



# Appendix H-4 –Air Quality Model summary

## Introduction

This Appendix presents the results of the air quality modelling carried out in 2017 and 2018 and reported in detail in Appendices H-2 and H-3. The modelling looked

The locations used by the local authorities for air quality monitoring have changed since this assessment was carried out; some of the locations are no longer used and others now have different reference numbers. The Environmental Statement uses the latest data; this Appendix quotes the 2012 to 2016 data used to inform the assessment at the time it was carried out. Baseline pollution levels have reduced since this time and are anticipated to fall further in the time between the 2021 construction year assumed in the original study and the Scheme's actual construction dates. In addition, the Scheme contains more traffic mitigation measures than was the case in 2018, in particular Old Abingdon Road will now be kept open to traffic rather than being closed for a period of several months.

For all the above reasons, air quality impacts due to emissions from road vehicles will be lower than the non-significant impacts assessed in 2018.

## Methodology

With the addition of HGVs to the road network surrounding the Scheme, there is the potential for local air quality to be affected. The expected number of construction vehicles that will be operated during the construction phase of the Scheme, expressed as daily HGV movements, were provided for each construction area on the basis of the total amount of material to be moved.

The study area covers receptors (residential and ecological) within 200m of the affected road network (ARN), as shown in Figure 13.1. The following scenarios have been considered as part of the local air quality assessment:

- Base Case
- Do minimum, without the construction site (i.e. no additional HGVs) and without the closure of Old Abingdon Road
- Do something, with the construction site (i.e. additional HGVs) and assuming the closure of Old Abingdon Road

The assessment is based on the 2016 traffic count data elaborated from that sourced from Oxfordshire County Council and Department of Transport. Traffic growth in future years has been considered by applying TEMPRO factors. Following a conservative approach, traffic flows modelled for the do minimum and do something scenarios have been projected to the year 2021, which is the end of construction year. Traffic flows at the beginning of the construction phase (i.e. 2018) are expected to be lower.

The local air quality assessment of construction traffic is concerned with pollutant concentration changes at receptors as a direct result of the addition of HGVs on the identified ARN. It is likely that all HGVs associated with the Scheme will be in compliance with Euro VI standards. However, Euro V emissions factors have been used instead to model the additional HGVs, in order to obtain a conservative estimate of the impacts of the Scheme.

Worst-case receptors representative of human exposure within 200m of the ARN were selected for the base year, do minimum and do something Scenarios. Additional receptors were selected as representative to ecological exposure at relevant distances within 200m of the ARN.



Annual mean background concentrations of NO<sub>x</sub>, NO<sub>2</sub> and PM<sub>10</sub> were obtained from LAQM Background Mapping page from the Defra website. The Defra maps provide annual forecasts on a 1 km<sup>2</sup> grid across the whole of the UK. Base 2016 maps were used for Oxfordshire and VoWH.

The road contributions of NO<sub>x</sub> and PM<sub>10</sub> at each receptor were calculated using an atmospheric dispersion model (ADMS-Roads version 4.0.1). NO<sub>x</sub> and PM<sub>10</sub> emissions were calculated for each road link of the ARN using Defra's Emission Factor Toolkit (v8.0, November 2017). These were used as input to the dispersion model for the base year, do minimum and do something scenarios.

The model was validated comparing results against measured concentrations at relevant monitoring locations. Four different verification factors have been applied to adjust modelled concentrations. The verification process is described in detail in Appendix H-2.

NO<sub>2</sub> concentrations were calculated using the latest version of Defra's NO<sub>x</sub> to NO<sub>2</sub> calculator (version 6.1, November 2017).

Following a conservative approach, background concentrations for the base year (2016) were applied to the future do minimum and do something scenarios as well, assuming no improvements in the background concentrations will occur between 2016 and the construction period (i.e. 2018-2021).

The impacts of the Scheme on pollutant concentrations are assessed in accordance with Institute of Air Quality Management guidance: 'Land-Use Planning and Development Control' (IAQM 2015). The significance of the impact of the Scheme is assessed at each receptor and is based on percentage contribution of the absolute pollutant concentration and magnitude of change (between the do minimum and do something) to the Air Quality Assessment Level (AQAL). Specific criteria are used to determine significance relating to the percentage contribution of the absolute pollutant concentration to the AQAL. Table 1 provides the criteria required to define a significant impact.

**Table 1: Magnitude of change criteria**

Annual 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 of AQAL	Moderate	Substantial	Substantial	Substantial

Table 2 details the Significance Classification used in the assessment of the modelled NO<sub>2</sub> and PM<sub>10</sub> concentrations results for the change between the do minimum and do something scenarios, i.e. DS-DM.



**Table 2: Significance Classification**

Change (DS-DM)	Significance based on IAQM Guidance
<-4	<i>LARGE DECREASE</i>
>-4 & <-2	<i>MEDIUM DECREASE</i>
>-2 & <-0.4	<i>SMALL DECREASE</i>
>-0.4 & <0.4	<i>INPERCEPTIBLE</i>
> 0.4 & < 2	<i>SMALL INCREASE</i>
> 2 & < 4	<i>MEDIUM INCREASE</i>
>4	<i>LARGE INCREASE</i>

## The modelling study

With the addition of HGVs to the road network surrounding the Scheme, there is the potential for local air quality to be affected. The expected number of construction vehicles that will be operated during the construction phase of the Scheme, expressed as daily HGV movements, were provided for each construction area on the basis of the total amount of material to be moved.

A total of 21 sensitive receptors were considered for this local air quality assessment as well as eight diffusion tube locations (four within Oxford City and four within VoWH district). The location of the receptors considered in the assessment are shown in Figure 1.

Total NO<sub>2</sub> and PM<sub>10</sub> concentrations were predicted for the Base Year (2016), DM and DS (2021) scenarios. The total pollutant concentrations predicted in all scenarios and at all receptors are presented in the sections below.

## NO<sub>2</sub>

Table 3 provides a summary of the NO<sub>2</sub> effects of the Scheme at selected receptors on the basis of the criteria set by the IAQM guidance, indicating the magnitude of change between the DM and DS Scenarios.

As presented in Table 3 and Figure 3, the impact of construction vehicle emissions at the majority of receptors will be 'Imperceptible'. Receptors along the temporary access tracks are likely to experience a 'Small Increase' in NO<sub>2</sub> emissions, however with the exception of receptor S3, results are indicated as being below the annual mean NO<sub>2</sub> objective.

Receptor S3 is located within the Botley AQMA, and is not expected to be non-compliant as a result of the Scheme but rather as a result of the adjacent A34 trunk road. VoWH DC is in the process of implementing various actions to bring this position into compliance.

Decreases in NO<sub>2</sub> concentrations as a result of the Scheme were expected along the Old Abingdon Road as a result of the road closure during the construction phase of the Scheme. Subsequent to the modelling study this road closure has been removed from the Scheme, resulting in the reduction at Old Abingdon Road not taking place, and increases in other roads that the traffic would have diverted onto also not materialising.

Appendix H-3 provides more details regarding the anticipated NO<sub>2</sub> concentration changes within the study area as a result of the Scheme.



**Table 3:** Significance of Construction Phase Traffic on NO<sub>2</sub> concentrations at key receptors

Receptor	NO <sub>2</sub> Concentrations (µg/m <sup>3</sup> )				Significance based on IAQM Guidance
	Base	DM	DS	DS-DM	
S1	30.30	27.55	27.78	0.23	IMPERCEPTIBLE
S2	35.40	28.16	28.46	0.30	IMPERCEPTIBLE
S3	<b>53.40</b>	<b>41.05</b>	<b>41.55</b>	0.50	SMALL INCREASE
S4	37.93	30.25	30.60	0.35	IMPERCEPTIBLE
DT2	27.51	24.57	24.84	0.27	IMPERCEPTIBLE
DT3	38.00	32.65	33.12	0.47	SMALL INCREASE
DT36	37.53	32.69	33.45	0.76	SMALL INCREASE
DT37	32.30	28.20	28.80	0.60	SMALL INCREASE
AR1	22.81	21.70	21.85	0.15	IMPERCEPTIBLE
AR2	16.75	15.26	15.70	0.44	SMALL INCREASE
AR3	19.18	17.39	17.95	0.56	SMALL INCREASE
AR4	<b>40.29</b>	32.20	32.59	0.39	IMPERCEPTIBLE
AR5	32.98	26.72	27.00	0.28	IMPERCEPTIBLE
AR6	21.13	20.02	20.54	0.52	SMALL INCREASE
AR7	34.37	29.79	29.91	0.12	IMPERCEPTIBLE
AR8	31.94	27.92	28.31	0.39	IMPERCEPTIBLE
AR9	19.13	18.30	18.86	0.56	SMALL INCREASE
AR10	29.47	26.03	26.40	0.37	IMPERCEPTIBLE
AR11	25.25	22.65	18.76	-3.89	MEDIUM DECREASE *
AR12	26.27	24.00	24.17	0.17	IMPERCEPTIBLE
AR13	<b>40.21</b>	31.64	31.99	0.35	IMPERCEPTIBLE
AR14	25.85	21.72	21.91	0.19	IMPERCEPTIBLE
AR15	34.94	28.06	28.39	0.33	IMPERCEPTIBLE
AR16	27.90	26.03	26.64	0.61	SMALL INCREASE
AR17	30.48	26.80	27.16	0.36	IMPERCEPTIBLE
AR18	18.06	17.28	17.71	0.43	SMALL INCREASE
AR19	38.41	32.93	33.44	0.51	SMALL INCREASE
AR20	33.44	28.74	29.36	0.62	SMALL INCREASE
AR21	30.45	26.43	28.07	1.64	SMALL INCREASE

\* The modelled decrease at receptor AR11 was due to traffic reductions resulting from a road closure which was required for the 2018 version of the Scheme but is not now part of the Scheme proposals. Therefore this reduction will not take place.



The contribution of HGVs associated with the Scheme in terms of NO<sub>2</sub> annual average concentrations at a roadside receptor is in most instances less than 0.4 µg/m<sup>3</sup> (i.e. 1% of the AQS). Therefore, the direct impact of HGVs on NO<sub>2</sub> concentrations is expected to be not significant. Furthermore, the impacts are temporary, as they only relate to the construction phase of the Scheme.

These estimates do not consider the indirect effects of the Scheme on local traffic. However, construction vehicles will not circulate during traffic peak hours to minimise the risk of congestion and reduce the impact on local traffic. This is a common practice for the construction of large schemes, which is covered under the Construction Traffic Management Plan, and will play an important role in limiting adverse effects on air quality.

It should also be noted that some of the construction areas will have a lower frequency of HGV movements and, in general, the number of HGVs will not be constant throughout the three years of the construction phase. In fact, during winter months (from November through to the end of March), the excavation will be suspended and the number of HGVs will therefore be significantly lower. This will reduce increases in annual average concentrations.

## PM<sub>10</sub>

Table 4 provides a summary of the PM<sub>10</sub> effects of the Scheme at selected receptors on the basis of the criteria set by the IAQM guidance, indicating the magnitude of change between the DM and DS Scenarios.

As presented in Table 4 and Figure 4 the impact of construction vehicle emissions at receptors will be Imperceptible, with all concentrations noted as being below the AQS Objective. Appendix H-3 provides more details regarding the anticipated PM<sub>10</sub> concentration changes within the study area as a result of the Scheme.

**Table 4:** Significance of Construction Phase Traffic on PM<sub>10</sub> concentrations at key receptors

Receptor	PM <sub>10</sub> Concentrations (µg/m <sup>3</sup> )				Significance based on IAQM Guidance
	Base	DM	DS	DS-DM	
S1	17.80	17.73	17.73	0.00	IMPERCEPTIBLE
S2	19.05	18.46	18.47	0.01	IMPERCEPTIBLE
S3	22.63	21.46	21.47	0.02	IMPERCEPTIBLE
S4	19.08	18.50	18.52	0.02	IMPERCEPTIBLE
DT2	15.38	15.33	15.34	0.01	IMPERCEPTIBLE
DT3	16.95	16.88	16.89	0.02	IMPERCEPTIBLE
DT36	16.17	16.19	16.19	0.00	IMPERCEPTIBLE
DT37	17.12	17.16	17.16	0.00	IMPERCEPTIBLE
AR1	15.79	15.79	15.79	0.01	IMPERCEPTIBLE
AR2	17.62	17.54	17.55	0.01	IMPERCEPTIBLE
AR3	14.63	14.56	14.57	0.01	IMPERCEPTIBLE
AR4	19.61	19.00	19.02	0.02	IMPERCEPTIBLE
AR5	18.55	18.08	18.09	0.01	IMPERCEPTIBLE
AR6	16.82	16.80	16.81	0.02	IMPERCEPTIBLE
AR7	16.40	16.33	16.29	-0.04	IMPERCEPTIBLE
AR8	16.01	15.95	15.97	0.02	IMPERCEPTIBLE
AR9	14.23	14.21	14.23	0.02	IMPERCEPTIBLE



Receptor	PM <sub>10</sub> Concentrations (µg/m <sup>3</sup> )				Significance based on IAQM Guidance
	Base	DM	DS	DS-DM	
AR10	15.65	15.60	15.61	0.02	IMPERCEPTIBLE
AR11	17.37	17.33	16.57	-0.76	SMALL DECREASE
AR12	16.85	16.78	16.78	0.00	IMPERCEPTIBLE
AR13	20.01	19.27	19.28	0.01	IMPERCEPTIBLE
AR14	17.15	16.87	16.88	0.01	IMPERCEPTIBLE
AR15	21.06	20.56	20.57	0.01	IMPERCEPTIBLE
AR16	15.69	15.67	15.68	0.01	IMPERCEPTIBLE
AR17	15.80	15.74	15.76	0.02	IMPERCEPTIBLE
AR18	13.89	13.88	13.89	0.01	IMPERCEPTIBLE
AR19	17.00	16.92	16.94	0.02	IMPERCEPTIBLE
AR20	18.88	18.80	18.87	0.07	IMPERCEPTIBLE
AR21	17.01	16.95	17.16	0.21	IMPERCEPTIBLE

## Ecological Assessment

The construction phase of the Scheme may potentially give rise to changes in the magnitude and location of vehicle emissions, which may change the concentrations of NO<sub>x</sub> and the rate of nitrogen deposition in the sites designated for nature conservation.

However, based on distance from the Scheme, all ecological designated sites have been scoped out. The change in concentrations of pollutants at the sensitive ecological receptors is going to be **imperceptible** and no adverse effects are anticipated.

The only exception is at Seacourt Nature Park, which is located in the footprint of the Scheme. Table 5 presents the assessment of NO<sub>x</sub> concentrations along a transect of receptors (i.e. a series of receptors located at regular distances to show the concentration pattern on the ecological site) within the Seacourt Nature Park (see Figure 1). Absolute concentration values above 60% of the critical level are considered potentially significant in terms of impacts to ecology.

As a worst-case scenario, background NO<sub>x</sub> concentrations for the DM and DS scenarios have been kept consistent with the 2016 Base, and not decreased. Only receptor E1 (located 25m from the ARN) shows a potentially significant impact for NO<sub>x</sub>. However, the Scheme contribution is limited and it is unlikely that a perceptible adverse effect will occur. Further details on E1 - E6 are provided in Appendix H-3.



**Table 5:** Assessment of NOx concentrations at Ecological Receptors in the Seacourt Nature Park

Receptor	NOx Concentrations ( $\mu\text{g}/\text{m}^3$ )							
	2016 Base	2021 Do-minimum	2021 Do-something	Change	Critical Level	Change as % of critical level	Total NOx as a % of critical level	Potentially Significant?
E1	34.31	31.50	32.46	0.96	30	3.20%	108.19%	Yes
E2	30.41	27.78	28.66	0.88	30	2.93%	95.54%	No
E3	29.04	26.43	27.26	0.84	30	2.79%	90.88%	No
E4	28.46	25.80	26.59	0.79	30	2.63%	88.63%	No
E5	28.23	25.50	26.23	0.72	30	2.41%	87.42%	No
E6	28.08	25.30	25.78	0.48	30	1.59%	85.94%	No





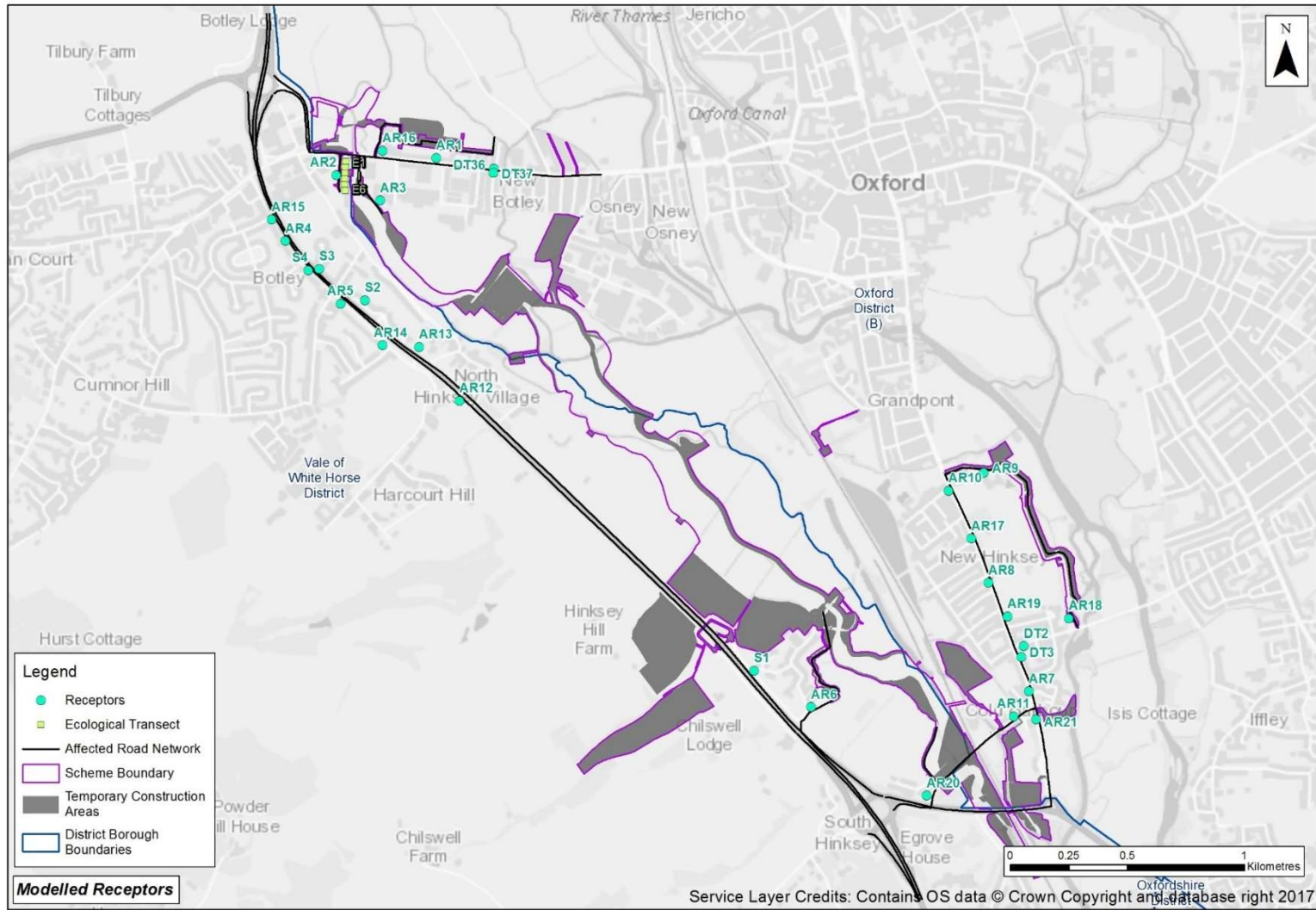


Figure 1: Oxford Flood Alleviation Scheme – Modelled Receptors

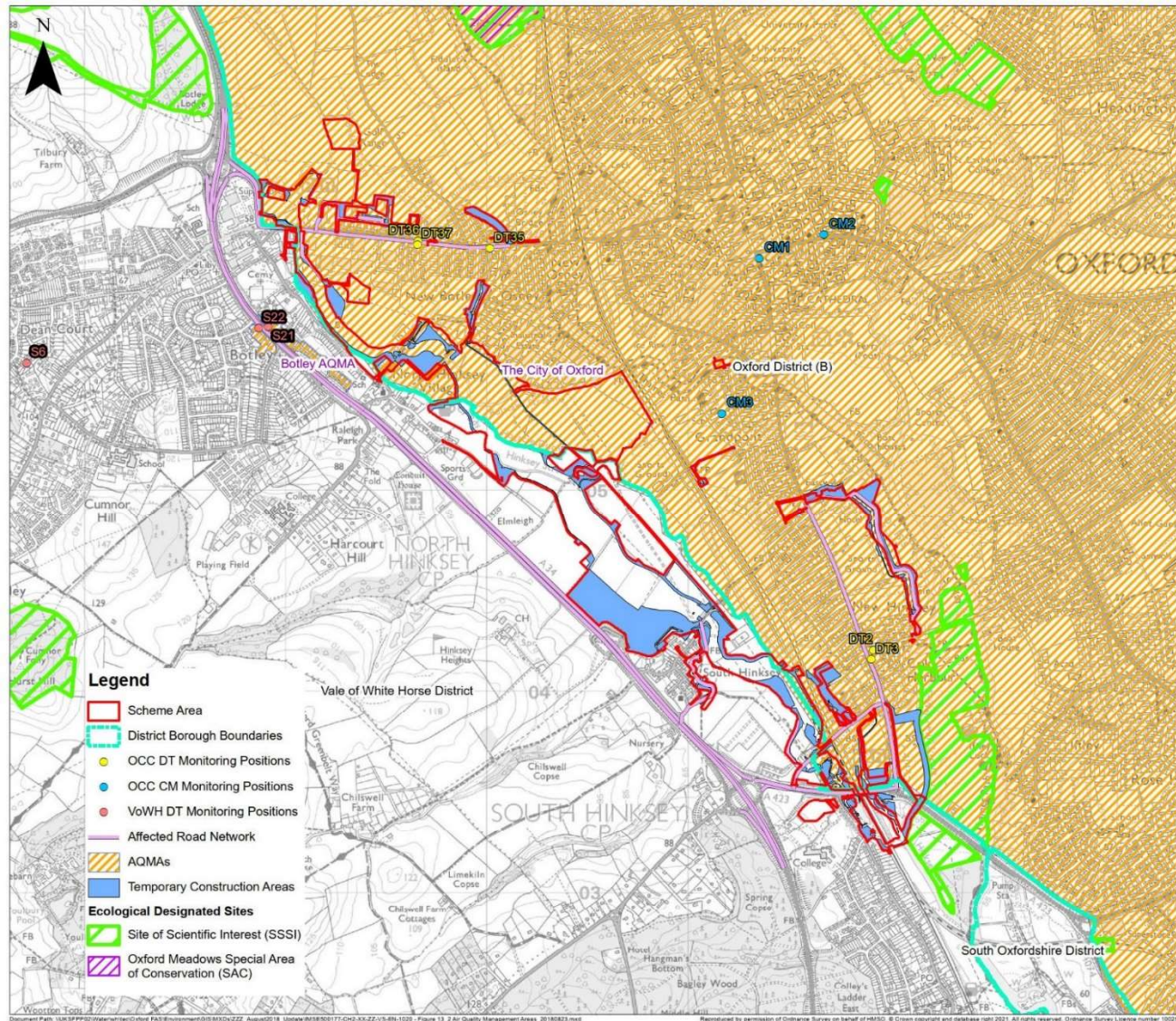


Figure 2: Air Quality Management Areas and background monitoring sites

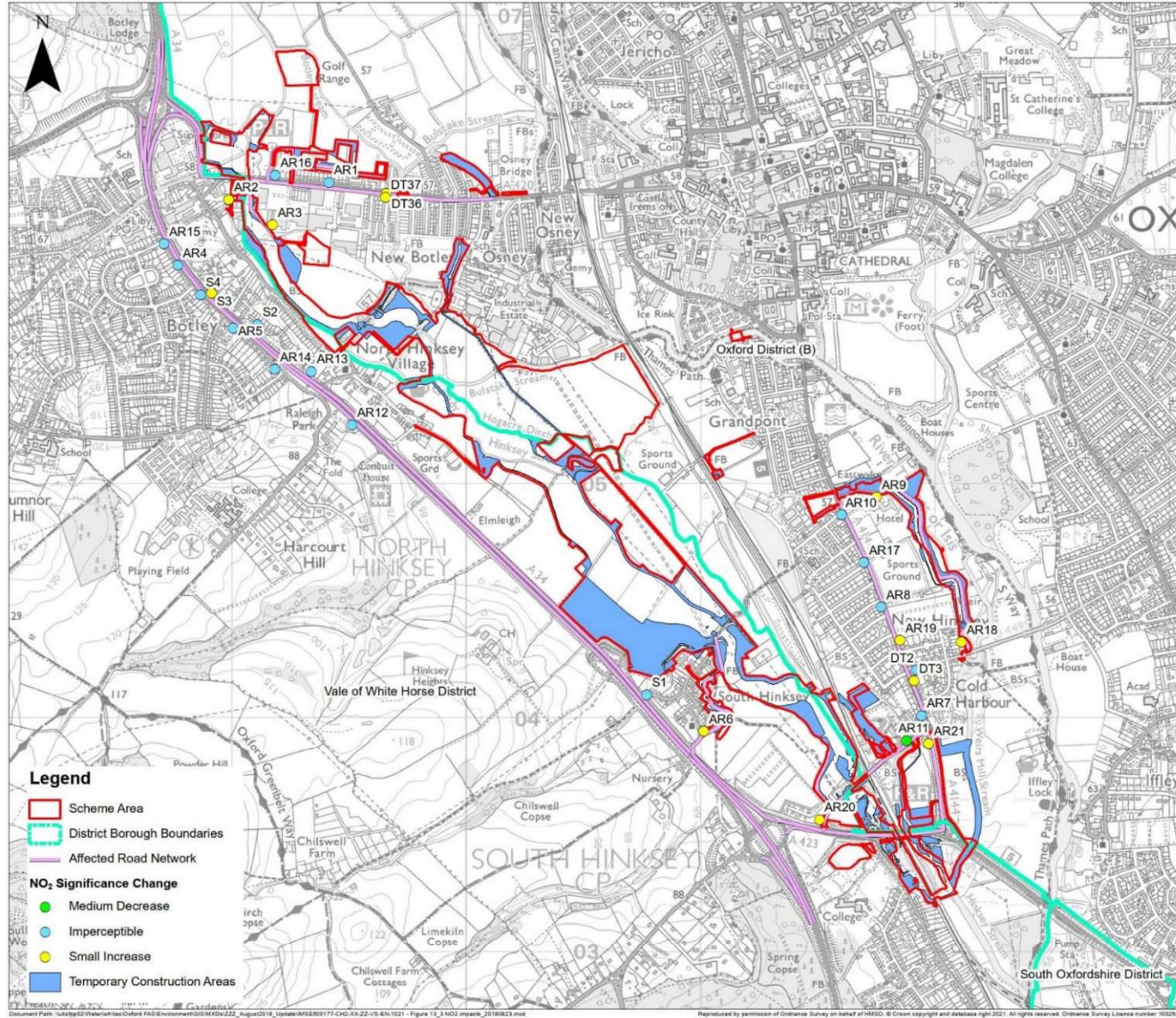


Figure 3: NO<sub>2</sub> impacts

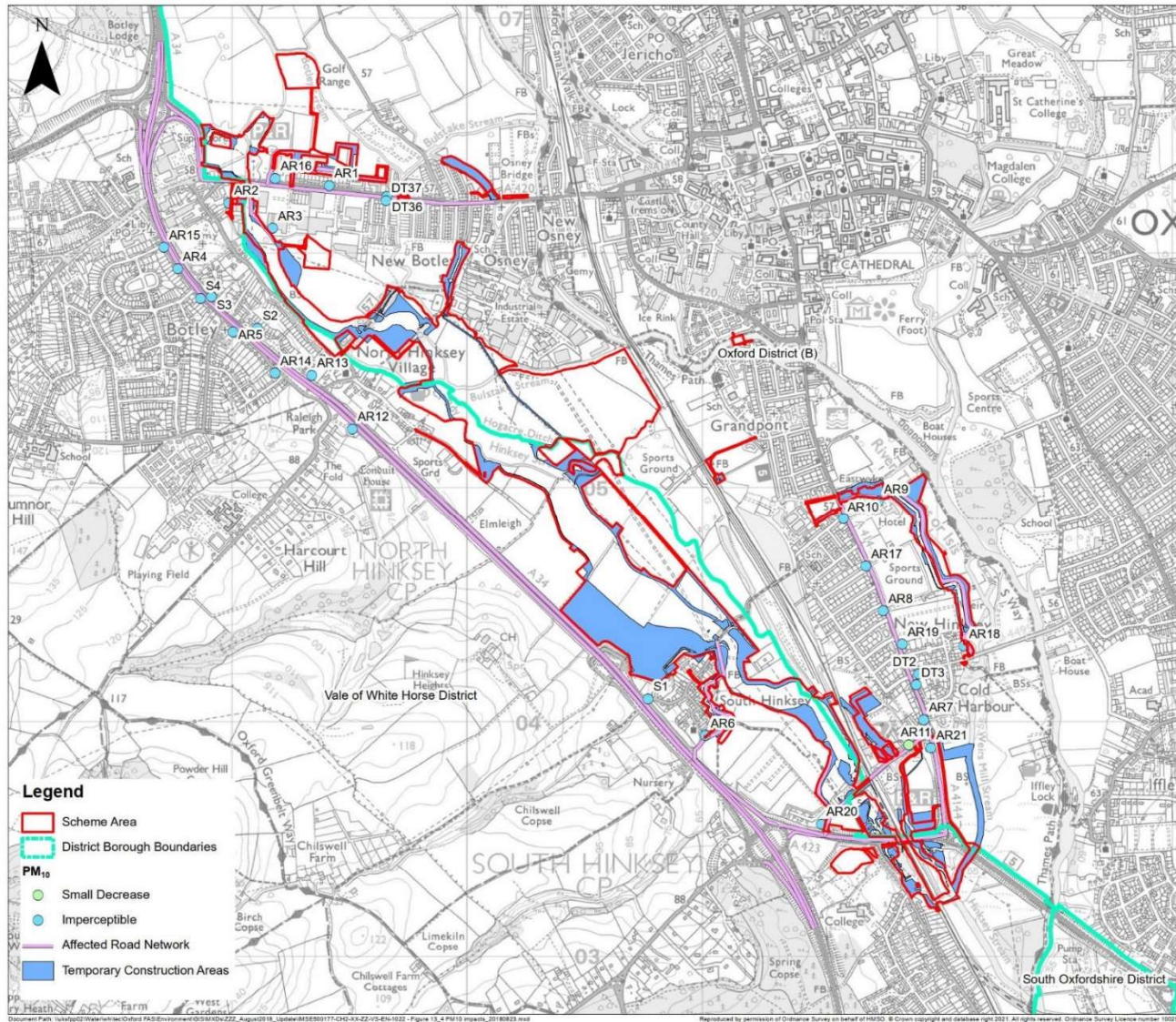


Figure 4: PM<sub>10</sub> impacts