Appendix 14.1 Traffic Data

Table A.14.1: Air Quality: Assessment Traffic Data

Links		Scaled 2017 Base			2026 DM			2026 DS1			2026 DS2		
		AADT (24hr) Total Flow	HGV	% HGVs	AADT (24hr) Total Flow	HGV	% HGVs	AADT (24hr) Total Flow	HGV	% HGVs	AADT (24hr) Total Flow	HGV	% HGVs
1	Bennetts Road N (North of Site Access)	2018	444	22%	2363	520	22%	2329	451	19%	2295	409	18%
2	Bennetts Road N (South of Site Access)	2018	444	22%	2363	520	22%	5474	436	8%	5436	399	7%
3	Howat Road	4292	503	12%	5242	621	12%	5242	621	12%	5242	621	12%
4	Bennetts Road N (between Howat Road and Exhall Road)	6310	946	15%	7605	1141	15%	11077	1108	10%	11082	1108	10%
5	Thompsons Road	NO DATA			645	65	10%	645	65	10%	664	60	9%
6	Exhall Road	4763	1044	22%	6419	1220	19%	7420	1041	14%	7886	925	12%
7	Bennetts Road N (between Thompsons Road and Fivefield Road)	3994	430	11%	5017	602	12%	7436	595	8%	10323	929	9%
8	Fivefield Road	947	589	62%	2462	1477	60%	2934	1555	53%	3699	1147	31%
9	Watery Lane	1113	379	34%	2068	1075	52%	2569	1182	46%	9317	1770	19%
10	Bennetts Road S (between Watery Lane and Penny Park Lane)	3133	176	6%	3959	198	5%	5474	219	4%	6325	190	3%
11	Bennetts Road S (between Penny Park Lane and Sandpits Lane)	8704	261	3%	10089	303	3%	10315	309	3%	8646	259	3%

Links		Scaled 2017 Base			2026 DM			2026 DS1			2026 DS2		
		AADT (24hr) Total Flow	HGV	% HGVs	AADT (24hr) Total Flow	HGV	% HGVs	AADT (24hr) Total Flow	HGV	% HGVs	AADT (24hr) Total Flow	HGV	% HGVs
12	Penny Park Lane	5640	33	1%	7621	0	0%	7631	0	0%	5053	0	0%
13	Sandpits Lane	6710	0	0%	7619	0	0%	7706	0	0%	3800	0	0%
14	Keresley Brook Road	3681	0	0%	4550	0	0%	4868	0	0%	3367	0	0%
15	Keresley Green Road (between Benson Road and Scotchill Roundabout)	8937	712	8%	11819	591	5%	12400	620	5%	12473	624	5%
16	The Scotchill	9862	159	2%	12463	125	1%	12549	125	1%	12626	126	1%
17	Kersley Road	18408	1434	8%	26790	2679	10%	27204	2720	10%	28320	2677	9%
18	Tamworth Road (between Waste Lane and Scotchill Roundabout)	12009	1684	14%	13314	2130	16%	13276	2187	16%	13131	2101	16%
19	Tamworth Road (between Fivefield Road and Long Lane)	10403	1789	17%	13466	2559	19%	13471	2560	19%	14390	2460	17%
Keresley Link Road (only with DS2)													
20	Between Tamworth Road roundabout and junction with right hand turn										9221	1014	11%
21	Between junction with right hand turn and roundabout adjacent to Hallbrook										8422	926	11%

Links		**Scaled 2017 Base**			**2026 DM**			**2026 DS1**			**2026 DS2**		
		AADT (24hr) Total Flow	**HGV**	**% HGVs**	**AADT (24hr) Total Flow**	**HGV**	**% HGVs**	**AADT (24hr) Total Flow**	**HGV**	**% HGVs**	**AADT (24hr) Total Flow**	**HGV**	**% HGVs**
22	Between roundabout adjacent to Hallbrook and Bennetts Road										7941	953	12%
23	Between Bennetts Road and Watery Lane roundabout										9317	1770	19%
24	Between Watery Lane roundabout and Central Boulevard / Easter Way / Winding Horse Lane roundabout										6316	1200	19%

Appendix 14.2 Air Quality Model Verification

14.1.1 Model verification was undertaken considering passive monitoring sites adjacent to the modelled ARN. Only three diffusion tube (DT) monitoring sites were located within the air quality study area. BA1c was located on the edge of the traffic network without full representation of sources. The comparison is presented but it has not been used in the verification.

14.1.2 Uncertainty in modelled estimates has been considered by calculating root mean square error (RMSE) and fractional bias statistics. An air quality model can be considered to perform reasonably well where modelled concentrations are within 25% of monitored concentrations in accordance with DEFRA's Technical Guidance LAQM.TG(16). The RMSE should ideally be within 10% of the relevant air quality criterion, but is acceptable where it is within 25% of the relevant air quality criterion. The Fractional Bias (FB) has an ideal value of 0, but is acceptable in the range between +2 and -2.

14.1.3 Firstly, unadjusted modelled estimates of total annual mean NO_2 concentrations have been compared against monitored annual means. These results indicate that the model underestimates compared to monitored concentrations by between 37 and 46%, which is not uncommon. Unadjusted model statistics are shown in Table A14.2.

Table A.14.2: – *Comparison of Unadjusted Modelled and Measured NO_2 Concentrations ($\mu g/m^3$)*

Site	Background Annual Mean NO_2	Monitored Annual Mean Total NO_2	Modelled Annual Mean Total NO_2	Modelled NO_2 Minus Monitored NO_2	% Difference (unadjusted modelled NO_2 - monitored NO_2) / monitored NO_2 * 100
BS1	13.34	24.99	15.62	-9.37	-37%
KG1	13.34	39.49	22.29	-17.20	-44%
BA1c	14.99	29.17	15.61	-13.56	-46%

14.1.4 For unadjusted modelled estimates of NO_2 compared to monitored concentrations, the RMSE is 13.76 $\mu g/m^3$, which is not within the target value according to DEFRA's Technical Guidance LAQM.TG(16) i.e. ideally less than 4 $\mu g/m^3$ in relation to the 40 $\mu g/m^3$ objective concentration for annual mean NO_2, but as a minimum not more than 25% of the objective i.e. 10 $\mu g/m^3$. The Fractional Bias (0.55) is above the ideal value of 0, indicating that the model tends to underestimate. The overall performance of the unadjusted model is therefore not acceptable.

14.1.5 The second comparison of modelled estimates of road contributed annual mean NO_x with the road NO_x component derived from monitoring data is presented in Table 10-10. This analysis requires the estimation of the monitored road NO_x component. This has been undertaken using DEFRA's NO_2 to NO_x calculator, version 6.1, October 2017.

Table A.14.3: – ***Comparison of Unadjusted Modelled and Measured NOx Concentrations (µg/m³)***

Site	Modelled Annual Mean Road NO_x	Monitored Annual Mean Road NO_x	Modelled NO_x Minus Monitored NO_x	Monitored Road NO_x / Modelled Road NO_x	% Difference (unadjusted modelled NOx - monitored NOx) / monitored NOx * 100
BS1	4.27	22.80	-18.53	5.33	-81%
KG1	17.31	55.13	-37.82	3.19	-69%

14.1.6 The results from the comparison above have been used to derive an adjustment factor of 3.309.

Table A.14.4: – ***Comparison of Adjusted Modelled and Measured NO_2 Concentrations (µg/m³),***

Site	Background Annual Mean NO_2	Monitored Annual Mean Total NO_2	Adjusted Modelled Annual Mean Total NO_2	Modelled NO_2 Minus Monitored NO_2	% Difference (adjusted modelled NO_2 - monitored NO_2) / monitored NO_2 * 100
BS1	13.34	24.99	20.71	-4.28	-17%
KG1	13.34	39.49	40.38	0.89	2%

14.1.7 The third comparison of the adjusted modelled estimates of total annual mean NO_2 with monitored concentrations is presented in Table A.14.4 to improve model performance. The RMSE for adjusted modelled NO_2 concentration compared to monitored concentration is 3.09 and the fractional bias is 0.05, which are acceptable model performance statistics.

Appendix 14.3 Trends Analysis

14.1.8 An analysis of overarching trends in measured NO_2 concentrations at urban background and rural sites obtained by Coventry City Council, Nuneaton and Bedworth Borough Council, North Warwickshire Borough Council and Defra's Automatic Urban and Rural Network has been conducted using the MAKESENS template for the analysis of annual data. Monitoring locations with more than four annual measurements in the period 2012-2017 were considered to ensure a robust and recent assessment was completed.

14.1.9 Data from continuous and diffusion tube monitoring demonstrate a decline in concentrations throughout the area with one out of the four sites examined exhibiting a significant decreasing trend in NO_2 concentrations at the 5% significance level.

14.1.10 Based on these analyses it is considered that the overall trend in the wider area is a decline in NO_2 concentrations. As the majority of monitoring locations are recording a fall in NO_2 concentrations of varying extents this supports the assertion that NO_2 concentrations are improving within the wider area. Consequently, no sensitivity testing with emission factors and background concentrations held to baseline levels has been performed, as the evidence suggests that air quality is improving in the wider area surrounding the Proposed Development site.

Table A.14.5: – Summary of Annual Mean NO_2 Concentration Trend Analysis

Site ID	Site Name	Monitoring Type	Site Type	No. of Data Points	Required S Value	S value *	Sens's Slope	Significant
NB1	Norman Avenue	Non-Automatic	Urban Background	6	>=11	-9	-0.50	No
NB2	Conifer Close	Non-Automatic	Urban Background	6	>=11	-14	-0.43	Yes
NW2	Kingsbury	Non-Automatic	Rural	6	>=11	-9	-0.37	No
COAL	Coventry Allesley	Automatic	Urban Background	3	>=11	-3	-0.46	No

*The absolute value of S is compared to the probabilities of the Mann-Kendall nonparametric test for trend to define if there is a monotonic trend or not at the level 0.1 of significance. A positive (negative) value of S indicates an upward (downward) trend.

**Sites not included in trend analysis as fewer than four data points within the period 2012-2017.

Appendix 14.4 Damage Cost Calculations

Table A.14.6: – Estimation of Damage Costs 2017 to 2034

Pollutants	2017 price per tonne*	Price per tonne of pollutant in projected years (Defra IGCB)				
		2030	2031	2032	2033	2034
NOx	£10,699	£8,850	£8,721	£8,595	£8,470	£8,348
$PM_{2.5}$	£203,331	£168,183	£165,745	£163,343	£160,976	£158,643
	Multiply by Economic growth factor 2% per annum since 2017	1.294	1.319	1.346	1.373	1.400
	Divide by Green Book - discounting factor -3.5% per annum since 2017	1.564	1.619	1.675	1.734	1.795
For analysis of future year impacts, the approach continues to assume a proxy for income growth is the long-run rate of economic growth of 2% per annum. Further, impacts in years after the year of emissions change are discounted using the Green Book discount rate of 3.5% (HMT, 2011).						
* £2017/tonne updated central national damage costs estimates for "Transport Average" sector, published in Air Quality damage cost update 2019, Defra AQ0650, published 30/01/2019 (Accessed-06/02/2019- https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1901300955_Damage_cost_update_2018_FINAL_Issue_1_publication.pdf)						

Table A.14.7: Estimate of Emissions from Additional Trips with Proposed Development 2030 - 2034

Pollutant	Projected yearly emissions (Defra Emissions Factor Toolkit v8)				
	2030	2031	2032	2033	2034
Trip generation resulting from Proposed Development.					
Total NOx (kg)	1433	1433	1433	1433	1433
Total $PM_{2.5}$ (kg)	187	187	187	187	187
Total NOx (t)	1.433	1.433	1.433	1.433	1.433
Total $PM_{2.5}$ (t)	0.187	0.187	0.187	0.187	0.187
No increase in traffic beyond the output of the CASM traffic model in 2026 is assumed. Emission factors are not available for years beyond 2030, for this calculation the traffic year and emissions in 2026 are substituted for emissions in 2030.					

Table A.14.8: Estimate of Change in Trip Emissions with Proposed Development 2030 - 2034

Pollutants	Damage Costs				
	2030 (year 1)	2031	2032	2033	2034 (year 5)
NOx	£12,680	£12,496	£12,315	£12,137	£11,961
$PM_{2.5}$	£31,383	£30,928	£30,480	£30,038	£29,603
Totals (cumulative NO_2 & $PM_{2.5}$)	£44,064	£43,425	£42,796	£42,175	£41,564

Appendix 14.5 Air Quality Monitoring – Annualisation Calculations

Table A.14.9: Annualisation of 2018 Partial Year Diffusion Tube Survey

Monitoring Site	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Survey Average_2017-18
BS1	-	-	-	-	-	-	-	17.15	13.40	19.68	18.86	22.44	**18.31**
KG1	-	-	-	-	-	-	-	32.31	27.36	30.48	25.04	29.49	**28.93**
Coventry Allesley	20.15	29.62	24.54	24.98	25.24	25.74	19.57	15.92	10.45	14.67	16.79	20.56	**20.69**
Birmingham Acocks Green	16.03	26.29	21.19	22.97	23.71	21.48	16.36	16.54	12.38	12.45	11.55	18.29	**18.27**

Table A.14.10: Annualisation of 2018 Partial Year Diffusion Tube Survey – Comparative 2017 Urban Background Data

Monitoring Site	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Survey Average_2017
BS1	-	-	-	-	-	-	-	-	-	-	-	-	
KG1	-	-	-	-	-	-	-	-	-	-	-	-	
Coventry Allesley	38.42	25.33	23.80	21.47	16.70	12.93	15.28	16.46	18.94	20.15	29.62	24.54	**21.97**
Birmingham Acocks Green	35.61	21.28	17.97	17.23	15.85	12.79	15.49	13.14	14.23	16.03	26.29	21.19	**18.93**

Table A.14.11: Annualisation of 2018 Partial Year Diffusion Tube Survey – Adjustment Factors

Monitoring Site	Lab analysis	2018 Bias adjustment factor”	Tube Survey Average 17-18	Data capture 17-18	Coventry Allesley*	Birmingham Acocks Green*	Ra_average adjustment 17-18^	Ra_average adjustment from 17-18 /2017 mean’	2017 annualised	2017 annualised (adjusted for survey bias in 2018)
BS1	Gradko 50%	1	18.31	42%	1.32	1.28	1.30	1.05	24.99	**24.5**
KG1	Gradko 50%	1	28.93	42%	1.32	1.28	1.30	1.05	39.49	**39.5**

”2018 Bias adjustment factor not available until all 2018 surveys have been submitted, a conservative estimate of 1 is assumed.
* Ratio of average of 12 monthly means / average of tubes available.
^Average of two value adjustment factors
’Average of Coventry 2017 Survey Average / Coventry 17-18 Survey Average and Birmingham Survey Average / Birmingham 17-18 Survey Average

Appendix 14.6 High and Medium Risk Construction Site Mitigation Measures

14.1.11 The Construction Dust Assessment identified that Construction, Earthworks and Trackout were potentially high risk activities and Demolition work was a medium risk activity. Additional mitigation measures are recommended to control emissions from medium or high-risk construction sites/activities so that no significant adverse residual effects occur.

14.1.12 The full list of mitigation measures from the IAQM guidance for low, medium and high risk sites, is reproduced below in **Insert 14.1**

Key: H = highly recommended, D = desirable, N = not required.

Insert 14.1: IAQM recommended mitigation for all sites

Mitigation for all sites: Communications

Mitigation measure	Low Risk	Medium Risk	High Risk
1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	N	H	H
2. Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	H	H	H
3. Display the head or regional office contact information	H	H	H

Mitigation for all sites: Dust Management

Mitigation measure	Low Risk	Medium Risk	High Risk
4. Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM10 continuous monitoring and/or visual inspections.	D	H	H
Site Management			
5. Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H	H	H
6. Make the complaints log available to the local authority when asked.	H	H	H
7. Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.	H	H	H
8. Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.	N	N	H
Monitoring			
9. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.	D	D	H
10. Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked	H	H	H
11. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H	H	H
12. Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	N	H	H
Preparing and maintaining the site			
13. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H	H	H
14. Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	H	H	H
15. Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period	D	H	H
16. Avoid site runoff of water or mud.	H	H	H
17. Keep site fencing, barriers and scaffolding clean using wet methods.	D	H	H

Mitigation measure	Low Risk	Medium Risk	High Risk
18. Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	D	H	H
19. Cover, seed or fence stockpiles to prevent wind whipping.	D	H	H
Operating vehicle/machinery and sustainable travel			
20. Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable	H	H	H
21. Ensure all vehicles switch off engines when stationary - no idling vehicles.	H	H	H
22. Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	H	H	H
23. Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)	D	D	H
24. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	N	H	H
25. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	N	D	H
Operations			
26. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	H	H	H
27. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	H	H	H
28. Use enclosed chutes and conveyors and covered skips.	H	H	H
29. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	H	H	H
30. Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	D	H	H
Waste management			
31. Avoid bonfires and burning of waste materials.	H	H	H

Measures specific to demolition

Mitigation measure	Low Risk	Medium Risk	High Risk
32. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	D	D	H
33. Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H	H	H
34. Avoid explosive blasting, using appropriate manual or mechanical alternatives.	H	H	H
35. Bag and remove any biological debris or damp down such material before demolition.	H	H	H

Measures specific to earthworks

Mitigation measure	Low Risk	Medium Risk	High Risk
36. Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable..	N	D	H
37. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable	N	D	H
38. Only remove the cover in small areas during work and not all at once	N	D	H

Measures specific to construction

Mitigation measure	Low Risk	Medium Risk	High Risk
39. Avoid scabbling (roughening of concrete surfaces) if possible	D	D	H
40. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	D	H	H
41. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	N	D	H
42. For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	N	D	D

Measures specific to trackout

Mitigation measure	Low Risk	Medium Risk	High Risk
43. Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	D	H	H
44. Avoid dry sweeping of large areas.	D	H	H
45. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D	H	H
46. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	N	H	H
47. Record all inspections of haul routes and any subsequent action in a site log book.	D	H	H
48. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	N	H	H
49. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	D	H	H
50. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	N	H	H
51. Access gates to be located at least 10m from receptors where possible.	N	H	H