

**NOTE FOR INSPECTOR**  
**RE: CUMULATIVE IMPACT OF AIR QUALITY**  
**22 AUGUST 2018**

1. The Inspector has requested that the Council prepare a note on how air quality, including its cumulative impact, has been considered for the sites proposed in the Part 2 plan, particularly in relation to the AQMAs in Abingdon-on-Thames and Marcham.

**Site Selection for the Part 2 plan**

2. The Council has undertaken a thorough and robust site selection process for the Part 2 plan that has appropriately taken into account the cumulative impact of air quality in the district, having regard to the relevant acts, regulations, national policy and guidance.
3. As set out in Appendix B of the Site Selection Topic Paper (TOP02.3), the Council tested 34 sites in detail. As part of this stage in the process, the Council consulted with a wide range of stakeholders. This included engagement with the Council's Environmental Health team who provided feedback on matters relating to noise pollution, light pollution, air quality, contaminated land, dust and odour pollution.
4. A summary of feedback received in relation to Air Quality is set out in Appendix B of the Site Selection Topic Paper under the heading 'Environmental Health' for each site.
5. In line with the feedback provided by Environmental Health through consultation, Appendix B highlights those sites which are most likely to impact upon specific AQMAs in the district.
6. The following sections consider each of the designated AQMAs in turn.

**Abingdon-on-Thames AQMA**

7. Four sites that were tested in detail were identified by Environmental Health as having the greatest potential to impact on this AQMA. These sites are:
  - South of Abingdon-on-Thames – Up to 1,500 dwellings
  - North East of Drayton – Up to 1,050 dwellings
  - West of Drayton – Up to 850 dwellings
  - South of Drayton – Up to 240 dwellings
8. None of these sites were recommended to be allocated in the Part 2 plan, having regard to the potential impact that development would have on the local transport network in Abingdon-on-Thames. Appendix B of the Site Selection

Topic Paper includes the officer recommendation that significant development in these locations would only be supported if funding is provided for a South of Abingdon-on-Thames bypass.

### **Marcham AQMA**

9. Two sites that were tested in detail were identified by Environmental Health as having the greatest potential to impact on this AQMA. These sites are:
  - North of Marcham (Marcham AQMA) – Up to 1,000 dwellings
  - South East of Marcham (Marcham (AQMA) – Up to 120 dwellings
10. At the Preferred Options stage, the two sites were recommended as draft allocations, totalling 520 dwellings. At that time, the Council considered there were *“opportunities for enhancements to improve access to the market town of Abingdon-on-Thames and the city of Oxford, to accommodate additional traffic from Marcham, without causing a further impact to the AQMA”*.
11. Concerns were raised through representations made to the Preferred Options consultation, including objections from Oxfordshire County Council and Highways England.
12. The Council proactively responded to the concerns raised and significantly reduced the scale of development proposed at Marcham. The North East of Marcham site was deleted as an allocation. The total number of dwellings proposed for the South East of Marcham site has been reduced from 120 to 90 to allow sufficient land to be safeguarded for the south of Marcham bypass.
13. The Council’s justification for this proposed alteration is set out on p.56 of the Site Selection Topic Paper - Appendix B, and is repeated below:

*“Concerns were raised about the cumulative impact of growth in Marcham as a result of two allocations proposing approximately 520 dwellings. The main concerns were in relation to traffic through the settlement and the impact that this would have on air quality. Concerns were also raised about the impact of growth on the existing primary school. As a result, the council has considered a significantly reduced level of growth at Marcham to address these concerns. Part of the [south-east of Marcham] site proposed at the Preferred Options consultation stage included land to be safeguarded for the south of Marcham Bypass. This has impacted the development potential of the site, reducing it from around 120 dwellings to around 90 dwellings.”*
14. The Council therefore believe that it has appropriately taken into account the cumulative impact that planned growth would have on designated AQMAs, noting that of the six sites specifically highlighted by the Environmental Health team as most likely to impact upon designated AQMAs, only one of these is proposed to be allocated in the Part 2 plan. South-East of Marcham is proposed

to be allocated for 90 dwellings and this represents only 2.5% of the total number of dwellings proposed to be allocated in the Part 2 plan.

15. Air Quality evidence prepared for the site promoters for the South-East of Marcham Site was discussed during week two of EiP and demonstrated that the impact that the proposed allocation would have on the Marcham AQMA was 'negligible', or ~0%.<sup>1</sup>

**Cumulative Impact of Growth on Marcham AQMA arising from development at East Hanney, Kingston Bagpuize with Southmoor (parish of Fyfield and Tubney) and Dalton Barracks**

16. In addition to the evidence set out above, the Council has requested RPS to consider the potential impacts and effects that cumulative growth proposed in the Part 2 Local Plan will have on air quality in the Marcham AQMA. Their technical note is appended to this document.
17. The note expressly takes account of the additional allocations at Marcham, Kingston Bagpuize with Southmoor (within the Parish of Fyfield and Tubney), Dalton Barracks and East Hanney. It applies cautious assumptions to additional traffic flows through Marcham arising from these schemes. It then assumes what the impact would be on the AQMA in Marcham if all of these schemes were delivered by 2022, in line with recent air quality evidence prepared to inform the additional allocation South East of Marcham.
18. Recognising that the majority of growth arising from the allocations at Dalton Barracks and Kingston Bagpuize with Southmoor will not begin to be delivered until 2025, the note then makes an adjustment to account for expected reductions over the plan period, 'due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on emissions'. The note uses Defra's 2017 emissions factor toolkit to provide emission factors up to 2030.
19. Using this methodology, the following conclusions have been made:

*"High-level analysis has been undertaken to determine the likely increases in annual-mean NO<sub>2</sub> concentrations and the likely annual-mean NO<sub>2</sub> concentrations within the Marcham AQMA, once all five developments are operational.*

*Taking into account the geographical extent of the impacts predicted in this study, the overall impact of the development on the surrounding area as a whole*

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<sup>1</sup> RPS. "Air Quality Assessment, Land Off Packhorse Lane, Marcham, For Catesby Land Promotions Limited" April 2018. P25-27, Tables 6.1, 6.2, 6.3.

*is considered to be 'negligible', using the descriptors adopted for this assessment.*

*Using professional judgement, the resulting cumulative air quality effect is considered to be 'not significant' overall."*

20. The note also recognises that if these additional allocations came forward by 2030, the predicted annual-mean NO<sub>2</sub> concentrations at receptors in Marcham would be below the relevant Air Quality Assessment Level (AQAL) of 40 µg.m<sup>-3</sup>. This is the objective set in the UK Air Quality Strategy and is numerically identical to the EU Limit Value set in the 2008 Ambient Air Quality Directive (2008/50/EC).
21. The Council considers that this proportionate evidence sufficiently demonstrates that, in air quality terms, the cumulative impact of growth on the AQMA at Marcham as a result of additional allocations in the Part 2 plan will have a 'slight adverse' effect at 10 Packhorse Lane and by 2031 the level of NO<sub>2</sub> concentrations at this point will be lower than they are at present. More importantly, it will be below the EU Limit Value. At all other receptors, the resulting change is 'negligible'. The conclusion of the consultants, with which the Council agrees, is that the overall resulting air quality effect is 'not significant'.
22. In addition to the above, the Council notes that strategic upgrades to the Frilford Junction will be delivered prior to development of the additional sites at Kingston Bagpuize with Southmoor (within the Parish of Fyfield and Tubney) and Dalton Barracks. There is also an expectation that the Marcham bypass will be delivered alongside development of these additional sites in the later part of the plan period (2026 – 2031).
23. The note takes into account relevant UK and European legislation, including the Ambient Air Quality Directive and air quality limits values. The note demonstrates that NO<sub>2</sub> concentrations in Marcham will likely fall below the current limit of 40 µg.m<sup>-3</sup> at all current receptor points by 2031.

**Appendix A: RPS Technical Note on the Cumulative Impact of Planned Growth in Air Quality in Marcham**



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**Quality Management**

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## Vale of White Horse District Local Plan 2031: Part 2 Evidence Base – Cumulative Impact of Planned Growth on Air Quality in Marcham

### Introduction

- 1.1 The Vale of White Horse District Council (VWHDC) has designated Air Quality Management Areas (AQMAs) in Abingdon, Botley and Marcham due to high levels of nitrogen dioxide (NO<sub>2</sub>) attributable to road traffic emissions. This high-level technical note considers the potential impacts and effects that cumulative growth proposed in the Part 2 Local Plan will have on air quality in the Marcham AQMA.
- 1.2 VWHDC states that *“The air pollution problem in Marcham is due to the volume of traffic on the A415 which passes through Marcham, congestion caused by the narrowness of the roads and the fact that some houses are very close to the road.”*
- 1.3 The sites identified in the Part 2 Local Plan that are likely to generate traffic passing through the Marcham AQMA are identified as follows:
  - South East of Marcham development (90 dwellings);
  - North of East Hanney (80 dwellings);
  - North-East of East Hanney (50 dwellings);
  - East of Kingston Bagpuize with Southmoor (600 dwellings); and
  - Dalton Barracks (1,200 dwellings).
- 1.4 An assessment of the air quality impacts has been undertaken for the South East of Marcham development; however, air quality impact assessments have not been undertaken for the other four developments, listed above, and the likely cumulative air quality effects once all developments are operational are not currently known.
- 1.5 This technical note gives high-level consideration to the likely cumulative effects based on the results of the detailed atmospheric modelling undertaken for the South East of Marcham development.
- 1.6 As the Marcham AQMA is designated due to high levels of annual-mean NO<sub>2</sub>, the analysis focuses on this pollutant.

### Approach to Analysis (Methodology)

#### Estimating the Cumulative Traffic Flow in the Marcham AQMA

- 1.7 Estimates of the trips generated by the other four developments and the likely percentage of those trips passing through the Marcham AQMA were provided by VWHDC.
- 1.8 The traffic flow passing through the Marcham AQMA was estimated from the generated trips and the percentage for each development.

1.9 The total traffic flow was calculated as the sum of each traffic flow.

### Estimating the Cumulative NO<sub>2</sub> Concentrations in the Marcham AQMA

1.10 The total traffic flow with all five developments was compared with the traffic flow used in the modelling for the South East of Marcham development to determine the ratio.

1.11 The increase in annual-mean NO<sub>2</sub> concentrations predicted at sensitive receptors for the South East of Marcham development [1] was multiplied by that ratio to estimate the increase in annual-mean NO<sub>2</sub> concentrations for the total traffic flow that would pass through the Marcham AQMA, should all five identified developments proceed.

### Describing the Estimated Cumulative NO<sub>2</sub> Impact on the Marcham AQMA

1.12 When describing the air quality impact at a sensitive receptor, the change in magnitude of the concentration should be considered in the context of the absolute concentration at that sensitive receptor.

1.13 Table 1.1 provides the approach set out in the EPUK/IAQM *Land-Use Planning & Development Control: Planning For Air Quality* document [5] for describing the human-health air quality impacts at sensitive receptors.

**Table 1.1 Impact Descriptors for Individual Sensitive Receptors**

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level			
	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 than AQAL	Moderate	Substantial	Substantial	Substantial

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

2. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as negligible.

3. The table is only designed to be used with annual mean concentrations.

4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

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

6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

- 1.14 For annual-mean NO<sub>2</sub>, the Air Quality Assessment Level (AQAL) is 40 µg.m<sup>-3</sup>. This is the objective set in the UK Air Quality Strategy [2] and is numerically identical to the EU Limit Value set in the 2008 Ambient Air Quality Directive (2008/50/EC) [3].
- 1.15 The human-health impact descriptors above apply at individual receptors. The EPUK/IAQM guidance states that the impact descriptors *“are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it maybe that there are ‘slight’, ‘moderate’ or ‘substantial’ impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.”*
- 1.16 Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts. This judgement is likely to take into account the extent of the current and future population exposure to the impacts and the influence and/or validity of any assumptions adopted during the assessment process.

## Results of Analysis

### Estimates of the Cumulative Traffic Flow in the Marcham AQMA

- 1.17 Air quality modelling is normally undertaken using traffic flows occurring over a 24-hour period. VWHDC has provided flows provided for the hours 07:00 to 19:00 for North of East Hanney; North-East of East Hanney and Dalton Barracks. In the absence of a 24-hour flow figure, the flow for 07:00 to 19:00 has been assumed to the 24-hour flow, i.e. the traffic over-night has been assumed to be such a small proportion of the daily traffic that it can be disregarded.
- 1.18 For the East of Kingston Bagpuize with Southmoor development, only the morning and evening peak traffic flows were provided. The daily flow in each case was estimated by applying the ratio of the daily flow with the sum of the morning and evening peak flows for Dalton Barracks, to the sum of the morning and evening peak flows for East of Kingston Bagpuize with Southmoor development.
- 1.19 The resulting estimated ‘daily’ traffic flows through the Marcham AQMA used in this high-level analysis are summarised in Table 1.2.

**Table 1.2 Estimated Daily Traffic Flows Through Marcham AQMA**

Site	Estimated a.m. peak	Estimated p.m. peak	Traffic Flows (07:00 to 19:00)	% Distribution Via Marcham AQMA	Total Daily Traffic Through Marcham AQMA
South-East of Marcham	-	-	-	-	38*
North of East Hanney	39	38	325	20	65
North-East of East Hanney	29	34	293	20	59

Site	Estimated a.m. peak	Estimated p.m. peak	Traffic Flows (07:00 to 19:00)	% Distribution Via Marcham AQMA	Total Daily Traffic Through Marcham AQMA
East of Kingston Bagpuize with Southmoor	316	302	No data	38	1,074*
Dalton Barracks	614	522	5,195	6	312
<b>Total</b>	-				1,548

\* Increase in 24-hour flow drawn from the Air Quality Assessment undertaken for South East of Marcham [1]

\*\*Calculated as  $(316 + 302) \times 5,195 / (614 + 522) \times 0.38$

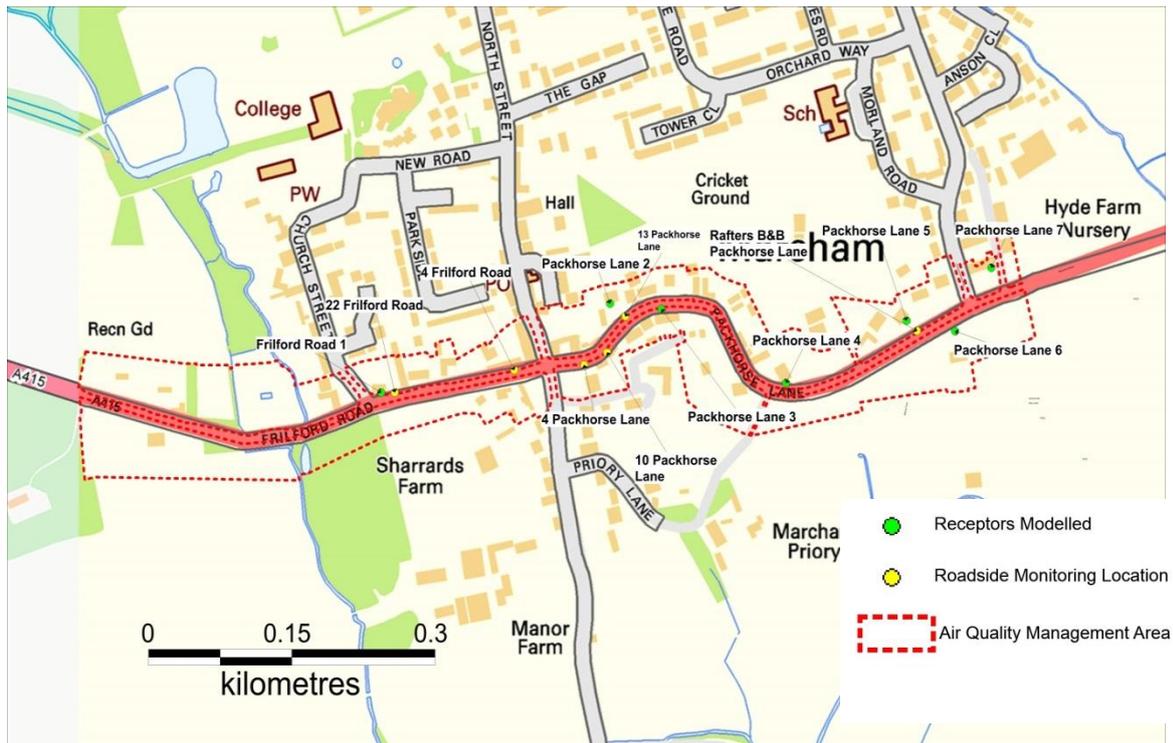
1.20 This indicates that the traffic flow generated by all five developments will be approximately  $1,548/38 = 41$  times the number of daily movements generated by the South East of Marcham development alone.

#### **Estimates of Cumulative NO<sub>2</sub> Concentrations in the Marcham AQMA**

1.21 The increases in annual-mean NO<sub>2</sub> concentrations with all five developments are likely to be a factor of 41 higher than those predicted for the South East of Marcham development alone.

1.22 Figure 1.1 below shows the location of the Marcham AQMA, the monitoring locations and the receptors modelled in the Air Quality Assessment undertaken for the South East of Marcham development [1].

**Figure 1.1 Map Showing Receptor Locations, Monitoring Locations and Marcham AQMA**



1.23 Table 1.3 below presents an estimate of the annual-mean NO<sub>2</sub> concentrations at the façades of receptors in 2022.

**Table 1.3 Predicted Annual-Mean NO<sub>2</sub> Impacts at Existing Receptors in 2022**

Receptors	Concentration (µg.m <sup>-3</sup> )			
	Absolute - Without Development	Increase – Land South East of Marcham	Increase – With All 5 Developments	Absolute - With all 5 Developments
Frilford Road 1	23.42	0.02	0.82	24.24
Packhorse Lane 2	17.88	0.02	0.82	18.70
Packhorse Lane 3	34.45	0.04	1.63	36.08
Packhorse Lane 4	28.72	0.03	1.22	29.94
Packhorse Lane 5	19.39	0.02	0.82	20.21
Packhorse Lane 6	25.66	0.06	2.45	28.11
Packhorse Lane 7	17.48	0.05	2.04	19.52
10 Packhorse Lane	40.89	0.05	2.04	42.93
4 Frilford Road	17.48	0.03	1.22	18.70

Data in shaded columns drawn from the Air Quality Assessment for the ‘South East of Marcham’ development. The relevant table is reproduced in Appendix 1 to this technical note for ease of reference

The ‘With all 5 Developments’ concentration is ‘Absolute Without Development’ + ‘Increase – With All 5 Developments’.

- 1.24 The increases in Table 1.3 assume, conservatively, that all developments would be operational in 2022, the year that the South East of Marcham development is expected to be fully operational by 2022. In practice, the other four developments are expected to be operational at later dates, with the East of Kingston Bagpuize with Southmoor and Dalton Barracks developments not being fully operational until 2031.
- 1.25 The modelling undertaken for the South East of Marcham development used Defra's 2017 emission factor toolkit (version 8.0) which, in turn, draws on emissions generated by the European Environment Agency (EEA) COPERT 5 emission calculation tool.
- 1.26 Emissions of nitrogen oxides from vehicles in the UK are expected to reduce over time, due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on emissions and Defra's 2017 emission factor toolkit provides emission factors up to 2030.
- 1.27 The analysis above only takes into account reductions up to 2022; therefore the increase shown in Table 1.3 is likely to be an over-estimate of the increase in 2031.
- 1.28 Using the traffic flows through the Marcham AQMA in the modelling undertaken for the South East of Marcham development, the NO<sub>2</sub> emission factor in 2030 is 68.7% of the emission factor in 2022.
- 1.29 The following additional steps have been undertaken to refine the estimate of the likely increase in annual-mean NO<sub>2</sub> concentrations and the likely 'with development' concentrations, using the forecast factors for 2030:
- The background annual-mean NO<sub>2</sub> concentration of 13.5 µg.m<sup>-3</sup> used in the assessment for the South East of Marcham development has been deducted from the 'Absolute - Without Development' concentrations shown in Table 1.3 above, to give the road contribution in 2022. For example, 'Without Development Road Contribution in 2022' at Frilford Road 1 is 23.42 – 13.5 = 9.92 µg.m<sup>-3</sup>.
  - The road contribution at each receptor from the South East of Marcham development modelling has then been multiplied by 68.7% (i.e. 0.687) to determine the likely road contributions in 2030. For example, 'Without Development Road Contribution in 2030' at Frilford Road 1 is 9.92 x 0.687 = 6.82 µg.m<sup>-3</sup>.
  - Now moving onto the annual-mean NO<sub>2</sub> concentration estimated for all five developments, the increase at each receptor (provided in Table 1.3) has been multiplied by 68.7% to determine the likely increase in 2030. For example, the estimated increase for all five developments at Frilford Road 1 is 0.82 x 0.687 = 0.56 µg.m<sup>-3</sup>.
  - An 'Absolute - With All 5 Developments' concentration has then been obtained as the sum of: the Without Development Road Contribution in 2030, the background of 13.5 µg.m<sup>-3</sup> and the estimated increase for all five developments in 2030. For example, the estimated concentration should all five developments proceed is 13.5 + 0.56 + 6.82 = 20.88 µg.m<sup>-3</sup>.

1.30 As stated earlier, the East of Kingston Bagpuize with Southmoor and Dalton Barracks developments are not expected to be fully operational until 2031. If vehicle exhaust emissions continue to reduce over time, emissions in 2031 are likely to be lower than the estimated emissions for 2030. The estimated increase in concentrations and the absolute concentrations with all 5 developments can therefore be considered conservative estimates. Furthermore, in reality, the background concentration of  $13.5 \mu\text{g.m}^{-3}$  will also reduce over time. In this analysis, no reduction in the background concentration has been assumed which adds to the conservatism of the assessment.

1.31 Table 1.4 below presents an estimate of the annual-mean  $\text{NO}_2$  concentrations at the façades of existing receptors in 2030 and the relevant impact descriptor.

**Table 1.4 Predicted Annual-Mean  $\text{NO}_2$  Impacts at Existing Receptors in 2030**

Receptors	Concentration ( $\mu\text{g.m}^{-3}$ )				Increase for cumulative as % of AQAL	Impact Descriptor
	Without Development Road Contribution in 2022	Without Development Road Contribution in 2030	Increase - for all 5 Developments in 2030	Absolute - With all 5 Developments in 2030		
Frilford Road 1	9.92	6.82	0.56	20.88	1	Negligible
Packhorse Lane 2	4.38	3.01	0.56	17.07	1	Negligible
Packhorse Lane 3	20.95	14.39	1.12	29.01	3	Negligible
Packhorse Lane 4	15.22	10.46	0.84	24.80	2	Negligible
Packhorse Lane 5	5.89	4.05	0.56	18.11	1	Negligible
Packhorse Lane 6	12.16	8.35	1.68	23.54	4	Negligible
Packhorse Lane 7	3.98	2.73	1.40	17.64	4	Negligible
10 Packhorse Lane	27.39	18.82	1.40	33.72	4	Slight Adverse
4 Frilford Road	3.98	2.73	0.84	17.08	2	Negligible

1.32 The results presented in Table 1.4 show that when the estimated increase in annual-mean  $\text{NO}_2$  concentration is considered in the context of concentration predicted assuming that all five developments proceed, the impact descriptors range from negligible to slight adverse.

### Overall Impacts and Significance of Effect

1.33 The impacts predicted at individual receptors and the geographical extent over which such impacts occur, can be used to inform the judgement on the impact on the surrounding area as a whole, and whether the resulting overall effect is significant or not. The IAQM guidance states *“Whilst it may be that there are ‘slight’, ‘moderate’, or ‘substantial’ impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.”*

- 1.34 When the magnitude of change in annual-mean NO<sub>2</sub> concentrations is considered in the context of the absolute predictions, the air quality impact is described as 'slight adverse' at 10 Packhorse Lane and 'negligible' at all other receptors. This is largely due to higher absolute concentration at 10 Packhorse Lane, compared with the other receptors; however, it should be noted that the results indicate that with all five developments, the predicted annual-mean NO<sub>2</sub> concentrations at receptors are below the relevant AQAL of 40 µg.m<sup>-3</sup> in 2030.
- 1.35 The results of air quality monitoring undertaken by VWDC demonstrate that the current annual-mean NO<sub>2</sub> concentration is above the AQS objective in a small area: Appendix 2 provides supporting evidence that existing high pollutant concentrations are highly localised.
- 1.36 Taking into account the geographical extent of the impacts predicted in this study, the overall impact of the development on the surrounding area as a whole is considered to be 'negligible', using the descriptors adopted for this assessment.
- 1.37 Using professional judgement, the resulting cumulative air quality effect is considered to be 'not significant' overall.

### **Summary of Conclusions**

- 1.38 This high-level technical note considers the potential impacts and effects that cumulative growth for five proposed developments in the Part 2 Local Plan will have on air quality in the Marcham AQMA, designated due to high levels of NO<sub>2</sub>.
- 1.39 An assessment of the air quality impacts has been undertaken for the South East of Marcham development; however, air quality impact assessments have not been undertaken for the other four developments.
- 1.40 High-level analysis has been undertaken to determine the likely increases in annual-mean NO<sub>2</sub> concentrations and the likely annual-mean NO<sub>2</sub> concentrations within the Marcham AQMA, once all five developments are operational.
- 1.41 Taking into account the geographical extent of the impacts predicted in this study, the overall impact of the development on the surrounding area as a whole is considered to be 'negligible', using the descriptors adopted for this assessment.
- 1.42 Using professional judgement, the resulting cumulative air quality effect is considered to be 'not significant' overall.

## Appendix 1: Predictions for South East of Marcham

The following table is a reproduction of the predicted annual-mean NO<sub>2</sub> concentrations provided in the assessment report accompanying the planning application for the South East of Marcham development.

**Table.5 Predicted Annual-Mean NO<sub>2</sub> Impacts at Existing Receptors**

Receptor ID	Concentration (µg.m <sup>-3</sup> )		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
Frilford Road 1	23.42	23.44	0	Negligible
Packhorse Lane 2	17.88	17.90	0	Negligible
Packhorse Lane 3	34.45	34.49	0	Negligible
Packhorse Lane 4	28.72	28.75	0	Negligible
Packhorse Lane 5	19.39	19.41	0	Negligible
Packhorse Lane 6	25.66	25.72	0	Negligible
Packhorse Lane 7	17.48	17.53	0	Negligible
10 Packhorse Lane (monitoring location)	40.89	40.94	0	Negligible
4 Frilford Road (monitoring location)	33.04	33.07	0	Negligible
<b>Maximum</b>	<b>40.89</b>	<b>40.94</b>	<b>0</b>	
<b>Minimum</b>	<b>17.48</b>	<b>17.53</b>	<b>0</b>	

Concentrations are shown to 2 decimal places to illustrate the very small relative differences in the 'with' and 'without' development predictions. This is not intended to be indicative of the accuracy of the model.

## Appendix 2: Monitoring Data

VWHDC monitors roadside annual-mean NO<sub>2</sub> concentrations passively using diffusion tubes at six locations in the vicinity of the Application Site. The concentrations reported over recent years are provided in Table 1.

**Table 1 Measured Annual-mean NO<sub>2</sub> Concentrations (µg.m<sup>-3</sup>)**

Monitoring Site	Distance to Road (m)	Distance to Relevant Exposure (m)	Measured Annual-mean NO <sub>2</sub> Concentrations (µg.m <sup>-3</sup> )				
			2012	2013	2014	2015	2016*
22 Frilford Road (S29)	1.0	3.0	27.6	28.8	27.0	26.1	29.9
10 Packhorse Lane (S31)	0.0	0.0	-	-	49.9	47.9	53.1
4 Frilford Road (S32)	0.5	0.5	39.8	39.0	40.4	38.8	44.8
4 Packhorse Lane (S33)	1.8	0.0	35.1	35.0	30.1	29.7	33.2
13 Packhorse Lane (S34)	2.0	7.5	38.6	39.9	39.9	38.2	40.4
Rafters B&B (S35)	0.6	3.0	39.0	36.9	39.3	36.7	36.9

\*Data drawn from Table B.1 in Appendix B of the Annual Status Report. The measured concentration excludes correction for distance to nearest relevant exposure.

The measured concentrations at 10 Packhorse Lane are consistently high; however, this is largely due to extremely localised factors including: slow-moving vehicles on a tight bend and a narrow street canyon formed by properties on either side of the road, trapping pollutants.

The measured concentrations at 4 Packhorse Lane, approximately 20m from the 10 Packhorse Lane monitoring location, are consistently below the AQS objective and are some 20 µg.m<sup>-3</sup> below the concentrations measured at 10 Packhorse Lane. This provides empirical evidence to support the view that localised air quality factors at 10 Packhorse Lane are largely responsible for the high concentrations there.

## References

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- 1 RPS (12 April 2018) Land Off Packhorse Lane, Marcham – Air Quality Assessment
- 2 Defra, 2007, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Volume 2.
- 3 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.