	0.5	Negligible	12.6	0.3	0.6	Negligible
8	10.1	12.5	0.3	0.5	Negligible	13.4	0.4	0.7	Negligible
9	10.1	12.4	0.4	0.6	Negligible	13.4	0.4	0.8	Negligible
10	10.1	19.1	1.2	2.3	Negligible	20.2	1.3	2.6	Negligible
11	11.4	12.7	0.3	0.6	Negligible	13.1	0.4	0.7	Negligible
12	10.1	18.8	1.2	2.2	Negligible	20.3	1.3	2.6	Negligible

Table 5-3: Predicted 90.4th percentile of 24-hour mean PM_{10} concentrations (µg/m^3) at modelled receptors

ID	Defra background 2024 (µg/m^3)	Dry filters 10mg/m^3, wet scrubbers 2mg/m^3				Dry filters 10mg/m^3, wet scrubbers 5mg/m^3			
		90.4th percentile (µg/m^3)	PC (µg/m^3)	PC % of AQAL	Impact descriptor	90.4th percentile (µg/m^3)	PC (µg/m^3)	PC % of AQAL	Impact descriptor
1	11.9	11.2	0.1	0.2	Negligible	11.3	0.1	0.3	Negligible
2	11.9	11.5	0.1	0.3	Negligible	11.7	0.1	0.4	Negligible
3	11.9	11.5	0.1	0.3	Negligible	12.1	0.1	0.4	Negligible
4	11.9	11.5	0.1	0.3	Negligible	12.1	0.1	0.4	Negligible
5	11.9	11.6	0.2	0.3	Negligible	12.1	0.2	0.4	Negligible
6	11.4	12.1	0.2	0.4	Negligible	12.2	0.2	0.6	Negligible
7	11.4	12.3	0.3	0.5	Negligible	12.7	0.3	0.7	Negligible
8	10.1	12.7	0.3	0.6	Negligible	12.9	0.4	0.9	Negligible
9	10.1	12.6	0.4	0.7	Negligible	14.1	0.4	1.1	Negligible
10	10.1	19.3	1.2	2.4	Negligible	14.7	1.3	2.9	Negligible
11	11.4	12.7	0.3	0.7	Negligible	20.8	0.4	0.8	Negligible
12	10.1	19.0	1.2	2.4	Negligible	13.4	1.3	3.0	Negligible

Table 5-4: Predicted 90.4th percentile of 24-hour mean PM_{10} concentrations (µg/m^3) at modelled receptors – Phase 1 and 2

The results for Phase 1 indicate that the maximum 90.4th percentile is 20.3µg/m^3 at receptor 12, which is lower than the short-term objective AQAL (50µg/m^3). This is based on worst case conditions or all units operating continuously and emitting at 10mg/m^3. Assuming the wet scrubbers emit at 2mg/m^3, the maximum 90.4th percentile reduces to 19.1µg/m^3. The process contributions (PCs) expressed as a % of the short-term objective (50µg/m^3) are all <6% at all receptors. The impact of short-term PM_{10} emissions associated with the operation of Phase 1 is therefore not considered to be significant.

The results for Phases 1 and 2 indicate that the maximum 90.4th percentile is 20.8µg/m^3 at receptor 11, which is lower than the short-term objective (50µg/m^3). This is based on worst case conditions or all units operating continuously and emitting at 10mg/m^3. Assuming the wet scrubbers emit at 2mg/m^3, a maximum 90.4th percentile of 19.3µg/m^3 is predicted. The process contributions (PCs) as a % of the short-term objective (50µg/m^3) are all <6% at all receptors. The impact of short-term PM_{10} emissions associated with the operation of Phases 1 and 2 is therefore not considered to be significant.

TG22 guidance[7] lists a calculation to predict the likely number of 24-hour mean exceedances, based on the predicted annual mean concentrations, but advises that this advises that this should not be applied when the annual mean PM_{10} is lower than 14.8µg/m^3. As the maximum 90.4th percentiles are all lower than the short-term objective (50µg/m^3), it is assumed that the number of exceedances of the 24-hour mean objective will be well below the permissible 35 times a year.

5.1.3 PM_{10} Gridded Results

The dispersion model was run over a 2km grid, as detailed in section 4.5.3, using combined meteorological data from 2016 to 2020. Figure 5-1 shows the total PM_{10} concentrations (predicted annual mean PM_{10} concentrations including Defra 2024 backgrounds) based on a worst-case scenario of all units for Phase 1 and 2 operating continuously with emitting at 10mg/m^3. As shown in Figure 5-1, the off-site total predicted PM_{10} annual mean concentrations are <16µg/m^3.

Figure 5-1*: Total annual mean PM_{10} concentrations dry filters emitting at 10mg/m^3 and the wet scrubbers at 2mg/m^3 – Phases 1 and 2*

5.2 Nitrogen Dioxide (NO_2)

5.2.1 Long-term NO_2

The predicted process contributions (PC) to long-term (annual mean) NO_2, predicted environmental concentrations (PEC) associated with the operation of the on-site combustion plant at each of the residential receptors along with the Defra background concentrations for the opening year (2024) are listed in Table 5-5 as part of Phase 1 only and Table 5-6 for Phases 1 and 2. The process contributions from the on-site combustion plant are based on the process conditions listed in section 2.2.

ID	Defra background 2024 (µg/m³)	NO_2 annual mean PC (µg/m³)	PC % of AQAL	Impact descriptor	PEC (plus 2024 background NO_2)	PEC > AQAL (40 µg/m³)?
1	10.2	0.1	0.2	Negligible	10.3	No
2	10.2	0.1	0.3	Negligible	10.4	No
3	10.2	0.1	0.3	Negligible	10.4	No
4	10.2	0.1	0.3	Negligible	10.4	No
5	10.2	0.2	0.4	Negligible	10.4	No
6	10.2	0.3	0.6	Negligible	10.4	No
7	10.2	0.3	0.7	Negligible	10.5	No
8	8.7	0.4	1.0	Negligible	9.1	No
9	8.7	0.4	1.1	Negligible	9.1	No
10	8.7	1.0	2.6	Negligible	9.7	No
11	10.2	0.3	0.8	Negligible	10.5	No
12	8.7	1.1	2.8	Negligible	9.8	No

Table 5-5: Predicted NO_2 concentrations (µg/m³) at modelled receptors, Phases 1 only

ID	Defra background 2024 (µg/m³)	NO_2 annual mean PC (µg/m³)	PC % of AQAL	Impact descriptor	PEC (plus 2024 background NO_2)	PEC > AQAL (40 µg/m³)?
1	10.2	0.2	0.5	Negligible	10.4	No
2	10.2	0.3	0.6	Negligible	10.5	No
3	10.2	0.3	0.7	Negligible	10.5	No
4	10.2	0.3	0.6	Negligible	10.5	No
5	10.2	0.3	0.8	Negligible	10.6	No
6	10.2	0.5	1.3	Negligible	10.7	No
7	10.2	0.6	1.4	Negligible	10.7	No
8	8.7	0.9	2.4	Negligible	9.6	No
9	8.7	0.9	2.3	Negligible	9.6	No
10	8.7	1.6	4.0	Negligible	10.3	No
11	10.2	0.6	1.4	Negligible	10.7	No
12	8.7	1.9	4.7	Negligible	10.6	No

Table 5-6: Predicted NO_2 concentrations (µg/m³) at modelled receptors, combined impact of Phases 1 and 2

Based on the total predicted NO_2 concentrations and the magnitude of change, the impact due to the operation of Phase 1 of the Proposed Development is *negligible* at all sensitive receptors. The predicted environmental

concentrations (PEC) concentrations including 2024 Defra backgrounds are all well below the NO_2 annual mean objective (40µg/m^3), with a maximum of 10.5µg/m^3 predicted at receptor 7 and 11. As the predicted environmental concentrations (PECs) are less than the NO_2 annual mean objective (40µg/m^3), and the maximum percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The impact of NO_2 emissions associated with the operation of Phase 1 is therefore not considered to be significant.

Based on the total predicted NO_2 concentrations and the magnitude of change, the impact due to the operation of Phases 1 and 2 of the Proposed Development is *negligible* at all sensitive receptors. The predicted environmental concentrations (PEC) including 2024 Defra backgrounds are all well below the NO_2 annual mean objective (40µg/m^3), with a maximum of 10.7µg/m^3 predicted at receptors 6, 7 and 11. As the predicted environmental concentrations (PEC) are less than the NO_2 annual mean objective (40µg/m^3), and the maximum percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The impact of NO_2 emissions associated with the operation of Phases 1 and 2 is therefore not considered to be significant.

5.2.2 Short-term NO_2

The predicted hourly mean NO_2 process contributions which are based on the 99.79th percentile of hourly mean, and the percentage of the short-term NO_2 objective of 200µg/m$^{3.}$ associated with Phase 1 are listed in Table 5-7and those associated with Phases 1 and 2 are listed in Table 5-8.

ID	Defra background 2024 (µg/m^3)	NO_2 short-term PC (µg/m^3)	% of the NO_2 short-term Air Quality Objective (200µg/m^3)	Impact descriptor	PEC (PC plus 2 x 2024 background NO_2)	PEC > AQAL? (200µg/m^3)
1	10.2	3.9	2.0	Negligible	24.4	No
2	10.2	4.2	2.1	Negligible	24.7	No
3	10.2	4.2	2.1	Negligible	24.7	No
4	10.2	4.0	2.0	Negligible	24.5	No
5	10.2	4.1	2.1	Negligible	24.6	No
6	10.2	3.2	1.6	Negligible	23.6	No
7	10.2	3.1	1.6	Negligible	23.5	No
8	8.7	7.5	3.8	Negligible	24.9	No
9	8.7	13.1	6.5	Negligible	30.5	No
10	8.7	7.8	3.9	Negligible	25.2	No
11	10.2	3.5	1.8	Negligible	23.9	No
12	8.7	9.5	4.8	Negligible	26.9	No

Table 5-7: Predicted short-term NO_2 concentrations (µg/m^3) at modelled receptors – Phase 1 only

ID	Defra background 2024 (µg/m^3)	NO_2 short-term PC (µg/m^3)	% of the NO_2 short-term Air Quality Objective (200µg/m^3)	Impact descriptor	PEC (PC plus 2 x 2024 background NO_2)	PEC > AQAL? (200µg/m^3)
1	10.2	4.8	2.4	Negligible	25.2	No
2	10.2	5.2	2.6	Negligible	25.7	No
3	10.2	5.2	2.6	Negligible	25.6	No
4	10.2	4.9	2.5	Negligible	25.4	No
5	10.2	5.0	2.5	Negligible	25.5	No
6	10.2	4.3	2.2	Negligible	24.7	No
7	10.2	4.4	2.2	Negligible	24.8	No
8	8.7	9.4	4.7	Negligible	26.7	No
9	8.7	15.1	7.6	Negligible	32.5	No
10	8.7	11.2	5.6	Negligible	28.6	No
11	10.2	5.0	2.5	Negligible	25.3	No
12	8.7	13.3	6.6	Negligible	30.7	No

Table 5-8: Predicted 24-hour mean NO_2 concentrations (µg/m^3) at modelled receptors – Phases 1 and 2

The results for Phase 1 indicate that the maximum short-term predicted environmental concentration is 30.5µg/m^3 at Receptor 9, which is well below the short-term objective (200µg/m^3.).The maximum percentile change of the short-term Air Quality Objective is 6.5%, as this is <10% all impacts are predicted to be negligible. The impact of short-term NO_2 emissions associated with the operation of Phase 1 is therefore not considered to be significant.

The results for Phases 1 and 2 indicate that the maximum short-term predicted environmental concentration is 32.5µg/m^3 at Receptor 9, which is well below the short-term objective (200µg/m^3.).The maximum percentile change of the short-term Air Quality Objective is 7.6%, as this is <10% all impacts are predicted to be negligible. The impact of short-term NO_2 emissions associated with the operation of Phases 1 and 2 is therefore not considered to be significant.

5.2.3 NO_2 Gridded Results

The dispersion model was run over a 2km grid, as detailed in section 4.5.3, using combined meteorological data from 2016 to 2020. Figure 5-2 shows the total NO_2 concentrations (predicted annual mean NO_2 concentrations including Defra 2024 backgrounds) based on operation of all on-site combustion plant associated with Phase 1 and 2. As shown in Figure 5-2, the off-site total predicted annual mean NO_2 concentrations are <16µg/m^3.

Elevated concentrations are expected close to the flues. As stated in 4.6.1, 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.

Figure 5-2: Total annual mean NO_2 concentrations – Phases 1 and 2

5.3 Nitrogen Oxides (NOx)

5.3.1 NO_X – Long-term

The predicted process contributions (PC) to long-term (annual mean) NO_x, predicted environmental concentrations (PEC) associated with the operation of the on-site combustion plant at each of the residential receptors along with the Defra background concentrations for the opening year (2024) are listed in Table 5-9 as part of Phase 1 only and Table 5-10 for Phases 1 and 2. The process contributions from the on-site combustion plant are based on the process conditions listed in section 2.2.

ID	Location	Defra background 2024 (µg/m^3)	NO_x annual mean PC (µg/m^3)	% change relative to AQO (30µg/m^3)	Impact descriptor	PEC (plus 2024 background NO_x)	PEC > AQAL? (30µg/m^3)
19	River Dee SAC SSSI	12.4	0.1	0.3	Negligible	12.5	No
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	10.2	0.1	0.4	Negligible	10.3	No
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	12.5	0.1	0.3	Negligible	12.6	No
22	The Dee Estuary SPA and Ramsar	9.1	0.1	0.3	Negligible	9.2	No
23	The Dee Estuary Ramsar SSSI, SAC, SPA	13.1	0.1	0.2	Negligible	13.2	No
24	Deeside and Buckley Newt Sites SAC and SSSI	9.7	0.1	0.2	Negligible	9.7	No
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	8.5	0.0	0.2	Negligible	8.5	No
26	The Gathering Grounds Wood SSSI and SAC	9.5	0.0	0.1	Negligible	9.6	No
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	11.3	0.0	<0.1	Negligible	11.4	No
28	River Dee and Bala Lake SAC and SSSI	15.0	0.1	0.3	Negligible	15.1	No
29	River Dee and Bala Lake SAC and SSSI	10.9	0.0	0.1	Negligible	11.0	No
30	Inner Marsh Farm SSSI	9.5	0.1	0.3	Negligible	9.6	No
31	Dee Estuary SAC, Ramsar, SSSI and SPA	9.1	0.1	0.2	Negligible	9.2	No
32	Deeside and Buckley Newt sites SAC and SSSI	8.0	0.0	0.1	Negligible	8.0	No
33	Connah's Quay Ponds and Woodland SSSI and SAC	9.4	0.0	0.1	Negligible	9.4	No
34	Deeside and Buckley New sites SAC and SSSI	9.5	0.0	0.1	Negligible	9.5	No
35	Buckley Claypits and Common SSSI and SAC	10.2	0.0	0.1	Negligible	10.2	No
36	Mersey Estuary SSSI, Ramsar and SPA	14.8	0.0	<0.1	Negligible	14.8	No
37	Mersey Estuary SSSI, Ramsar and SPA	20.5	0.0	<0.1	Negligible	20.5	No

ID	Location	Defra background 2024 (µg/m^3)	NO_x annual mean PC (µg/m^3)	% change relative to AQO (30µg/m^3)	Impact descriptor	PEC (plus 2024 background NO_x)	PEC > AQAL? (30µg/m^3)
38	Mersey Estuary SSSI, Ramsar and SPA	22.1	0.0	<0.1	Negligible	22.1	No
39	Mersey Estuary Ramsar, SSSI and SPA	27.0	0.0	<0.1	Negligible	27.0	No
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	6.6	0.0	<0.1	Negligible	6.6	No
41	Halkyn Common and Holywell Grasslands SSSI	5.5	0.0	<0.1	Negligible	5.5	No
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	5.6	0.0	<0.1	Negligible	5.6	No
43	Tyddyn-Dows Wood SAC and SSSI	5.4	0.0	<0.1	Negligible	5.4	No
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	5.0	0.0	<0.1	Negligible	5.0	No
45	Alyn Valley Woods SAC and SSSI	8.7	0.0	<0.1	Negligible	8.7	No
46	Halkyn Common and Holywell Grasslands SSSI	9.0	0.0	0.1	Negligible	9.0	No
47	Dee Estuary SAC, SSSI and Ramsar	7.5	0.0	0.1	Negligible	7.6	No
48	Dee Estuary Ramsar, SSSI, SAC and SPA	6.9	0.0	0.1	Negligible	6.9	No
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	11.2	0.0	<0.1	Negligible	11.2	No
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	14.2	0.0	<0.1	Negligible	14.3	No

Table 5-9: Predicted NO_x concentrations (µg/m^3) at modelled ecological receptors, Phase 1 only

ID	Location	Defra background 2024 (µg/m^3)	NO_x annual mean PC (µg/m^3)	% change relative to AQO (30µg/m^3)	Impact descriptor	PEC (plus 2024 background NO_x)	PEC > AQAL? (30µg/m^3)
19	River Dee SAC SSSI	12.4	0.1	0.7	Negligible	12.6	No
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	10.2	0.1	0.7	Negligible	10.4	No
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	12.5	0.1	0.5	Negligible	12.7	No
22	The Dee Estuary SPA and Ramsar	9.1	0.1	0.5	Negligible	9.3	No
23	The Dee Estuary Ramsar SSSI, SAC, SPA	13.1	0.1	0.3	Negligible	13.2	No
24	Deeside and Buckley Newt Sites SAC and SSSI	9.7	0.1	0.4	Negligible	9.8	No
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	8.5	0.0	0.3	Negligible	8.6	No
26	The Gathering Grounds Wood SSSI and SAC	9.5	0.0	0.3	Negligible	9.6	No
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	11.3	0.0	0.1	Negligible	11.4	No
28	River Dee and Bala Lake SAC and SSSI	15.0	0.1	0.5	Negligible	15.2	No
29	River Dee and Bala Lake SAC and SSSI	10.9	0.0	0.1	Negligible	11.0	No
30	Inner Marsh Farm SSSI	9.5	0.1	0.5	Negligible	9.7	No
31	Dee Estuary SAC, Ramsar, SSSI and SPA	9.1	0.1	0.4	Negligible	9.3	No
32	Deeside and Buckley Newt sites SAC and SSSI	8.0	0.0	0.1	Negligible	8.0	No
33	Connah's Quay Ponds and Woodland SSSI and SAC	9.4	0.0	0.2	Negligible	9.4	No
34	Deeside and Buckley New sites SAC and SSSI	9.5	0.0	0.1	Negligible	9.5	No
35	Buckley Claypits and Common SSSI and SAC	10.2	0.0	0.1	Negligible	10.2	No
36	Mersey Estuary SSSI, Ramsar and SPA	14.8	0.0	0.1	Negligible	14.8	No
37	Mersey Estuary SSSI, Ramsar and SPA	20.5	0.0	0.1	Negligible	20.5	No

ID	Location	Defra background 2024 (µg/m^3)	NO_x annual mean PC (µg/m^3)	% change relative to AQO (30µg/m^3)	Impact descriptor	PEC (plus 2024 background NO_x)	PEC > AQAL? (30µg/m^3)
38	Mersey Estuary SSSI, Ramsar and SPA	22.1	0.0	0.1	Negligible	22.1	No
39	Mersey Estuary Ramsar, SSSI and SPA	27.0	0.0	0.1	Negligible	27.0	No
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	6.6	0.0	0.1	Negligible	6.6	No
41	Halkyn Common and Holywell Grasslands SSSI	5.5	0.0	<0.1	Negligible	5.5	No
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	5.6	0.0	<0.1	Negligible	5.6	No
43	Tyddyn-Dows Wood SAC and SSSI	5.4	0.0	<0.1	Negligible	5.4	No
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	5.0	0.0	<0.1	Negligible	5.0	No
45	Alyn Valley Woods SAC and SSSI	8.7	0.0	0.1	Negligible	8.8	No
46	Halkyn Common and Holywell Grasslands SSSI	9.0	0.0	0.1	Negligible	9.0	No
47	Dee Estuary SAC, SSSI and Ramsar	7.5	0.0	0.2	Negligible	7.6	No
48	Dee Estuary Ramsar, SSSI, SAC and SPA	6.9	0.0	0.1	Negligible	6.9	No
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	11.2	0.0	0.1	Negligible	11.2	No
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	14.2	0.0	0.1	Negligible	14.3	No

Table 5-10: Predicted NO_x concentrations (µg/m^3) at modelled receptors, Phases 1 and 2

Based on the total predicted NOx concentrations and the magnitude of change, the impact due to the operation of Phase 1 of the Proposed Development is *negligible* at all sensitive ecological receptors. The predicted environmental concentrations (PEC) including 2024 Defra are all below the NOx annual mean objective (30µg/m^3), with a maximum of 27.0µg/m^3 predicted at receptor 39. As the total concentrations are less than the NO_x annual mean objective (30µg/m^3), and the percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The impact of NO_x emissions associated with the operation of Phase 1 is therefore not considered to be significant.

Based on the total predicted NOx concentrations and the magnitude of change, the impact due to the operation of Phases 1 and 2 of the Proposed Development is *negligible* at all sensitive ecological receptors. The predicted environmental concentrations (PECs) including 2024 Defra backgrounds are all below the NOx annual mean objective (30µg/m^3), with a maximum of 27.0µg/m^3 predicted at receptor 39. As the total concentrations are less than

the NO_x annual mean objective (30µg/m^3), and the percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The impact of NO_x emissions associated with the operation of Phase 1 is therefore not considered to be significant.

5.3.2 Nitrogen deposition

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 5-11. The calculated nitrogen deposition rates (kg N/ha/yr) (process contribution (PC)) for Phase 1 only and Phases 1 and 2 are also listed. These have been calculated in accordance with the methodology outlined in section 4.6.3. The proportion of the process contribution (PC) in relation to both the minimum and maximum Critical Loads (CLs) are also listed.

The change in nitrogen deposition for Phase 1 only and Phase 1 and 2 combined at each of the ecological receptor points is <1% of the corresponding minimum critical load (CL). A maximum of 0.49% 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 Proposed Development 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 5-11 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 and 2	Phase 1 only	Phases 1 and 2	Phase 1 only	Phases 1 and 2
19	River Dee SAC SSSI	10.50	8	10	0.01	0.02	0.13	0.26	0.10	0.20
20	The Dee Estuary SPA, SSSI, SAC and Ramsar	9.66	8	10	0.01	0.02	0.14	0.26	0.11	0.21
21	Shotton Lagoons and Reedbeds SSSI, SPA and Ramsar	9.66	5	15	0.01	0.02	0.18	0.32	0.06	0.11
22	The Dee Estuary SPA and Ramsar	9.66	8	10	0.01	0.02	0.11	0.19	0.08	0.15
23	The Dee Estuary Ramsar SSSI, SAC, SPA	11.76	8	10	0.01	0.01	0.07	0.13	0.06	0.10
24	Deeside and Buckley Newt Sites SAC and SSSI	12.88	10	15	0.01	0.01	0.06	0.11	0.04	0.07
25	River Dee and Bala Lake SAC, SPA, SSSI and Ramsar	11.76	3	10	<0.01	0.01	0.16	0.28	0.05	0.08
26	The Gathering Grounds Wood SSSI and SAC	12.88	3*	10*	<0.01	0.01	0.15	0.28	0.04	0.08
27	Buckley Claypits and Commons/ Deeside and Buckley Newt sites SSSI and SAC	12.88	10	15	<0.01	0.00	0.01	0.03	0.01	0.02
28	River Dee and Bala Lake SAC and SSSI	10.50	3	10	0.01	0.01	0.26	0.49	0.08	0.15
29	River Dee and Bala Lake SAC and SSSI	10.22	3	10	<0.01	<0.01	0.08	0.15	0.02	0.04

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 and 2	Phase 1 only	Phases 1 and 2	Phase 1 only	Phases 1 and 2
30	Inner Marsh Farm SSSI	9.66	10	10*	0.01	0.01	0.08	0.15	0.04	0.07
31	Dee Estuary SAC, Ramsar, SSSI and SPA	9.66	8	10	0.01	0.01	0.08	0.15	0.07	0.12
32	Deeside and Buckley Newt sites SAC and SSSI	12.88	10	15	<0.01	<0.01	0.02	0.04	0.01	0.02
33	Connah's Quay Ponds and Woodland SSSI and SAC	12.88	3*	10*	<0.01	0.01	0.10	0.20	0.03	0.06
34	Deeside and Buckley New sites SAC and SSSI	12.88	10	15	<0.01	<0.01	0.02	0.03	0.01	0.02
35	Buckley Claypits and Common SSSI and SAC	12.88	10	15	<0.01	<0.01	0.02	0.03	0.01	0.02
36	Mersey Estuary SSSI, Ramsar and SPA	12.04	5	10	<0.01	<0.01	0.03	0.05	0.01	0.02
37	Mersey Estuary SSSI, Ramsar and SPA	11.48	5	10	<0.01	<0.01	0.03	0.05	0.01	0.02
38	Mersey Estuary SSSI, Ramsar and SPA	12.04	5	10	<0.01	<0.01	0.02	0.04	0.01	0.02
39	Mersey Estuary Ramsar, SSSI and SPA	11.48	5	10	<0.01	<0.01	0.02	0.04	0.01	0.02
40	Jetties Docks/ Mersey Estuary Ramsar, SSSI and SPA	14.70	5	10	<0.01	<0.01	0.02	0.04	0.01	0.02
41	Halkyn Common and Holywell Grasslands SSSI	16.66	3*	10*	<0.01	<0.01	0.03	0.05	0.01	0.01
42	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	17.36	15	20	<0.01	<0.01	<0.01	0.01	<0.01	0.01
43	Tyddyn-Dows Wood SAC and SSSI	17.36	3*	10*	<0.01	<0.01	0.02	0.05	0.01	0.01
44	Alyn Valley Woods and Alyn Gorge Caves SAC and SSSI	18.34	15	20	<0.01	<0.01	0.00	0.01	<0.01	0.01
45	Alyn Valley Woods SAC and SSSI	14.70	15	20	<0.01	<0.01	0.01	0.01	0.01	0.01
46	Halkyn Common and Holywell Grasslands SSSI	11.76	10	15	<0.01	<0.01	0.02	0.04	0.01	0.03
47	Dee Estuary SAC, SSSI and Ramsar	11.76	8	10	<0.01	0.01	0.04	0.08	0.03	0.06

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 and 2	Phase 1 only	Phases 1 and 2	Phase 1 only	Phases 1 and 2
48	Dee Estuary Ramsar, SSSI, SAC and SPA	10.22	8	10	<0.01	<0.01	0.02	0.05	0.02	0.04
49	Dee Estuary (Golf Course) Ramsar, SSSI, SAC and SPA	10.64	8	10	<0.01	<0.01	0.01	0.02	0.01	0.02
50	Dee Estuary SPA, RSPB Reserve, SSSI, SAC and Ramsar	12.04	8	10	<0.01	<0.01	0.01	0.02	0.01	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 5-11: ***Predicted Process Contributions from on-site Combustion Plant at Ecological Receptors – Phase 1 only and Phases 1 and 2***

6.0 Conclusions

6.0 Conclusions

This air quality assessment report has been produced to support the application of an Environmental Permit associated with the operation of Phases 1 and 2 of the proposed ICT Paper Mill in Flintshire.

Detailed dispersion modelling of the process contributions from the on-site combustion plant and dust emission sources has been carried out and is based on the methodology and process outlined in this report. This includes some conservative assumptions, such as the background concentrations remaining at Phase 1 opening year (2024).

Based on the total predicted PM_{10} concentrations and the magnitude of change, the impact due to the operation of Phase 1 and 2 of the Proposed Development is *negligible* at all sensitive receptors. As the predicted environmental concentrations (PECs) are less than the PM_{10} annual mean objective (40µg/m^3), and the maximum percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The process contributions (PC) expressed as a % of the short-term objective (50µg/m^3) are all <6% at all receptors. The impact of PM_{10} emissions associated with the operation of Phases 1 and 2 is therefore not considered to be significant.

Based on the total predicted NO_2 concentrations and the magnitude of change, the impact due to the operation of Phases 1 and 2 of the Proposed Development is *negligible* at all sensitive receptors. As the predicted environmental concentrations (PECs) are less than the NO_2 annual mean objective (40µg/m^3), and the maximum percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. As the percentile change of the short-term NO_2 Air Quality Objective is <10%, all impacts are predicted to be negligible. The impact of NO_2 emissions associated with the operation of Phases 1 and 2 is therefore not considered to be significant.

Based on the total predicted NOx concentrations and the magnitude of change, the impact due to the operation of Phases 1 and 2 of the Proposed Development is *negligible* at all sensitive ecological receptors. As the total concentrations are less than the NO_x annual mean objective (30µg/m^3), and the percentage change in concentrations relative to the air quality assessment level (AQAL) is <6% at all receptors, a negligible impact is predicted at all receptors. The impact of NO_x emissions associated with the operation of Phases 1 and 2 is therefore not considered to be significant.

An assessment of nitrogen deposition at ecological sites within 15km indicates that the predicted change in nitrogen deposition at each of the ecological receptor points is <1% of the corresponding minimum critical load (CL). The impact of the operation of the Application Site all ecological features can therefore be screened out as insignificant.

5.0 References

7.0 References

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