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Warrington Borough Council Local Plan Air Quality Modelling

Executive Summary and Technical Report

Warrington Borough Council

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1. Executive Summary

This document considers what air quality in Warrington will be like over the course of the next 20 years, taking account of the growth aspirations of the Borough, described in the Local Plan.

1.1 The importance of good air quality

Good air quality is essential for a healthy population. Air pollution is now recognised as the greatest environmental risk to human health in the UK, and the fourth greatest threat to public health after cancer, heart disease and obesity; it shortens lives and contributes to chronic illness; both short-term and long-term exposure to air pollution affects health.

Air pollution also has direct impacts on the natural environment, such as contributing to climate change, damaging sensitive habitats, and reducing crop yields.

Taking action to improve air quality is good for the economy, through making a region a better place to live and work.

1.2 What is air quality currently like in Warrington?

Air quality in Warrington is fairly typical of urban areas throughout the UK. The main contributor to poor air quality is road vehicles, and consequently the problem areas are near to the busier and more congested roads in the borough. Air pollution levels drop off rapidly with distance from the source and hence set back from roads, air quality tends to be much better. This situation is recognised by the designation of an ‘Air Quality Management Area’, encompassing the main roads in the town, but restricted to the properties facing onto them. There is also an Air Quality Management Area that includes the motorways that cross the borough, although relatively few people live or spend time near the motorways.

The pollutant of most concern in Warrington, in terms of national and European targets, is nitrogen dioxide (NO_2). This is typical of most urban areas throughout the UK. However, fine particulate matter, known to cause health problems, is also a concern; whilst national and European targets are currently met in Warrington, the Government has expressed its intention to tighten the target for very fine particulate material (referred to as $PM_{2.5}$) to match World Health Organisation guidelines, in recognition of the health threat of $PM_{2.5}$.

Measurements – the Council monitor air quality at approximately 50 locations – together with estimates made using computer modelling, presented in this report, indicate that approximately 300-600 properties in Warrington may be located in areas where NO_2 national and European targets are currently being exceeded. Air quality levels do fluctuate significantly from day to day, month to month and year to year, and therefore it is appropriate to consider this to be an estimate, or an indication.

1.3 What is being done to improve air quality?

The Council is committed to reducing the exposure of people in Warrington to poor air quality in order to improve the health and wellbeing of residents. A new Air Quality Action Plan is in place which describes what the Council has been doing and will do to improve air quality. The new plan (adopted in 2018) replaced a previous plan, which had been in place since 2008. Initial actions in the new Plan focus on a framework of policies and plans to improve air quality and to support wider action to promote health and wellbeing and tackle social injustice. The actions fall into three delivery areas: policy, infrastructure, and additional measures. This report satisfies part of the measure to assess the implication of the Local Plan on air quality and inform development policies.

National actions to improve air quality are described in the UK government's (draft) Clean Air Strategy (Defra, 2018a), which is due to be published in 2019. The strategy covers all sources of pollution, and provides a wide array of actions, measures and initiatives to improve air quality. For instance, the government's commitment to end the sale of new conventional petrol and diesel cars and vans by 2040 will support a very significant reduction in road vehicle emissions over the next 20 years. This is reinforced by the Government's 'The Road to Zero' strategy document which states that, "*By then [2040], we expect the majority of new cars and vans sold to be 100% zero emission and all new cars and vans to have significant zero emission capability.*" This transition is expected to be led by industry and the consumer and supported by government. National Grid, whom are responsible for ensuring adequate electric supply, assume that, "*There could be as many as 11 million electric vehicles by 2030 and 36 million by 2040*" (National Grid, 2018).

European vehicle emissions standards have helped the automotive industry reduce emissions from vehicles over the past 20-30 years, even though the so-called 'dieselgate scandal' illustrated problems in their effectiveness. Nevertheless, these standards will continue to help ensure that emissions from conventionally fuelled vehicles (petrol and diesel) continue to drop, year on year, as engines get cleaner.

In addition to tailpipe emissions the government also states in its Clean Air Strategy that it will address non-exhaust particulate emissions from tyres and brakes.

The combined effect of local and national action to improve air quality, and ever improving technology to reduce emissions, not just from vehicles, will result in air quality improvements in Warrington.

1.4 What quality of air can we expect to breathe over the next 10-20 years?

Our computer simulations of future air quality in Warrington confirm that conditions will improve significantly throughout the borough, between now and 2026, and through to 2036:

- By 2026, the number of properties exceeding national and European targets for NO_2 is predicted to fall by over 95%.
- By 2036 no properties are predicted to exceed national and European targets for NO_2.

- Concentrations of NO_2 are predicted to drop, on average, by 22% between 2016 and 2026, and 39% between 2016 and 2036.
- Concentrations of $PM_{2.5}$ are predicted to drop, on average, by 5% between 2016 and 2026, and 7% between 2016 and 2036.

We can only estimate air quality conditions in 10 and 20 years' time, based on the data and information we have, and making sensible and cautious judgements about what will happen in the future. However, we should take encouragement in the improvements that are expected, particularly considering the cautious approach we have adopted, to not over predict future improvements.

1.5 Summary

The burden of poor air quality on people's health is expected to reduce in Warrington considerably in the future, as emissions are reduced, largely due to improvements in vehicle emissions outweighing increases in the number of vehicle journeys. However, this conclusion should not encourage complacency, particularly given the health threat posed by $PM_{2.5}$; as such the Council is committed to implementing the actions in the Air Quality Action Plan, to ensure that opportunities to improve air quality are fully realised. Most importantly in the context of the Local Plan, planning applications will be closely scrutinised to ensure that air quality has been appropriately considered, to ensure that opportunities to improve air quality are not missed, and to ensure that developments that could have a significant detrimental impact are not approved.

2. Introduction

1.6 Local Plan Background

2.1 AECOM was appointed by Warrington Borough Council (WBC) to produce a borough-wide air quality assessment of concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$), and carbon dioxide (CO_2) emissions from the local transport network, to support further evaluation of the growth options in the draft Preferred Development Option. The draft Local Plan sets out the Council's proposed approach to meet the region's need for new homes and jobs between now and 2036.

1.7 Purpose of the Study

2.2 This assessment examines potential air quality constraints of the Preferred Development Option with regards to national air quality objectives at sensitive receptors located within current areas of poor air quality and identifies areas which might still be at risk of exceedances with implementation of Local Development Plan option.

2.3 Initially a screening assessment was carried out (Section 3), covering the whole borough, to identify areas where there may be air quality issues. Those areas were then further assessed, in detail (Section 4), using the traffic growth predictions for the Preferred Development Option over the next 20 years.

2.4 The national Air Quality Objectives for the pollutants of relevance to this assessment are displayed in Table 1.

Table 1: Air Quality Objectives

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances	Target Date
Nitrogen Dioxide (NO_2)	Annual Mean	40 µg/m^3	None	31/12/2005
	Hourly Mean	200 µg/m^3	18 times per year	31/12/2005
Particulate Matter (PM_{10})	Annual Mean	40 µg/m^3	None	31/12/2004
	24-hour	50 µg/m^3	35 times per year	31/12/2004
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	25 µg/m^3 (Note the following paragraph)	None	2020

2.5 Whilst the $PM_{2.5}$ objective is currently 25 µg/m^3 with a target date of 2020, this is widely already met in the UK and Defra has stated its intention to ultimately tighten the objective to 10 µg/m^3 as an annual mean, to match World Health Organization guidelines. It is likely that the objective will be reduced to 10 µg/m^3 during the lifetime of the Local Plan.

3. Current Air Quality Situation

1.8 LAQM Summary

3.1 Under the requirements of Part IV of the Environment Act (H.M. Government, 1995), WBC has carried out a phased review and assessment of local air quality within the Borough. As a result of the review and assessment process two AQMAs have been designated for exceedance of the NO_2 annual mean objective:

- Motorway AQMA – an area 50 m from roadside around the M62, M6 and M56; and
- Warrington AQMA – an area around the town centre and arterial roads.

3.2 A revised Air Quality Action Plan (AQAP) (WBC, 2018a) was published in February 2018, replacing the previous AQAP, which had been in place since 2008. The revised AQAP includes 17 actions to improve air quality in Warrington between 2017 and 2022, grouped under three key delivery topics: policy, infrastructure and additional measures. The initial actions focus on a framework of policies and plans to improve air quality and to support wider action to promote health and wellbeing and tackle social injustice.

1.9 WBC Monitoring

3.3 A review of existing baseline air quality was undertaken using information presented within the Annual Status Report (ASR) for 2017 (WBC, 2018b (Each Council is required to review air quality annually and present findings within an ASR)) and Defra Background Maps (Defra, 2018 (Defra publish estimates of 'background' pollutant concentrations, based on national modelling studies)).

3.4 WBC undertakes monitoring of NO_2 concentrations at 50 locations within its administrative area. The monitoring network includes 47 diffusion tube (DT) monitoring locations and three continuous monitoring (CM) sites.

3.5 PM_{10} and $PM_{2.5}$ concentrations are measured at one urban background CM site (CM1, Selby Street).

3.6 Measured concentrations and further details are reported annually in the ASR. The monitoring locations are shown in the figures in Appendix A.

3.7 In 2016, the NO_2 annual mean objective was exceeded at 25 out of 47 DT sites, and at CM2 (on Parker Street).

3.8 For PM_{10}, the annual mean and the short-term objective were met at CM1 in 2016 and all previous years. Between 2012 and 2016 a slight decrease in PM_{10} concentrations was observed. For $PM_{2.5}$ the annual mean objective has been met in previous years, but concentrations have consistently been above the WHO guideline of 10 $\mu g/m^3$.

1.10 Defra Background Concentrations

3.9 Background concentrations taken from Defra's background maps for the year 2016, 2021 and 2026, are presented in Table 2. For each year and pollutant a range is provided to reflect variations throughout the borough.

3.10 It is commonly agreed that the improvements projected in the Defra background maps are overly optimistic. To ensure a robust approach, and to ensure future concentrations are not under-predicted, this study has used the Defra 2021 background concentrations to represent conditions in 2026 and Defra 2026 background concentrations to represent conditions in 2036.

3.11 The monitored urban background concentrations in 2016 are broadly similar to the 2016 Defra values for the corresponding part of the borough.

Table 2: Background concentrations across WBC in the years 2016, 2021 and 2026

Year	Annual Mean Background Concentration (µg/m^3)		
	NO_2	PM_{10}	$PM_{2.5}$
2016	15.5 to 27.1	11.3 to 18.5	7.4 to 14.6
2021	9.3 to 15.6	10.8 to 14.3	7.0 to 8.7
2026	8.0 to 14.0	10.7 to 14.2	6.9 to 8.5

4. Screening

1.11 Introduction

4.1 The screening stage considered the whole borough at a relatively coarse level, and helped inform the spatial scope of the detailed dispersion modelling stage, described in Section 5. NO_2 is the pollutant of greatest concern with regard to compliance with the objectives and therefore this is the pollutant considered for the screening stage.

1.12 Approach

4.2 The screening stage was based on AECOM's ASSIST roadside screening tool. The ASSIST tool makes roadside NO_2 predictions using pollutant dispersion algorithms. Screening was performed for a base year (2016) and the two future plan years (2026 and 2036) with the Preferred Development Option. It should be noted that changes to infrastructure are not incorporated in the scenarios extracted from the traffic model. Road vehicle CO_2 emissions were also calculated for the whole traffic model domain.

1.12.1 Scenarios

4.3 The following assumptions have been made regarding emissions and backgrounds:

- **2016 scenario**
  - 2016 Emissions (based on Emissions Factor Toolkit (EFT, version 8.01))
  - 2016 Defra background (closest 1 km grid square for each receptor/node)
- **2026 scenario** (traffic model with the effects of the Local Plan growth):
  - 2021 Emissions (EFT), a cautious and robust approach to take account of uncertainties about future projections, and ensure concentrations were not under-predicted.
  - 2021 Defra backgrounds (closest 1 km grid square for each receptor/node)
- **2036 scenario** (traffic model with the effects of the Local Plan growth)
  - 2026 EFT a cautious approach to take account of uncertainties about future projections.
  - 2026 Defra background (closest 1 km grid square for each receptor/node)

1.12.2 Traffic Data

4.4 The traffic data for the years and scenarios described were extracted from the Warrington Multi-Modal Transport Model. 24-hour Annual average daily traffic (AADT) data, the proportion of Heavy duty vehicles (HDV), and modelled link speeds were obtained. The AADT data were derived from the transport model's peak hour data using a standard formulae, using locally observed long term data. The steps that were followed were:

1. Obtained count data from several WBC long-term traffic monitoring sites (five sites were used in different locations across the borough);
2. Calculated peak hour, 12 hour, and 5-day averages for June 2016 and for the year for each site;
3. Calculated AADT assuming 3x AM peak, plus 6x inter-peak ,plus 3x PM peak to derive specific locally observed factors for each site; and
4. Took an average of the five factors and then applied the averaged factor to every link in the model.

1.12.3 Model domain

4.5 The screening exercise considered all transport model road links within the Borough, as shown in Figure 1 to Figure 3. The figures are contained within Appendix A.

1.12.4 Receptors

4.6 Roadside concentrations were calculated at 10 m intervals along each modelled road link. Concentrations were predicted at a nominal 5 m distance set back from the kerb.

4.7 To aid interpretation of the results, the modelled data are presented in Figure 1 to Figure 3 for roadside locations that are within 50 m of a sensitive receptor. Sensitive receptors were identified using Council address point data; this dataset allows all sensitive receptor addresses (such as residential properties and schools) to be identified, and non-sensitive locations such as workplaces to be disregarded. The advantage of this presentation technique is to focus attention on areas where the national annual mean air quality objectives apply.

1.12.5 Verification

4.8 Comparison was made with 2016 monitoring data to allow the screening output to be verified and adjusted. Only roadside monitoring sites were used in the verification process.

1.13 Results

1.13.1 CO_2 Emissions

4.9 Road vehicle CO_2 emissions were calculated for the whole traffic model domain and are presented in Table 3.

Table 3: Road vehicle CO_2 emissions, tonnes/yr

Year	Total	LDV	HDV
2016	544,645	528,477	549,135

Year	Total	LDV	HDV
2026	324,474 *(-40%)*	317,230 *(-40%)*	327,538 *(-40%)*
2036	220,171 *(-60%)*	211,247 *(-60%)*	221,598 *(-60%)*

4.10 The figures in Table 3 demonstrate that between 2016 and 2026 it is predicted that there will be a 40% fall in CO_2 emissions, and between 2016 and 2036 a 60% fall. These falls will occur despite the increases in vehicle kilometres between 2016 and 2026/2036. The drops in CO_2 emissions are a consequence of predicted improvements in vehicle technology.

1.13.2 NO_2 Results

4.11 The results of screening are shown in Figure 1, Figure 2, and Figure 3, for 2016, 2026 and 2036 respectively. As described in paragraph 4.6 and 4.7, screening data are presented only for roadside locations near to sensitive receptors.

4.12 Following adjustment of the screening results (by comparison with roadside monitoring data, as described in paragraph 4.8), the degree of confidence that can be assumed was estimated. The colour scale used in the figures was chosen to reflect the confidence limits. Therefore, any roadside location where a NO_2 concentration over 80% of the objective (i.e. >32 µg/m^3) was predicted is shown in colour. Oranges and reds indicate roadside locations where exceedences may be considered ‘likely’. Dark green indicates a ‘low risk of exceedence’, and lime green a ‘possible risk’. This is summarised in Table 4. Clearly for road links with residential receptors very close to the road the risks are greater than for links where receptors are further away.

Table 4: Explanation of the Colour Scale Used to Indicate Risk of Exceedence

Concentration	Colour	Description
<32 µg/m^3	**Grey**	Exceedence at sensitive receptor very unlikely
32-36 µg/m^3	**Dark Green**	Low risk of exceedence at sensitive receptor
36-40 µg/m^3	**Lime Green**	Possibility risk of exceedence at sensitive receptor
40-44 µg/m^3	**Yellow**	Exceedence at sensitive receptor probable
44-48 µg/m^3	**Orange**	Exceedence at sensitive receptor likely
>48 µg/m^3	**Red**	Exceedence at sensitive receptor very likely

4.13 It should be noted that the screening tool is best suited to urban locations; for the motorway it is not as useful, particularly as there are few monitoring locations in the vicinity of the motorway.

4.14 The screening identified some areas outside of the town AQMA that were of potential concern. Several of these were included within the detailed stage of work described in the following Section 5.

1.14 Screening Summary

4.15 The screening stage considered the whole borough at a coarse level, to inform the spatial scope of the detailed dispersion modelling stage. The screening identified a number of areas outside of the town AQMA, such as Winwick and Padgate, that were of potential concern, and these have been included within the detailed stage. The screening also helped demonstrate that the areas around the motorway network, whilst designated as being within an AQMA, are of relatively minor concern (compared to the town AQMA) considering the few properties near to the motorways.

5. Detailed Modelling

1.15 Approach

5.1 The detailed modelling used ADMS-Road version 4.1 air dispersion model for road sources. ADMS is a modern dispersion model with an extensive published track record of use in the UK for the assessment of local air quality effects, including model validation and verification studies.

5.2 The scenarios modelled, and corresponding assumptions are consistent with the screening approach, described in paragraph 4.3.

1.15.1 Traffic Data

5.3 The same traffic data that were used for the screening stage were used for the detailed stage.

1.15.2 Model domain

5.4 The model domain was determined based on the outcome of the screening study. The domain included the town AQMA, and additional areas identified during screening as of being at risk of NO_2 exceedence. The motorway AQMA was excluded from the detailed study, due in part to the very small number of receptors close to or within the AQMA.

1.15.3 Model Input Data

5.5 *ADMS-Roads* calculates concentrations of pollutants emitted from vehicles using the following parameters:

- Traffic volume: The number of vehicles travelling a length of road in a given time will affect the subsequent emissions and dispersion of pollutants;
- Fleet composition: The proportion of Heavy Duty Vehicles (HDVs) (e.g. HGVs and buses) to Light Duty Vehicles (LDVs) (e.g. cars and LGVs) will affect the mass emissions of pollutants; and
- Fleet velocity: The speed of the fleet affects the mass emissions of pollutants.

5.6 Emission factors from Defra EFT tool version 8.01 published November 2017 were used in the model, consistent with the screening stage.

5.7 The dispersion model input data and model conditions are provided in Table 5.

Table 5: General ADMS-Roads Model Conditions

Variables	ADMS Roads Model Input
Surface roughness at source	0.5 m
Minimum Monin-Obukhov length for stable conditions	100 m
Terrain types	Flat

Variables	ADMS Roads Model Input
Receptor locations	x, y coordinates determined by GIS, z=various
Emissions	NO_X, PM_{10}, $PM_{2.5}$
Emission factors	EFT Version 8.01. emission factor dataset
Meteorological data	1 year (2016) hourly sequential data from Rostherne meteorological station
Emission profiles	No
Model output	Long-term annual mean NO_X concentrations Long-term annual mean PM_{10} and $PM_{2.5}$ concentrations

1.15.4 Receptors

5.8 Receptors considered in the modelling study included all residential properties and other sensitive locations such as school, hospitals, medical centres etc, located within 50m of the modelled road network. Over 11,000 receptors were modelled. The receptors were identified using WBC address point data. It should be noted that the coordinates for each receptor are generally taken as the receptor centroid, rather than the receptor façade. This has been considered when interpreting the results.

1.15.5 NO_X to NO_2 Conversion

5.9 For road transport emissions a 'NO_X to NO_2' conversion spreadsheet has been made available by the Defra (published in July 2016) to calculate the road NO_2 contribution from modelled road NO_X contributions. The tool comes in the form of an MS Excel spreadsheet and uses borough-specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_X. Due to the location of the study, the 'England-Urban' traffic setting was selected.

1.15.6 Road Traffic Emissions Model Verification

5.10 The model verification process was undertaken through comparison with WBC monitoring data.

5.11 The following monitoring locations were not included in the verification procedure:

- CM1, DT2-5 – background locations are not suitable for model verification.
- DT6, DT8, DT26, DT28, DT33, DT36, DT38 – monitoring locations not within the modelled network.

5.12 The results of the monitoring were compared to modelled results for those locations, for 2016, and a bias adjustment factor was calculated in line with method outlined in LAQM TG(16). Details of this comparison can be found in Table 6.

Table 6: Summary of NO_2 Verification

Site ID	Measured Total NO_2 Concentration (µg/m^3)	Measured Road NO_X Contribution (µg/m^3)	Modelled Road NO_X Contribution(µg/m^3)	Road NO_X Factor
CM2	47.0	65.6	26.8	2.4449
CM3	34.0	40.8	32.6	1.2513
DT7	55.7	89.2	25.1	3.5558
DT9	49.5	72.1	31.5	2.2875
DT10	39.4	46.9	11.6	4.0312
DT11	42.7	52.0	32.6	1.5935
DT12	37.5	39.7	28.4	1.3978
DT13	49.9	70.2	32.3	2.1701
DT14	40.3	46.3	16.1	2.8652
DT15	42.3	58.9	12.5	4.6957
DT16	40.6	55.1	11.3	4.8659
DT17	36.8	49.7	11.3	4.4115
DT18	46.8	65.1	15.8	4.1266
DT19	39.2	46.4	16.8	2.7587
DT20	38.4	51.0	24.7	2.0657
DT21	40.9	57.0	26.9	2.1224
DT22	38.7	45.3	11.9	3.7985
DT23	40.4	54.2	17.6	3.0741
DT24	48.5	74.6	18.5	4.0387
DT25	33.4	43.4	13.4	3.2303
DT27	34.9	38.2	11.0	3.4810
DT29	41.5	58.5	17.4	3.3629
DT30	42.2	60.2	26.1	2.3081
DT31	48.3	75.8	19.7	3.8425
DT32	36.7	47.0	23.1	2.0311
DT34	43.4	59.1	21.4	2.7571
DT35	50.6	77.6	25.1	3.0873
DT37	42.1	55.9	30.4	1.8372
DT39	41.9	53.3	13.7	3.8831
DT40	47.4	71.0	23.5	3.0138
DT41	42.1	57.6	21.4	2.6904
DT42	45.3	65.6	15.8	4.1567
DT43	39.9	49.0	20.8	2.3618
DT44	50	74.8	37.4	2.0003
DT45	55	88.3	22.1	3.9900
DT46	41.6	53.5	16.8	3.1770
DT47	34.7	39.3	11.1	3.5382

Site ID	Measured Total NO_2 Concentration (µg/m^3)	Measured Road NO_X Contribution (µg/m^3)	Modelled Road NO_X Contribution(µg/m^3)	Road NO_X Factor
Overall Road NO_X Factor:				**2.5443**

5.13 Table 6 demonstrates that the unadjusted model under-predicted annual mean concentrations of NO_2 at all locations. To account for this bias, the factor of the difference between the modelled and measured road NO_X contributions was used to adjust the model output at all receptors, for all three years.

5.14 The accuracy of the adjusted model was considered using the Route Mean Square Error (RMSE) statistic. An RMSE value of above 10% of the national air quality objective of 40 µg/m^3 is considered to be ideal i.e. 4 µg/m^3. The RMSE value for the adjusted model was approximately 7.4 µg/m^3, which considering the spatial scope, is considered to be acceptable.

1.16 Results

5.15 The model outputs are presented in Appendix 1. Figures are provided showing the entire detailed study area, for each year and pollutant (Figure 4 to Figure 12). To allow closer inspection the study area has been split into four, and separate figures provided for each area, year, and pollutant (except PM_{10}) (Figure 13 to Figure 36).

5.16 Table 7, Table 8 and Table 9 summarise the number of receptors in separate concentrations bands for the three pollutants: NO_2, PM_{10} and $PM_{2.5}$.

5.17 For NO_2, when considering the model uncertainty, concentrations below 32 µg/m^3 tend to indicate a very low risk of execeedence of the annual mean objective; 32 to 36 µg/m^3 may be taken to be a low risk, 36 to 40 µg/m^3 a possible risk, 40 to 44 µg/m^3 a likely risk, and over 44 µg/m^3 a very likely exceedence.

5.18 For PM_{10}, the annual mean objective is currently being met at all receptors. It will continue to be met in future years.

5.19 For $PM_{2.5}$ the current annual mean objective of 25 µg/m^3 is being met at all receptors. However Table 9 also indicates the number of receptors that meet or exceed a possible future annual mean standard of 10 µg/m^3 (the WHO guideline). Currently 1000 of the receptors within the model domain are predicted to not meet this tighter hypothetical standard, but this figure is predicted to drop to 198 receptors in 2026 and 156 receptors in 2036.

Table 7: Air Quality Receptor Statistics for NO_2

	Annual Mean NO_2 (µg/m^3)	2016	2026	2036
		Number of Receptors in each Band		
Residential Receptors	<32	9734	11423	11601
	32 to 36	1261	102	4
	36 to 40	319	71	0
	40 to 44	116	6	0
	>44	175	3	0
Other Sensitive Receptors (e.g. schools)	<32	16	23	23
	32 to 36	7	0	0
	36 to 40	0	0	0
	40 to 44	0	0	0
	>44	0	0	0
Maximum Concentration (µg/m^3)		59.0 (Knutsford Road)	45.4 (Knutsford Road)	32.9 (Knutsford Road)

Table 8: Air Quality Receptor Statistics for PM_{10}

	Annual Mean PM_{10} (µg/m^3)	2016	2026	2036
		Number of Receptors in each Band		
Residential Receptors	<35	11605	11605	11605
	35 to 40	0	0	0
	>40	0	0	0
Other Sensitive Receptors	<35	23	23	23
	35 to 40	0	0	0
	>40	0	0	0
Maximum Concentration (µg/m^3)		20.6 (Elm Rd, nr J9, M6)	20.0 (Elm Rd, nr J9, M6)	19.9 (Elm Rd, nr J9, M6)

Table 9: Air Quality Receptor Statistics for $PM_{2.5}$

	Annual Mean $PM_{2.5}$ ($\mu g/m^3$)	2016	2026	2036
		Number of Receptors in each Band		
Residential Receptors	<10	10605	11407	11449
	10 to 15	1000	198	156
	15 to 25	0	0	0
	>25	0	0	0
Other Sensitive Receptors	<10	23	23	23
	10 to 15	0	0	0
	15 to 25	0	0	0
	>25	0	0	0
Maximum Concentration ($\mu g/m^3$)		12.7 (Elm Rd, nr J9, M6)	12.2 (Elm Rd, nr J9, M6)	11.8 (Elm Rd, nr J9, M6)

1.16.1 Nitrogen Dioxide

5.20 As presented in Table 7, it was predicted that the annual mean NO_2 objective was exceeded (or was likely exceeded) at almost 300 modelled receptors in 2016. The roads these receptors are near to are indicated in Table 10.

Table 10: Roads with predicted exceedances of NO_2 annual objective in 2016

Street/ Road	Within AQMA	Approx. no. receptors	Street/ Road	Within AQMA	Approx. no. receptors
Baxter Street	Y	8	Mersey Street	Y	3
Chester Road	Y	4	Myddleton Lane	N	3
Church Street	Y	10	Newton Road	Y	10
Elm Road	Y	7	Padgate Lane	N	33
Folly Lane	N	1	Parker Street	Y	25
Golborne Road	N	3	Rectory Close	N	2
Gorsey Lane	N	1	School Road	N	1
Green Street	Y	4	St Anthonys Place	N	1
Higher Knutsford Rd	Y	2	St. Peters Way	Y	5
Kingsway South	Y	11	Thelwall New Rd	Y	1
Knutsford Road	Y	9	Toll Bar Road	Y	2
Liverpool Road	Y	1	Victoria Street	Y	6
Long Lane	Y	3	White Street	Y	1
Lovely Lane	Y	14	Whitecross Road	Y	3
Manchester Road	N	11	Wilson Patten St	Y	67
Manley Gardens	Y	6	Winwick Road	Y	25
Marsh House Lane	N	6			

5.21 The maximum concentration of 59 µg/m^3 was predicted at a residential receptor located on Knutsford Road, near the junction with Kingsway South. The majority of the identified exceedance were located within the existing AQMA.

5.22 Taking account of those receptors in the 36-40 µg/m^3 bracket, and thereby acknowledging model uncertainties, approximately 300 additional receptors may be considered to be at reasonable risk of being in exceedence.

5.23 In 2026 nine exceedances of the annual mean NO_2 objective were predicted at residential properties alongside seven roads, all located within the existing AQMA (Table 11).

Table 11: Roads with predicted exceedances of NO_2 annual objective in 2026

Street/ Road	Within AQMA	Approx. no. receptors	Street/ Road	Within AQMA	Approx. no. receptors
Baxter Street	Y	1	Liverpool Road	Y	1
Chester Road	Y	2	Lovely Lane	Y	1
Green Street	Y	1	Manley Gardens	Y	1
Knutsford Road	Y	2			

5.24 The maximum predicted NO_2 concertation of 45.4 µg/m^3 in 2026, was identified at a residential receptor on Knutsford Road (the same receptor as for 2016).

5.25 Taking account of those receptors in the 36-40 µg/m^3 bracket, and thereby acknowledging model uncertainties, approximately 70 additional receptors may be considered to be at risk of being in exceedence, on the following roads: Baxter Street, Chester Road, Church Street, Elm Road, Green Street, Kingsway South, Knutsford Road, Liverpool Road, Long Lane, Lovely Lane, Manchester Road, Manley Gardens, Mersey Street, Newton Road, Parker Street, St Peters Way, White Street, Wilson Patten Street, and Winwick Road.

5.26 No exceedances of the annual mean NO_2 objective were predicted in 2036.

1.16.2 PM_{10} and $PM_{2.5}$

5.27 As presented in Table 8 and Table 9, for both PM_{10} and $PM_{2.5}$ the annual mean objective was predicted to be met at all receptors, and will continue to be met in future years. However, it was predicted that the annual mean $PM_{2.5}$ WHO guideline value was exceeded (or was likely exceeded) at 1000 modelled receptors in 2016, at locations spread throughout the town.

5.28 In 2026, 198 exceedances of the $PM_{2.5}$ WHO guideline value, and in 2036, 156 exceedences of the value were predicted at sensitive receptors alongside roads as indicated in Table 12 and Table 13.

Table 12: Roads with predicted exceedances of $PM_{2.5}$ WHO guideline in 2026

Street/ Road	Approx. no. receptors	Street/ Road	Approx. no. receptors
Baxter Street	6	Manchester Road	4
Chester Road	13	Manley Gardens	9
Chiltern Place	2	Mersey Street	3
Church Street	10	Newton Road	10
Elm Road	7	Parker Street	21
Folly Lane	1	Sandy Lane West	1
Golborne Road	2	St. Peters Way	3
Gough Avenue	1	Toll Bar Road	18
Green Street	4	Victoria Street	6
Kingsway South	4	White Street	1
Knutsford Road	3	Whitecross Road	1
Liverpool Road	1	Wilderspool Causeway	21
Long Lane	2	Wilson Patten St	1
Lovely Lane	17	Winwick Road	25

Table 13: Roads with predicted exceedances of $PM_{2.5}$ WHO guideline in 2036

Street/ Road	Approx. no. receptors	Street/ Road	Approx. no. receptors
Baxter Street	5	Manchester Road	2
Chester Road	8	Manley Gardens	9
Chiltern Place	2	Mersey Street	3
Church Street	3	Newton Road	10
Elm Road	7	Parker Street	6
Folly Lane	0	Sandy Lane West	0
Golborne Road	2	St. Peters Way	1
Gough Avenue	0	Toll Bar Road	18
Green Street	4	Victoria Street	6
Kingsway South	2	White Street	0
Knutsford Road	2	Whitecross Road	1
Liverpool Road	1	Wilderspool Causeway	21
Long Lane	2	Wilson Patten St	1
Lovely Lane	13	Winwick Road	25

6. Conclusions and Recommendations

6.1 This document provides an assessment of future air quality in Warrington, in 2026 and 2036, taking account of the growth aspirations of the Borough, described in the draft Local Plan. The document also provides predicted pollutant concentrations across the borough for the year 2016.

6.2 Current air quality in Warrington is fairly typical of urban areas throughout the UK. The pollutant of most concern in Warrington, in terms of national and European targets, is NO_2. The main contributor to poor air quality in Warrington is road vehicles, and consequently the problem areas are near to the busier and more congested roads in the borough. Further set back from roads, air quality tends to be much better. This is reflected by the designated Air Quality Management Areas.

6.3 The detailed NO_2 modelling presented in this report for the year 2016 has been verified by comparison with monitoring data from 37 locations. Generally, it was found that NO_2 concentrations were greatest at locations within the AQMA. However, the modelling did identify several locations outside of the current AQMA where NO_2 concentrations were predicted to be in excess of national objectives. It is recommended that for many of these locations further monitoring is performed to confirm this finding, and determine where it would be appropriate to amend the extent of the AQMA. Our study identified approximately 300 to 600 properties in Warrington that may be in areas where NO_2 national and European targets are currently being exceeded. It should be stressed that pollutant concentrations do fluctuate from day to day, month to month and year to year, and therefore it is appropriate to consider this to be an estimate. In addition, techniques to monitor and model air quality are both subject to various limitations and uncertainties.

6.4 The detailed modelling for PM_{10} and $PM_{2.5}$, for 2016, confirms that there are no locations where concentrations are in excess of the national and European objectives. However, widespread exceedences of the $PM_{2.5}$ WHO guideline were predicted (approximately 1000 properties in 2016, 200 in 2026 and 150 in 2036).

6.5 The modelling approach followed to predict concentrations in the future, in 2026 and 2036 is considered to be cautious; this robust approach should ensure that concentrations in the future have not been under estimated.

6.6 The detailed NO_2 modelling presented in this report for the year 2026 demonstrates that the situation is expected to improve significantly. On average concentrations were predicted to fall by 22%, and the number of properties in excess of the national and European objectives was predicted to drop by 95%. A similar, albeit less marked change was predicted for particulates: $PM_{2.5}$ concentrations were predicted to fall by 5%. For 2036, further significant improvements were predicted.

6.7 In summary the burden of poor air quality on people's health is expected to reduce in Warrington considerably in the future, as emissions are reduced, despite the planned growth described in the draft Local Plan.

7. References

Defra (2016), Air Quality Management – Technical Guidance 2016, TG(16).

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H.M. Government (1995), The Environment Act.

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Warrington Borough Council (2017), Local Plan Preferred Development Option.

Warrington Borough Council (2018a), Air Quality Action Plan 2017 – 2022.

Warrington Borough Council (2018b), Annual Status Report for 2017

Appendix A – Figures

Various figures have been prepared to present the results of the study. They are provided as separate files, listed below:

Figure 1: Screening: Predicted Annual Mean Roadside NO_2 Concentrations, 2016

Figure 2: Screening: Predicted Annual Mean Roadside NO_2 Concentrations, 2026

Figure 3: Screening: Predicted Annual Mean Roadside NO_2 Concentrations, 2036

Figure 4: Predicted Annual Mean NO_2 Concentrations, 2016, at Sensitive Receptors

Figure 5: Predicted Annual Mean NO_2 Concentrations, 2026, at Sensitive Receptors

Figure 6: Predicted Annual Mean NO_2 Concentrations, 2036, at Sensitive Receptors

Figure 7: Predicted Annual Mean PM_{10} Concentrations, 2016, at Sensitive Receptors

Figure 8: Predicted Annual Mean PM_{10} Concentrations, 2026, at Sensitive Receptors

Figure 9: Predicted Annual Mean PM_{10} Concentrations, 2036, at Sensitive Receptors

Figure 10: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2016, at Sensitive Receptors

Figure 11: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2026, at Sensitive Receptors

Figure 12: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2036, at Sensitive Receptors

Figure 13: Predicted Annual Mean NO_2 Concentrations, 2016, at Sensitive Receptors – Area 1

Figure 14: Predicted Annual Mean NO_2 Concentrations, 2016, at Sensitive Receptors – Area 2

Figure 15: Predicted Annual Mean NO_2 Concentrations, 2016, at Sensitive Receptors – Area 3

Figure 16: Predicted Annual Mean NO_2 Concentrations, 2016, at Sensitive Receptors – Area 4

Figure 17: Predicted Annual Mean NO_2 Concentrations, 2026, at Sensitive Receptors – Area 1

Figure 18: Predicted Annual Mean NO_2 Concentrations, 2026, at Sensitive Receptors – Area 2

Figure 19: Predicted Annual Mean NO_2 Concentrations, 2026, at Sensitive Receptors – Area 3

Figure 20: Predicted Annual Mean NO_2 Concentrations, 2026, at Sensitive Receptors – Area 4

Figure 21: Predicted Annual Mean NO_2 Concentrations, 2036, at Sensitive Receptors – Area 1

Figure 22: Predicted Annual Mean NO_2 Concentrations, 2036, at Sensitive Receptors – Area 2

Figure 23: Predicted Annual Mean NO_2 Concentrations, 2036, at Sensitive Receptors – Area 3

Figure 24: Predicted Annual Mean NO_2 Concentrations, 2036, at Sensitive Receptors – Area 4

Figure 25: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2016, at Sensitive Receptors – Area 1

Figure 26: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2016, at Sensitive Receptors – Area 2

Figure 27: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2016, at Sensitive Receptors – Area 3

Figure 28: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2016, at Sensitive Receptors – Area 4

Figure 29: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2026, at Sensitive Receptors – Area 1

Figure 30: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2026, at Sensitive Receptors – Area 2

Figure 31: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2026, at Sensitive Receptors – Area 3

Figure 32: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2026, at Sensitive Receptors – Area 4

Figure 33: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2036, at Sensitive Receptors – Area 1

Figure 34: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2036, at Sensitive Receptors – Area 2

Figure 35: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2036, at Sensitive Receptors – Area 3

Figure 36: Predicted Annual Mean $PM_{2.5}$ Concentrations, 2036, at Sensitive Receptors – Area 4

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